Project Day 2025

Computer Engineering

Chemical Engineering

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Environmental Engineering

Electronics and Telecommunication Engineering

Production Engineering

Webapp for website security checking with block programming

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Computer Engineering

Abstract

In today’s digital era, the increasing reliance on online services and websites brings with it a heightened risk of cyberattacks, including SQL Injection, Cross-Site Scripting (XSS), Cross-Site Request Forgery (CSRF), and other vulnerabilities that threaten both users' data and the integrity of websites. However, security testing typically requires specialized technical skills, making it difficult for non-experts to ensure their websites are secure. This project aims to develop a web application that allows users to check the security of websites through a user-friendly interface based on block programming. The platform will provide an easy-to-use, no-code solution for testing common security vulnerabilities without requiring coding knowledge. Users will be able to perform security assessments by selecting specific features they want to test, helping to identify potential threats and vulnerabilities. The system is designed to provide detailed reports and to be updated regularly to keep pace with evolving cybersecurity standards. The goal is to empower users to proactively assess and improve website security, contributing to a safer digital environment.

Data Visualization tool on web

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Computer Engineering

Abstract

In an era where data and data visualization play a crucial role in driving business, data visualization helps transform complex raw data into easy-to-understand images or graphics. This allows users to interpret and make decisions without having to read through raw data. Additionally, data visualization tools enable general users to create data visuals conveniently without needing programming knowledge, saving time and resources in managing and presenting data. Therefore, our group would like to develop a data visualization tool to address the continuously increasing importance of data. This tool will assist in managing and presenting user data by creating a website that can accept .csv and .txt files. It can perform data preparation and data cleansing tasks such as pivoting data, splitting columns, filtering rows, transforming data, removing duplicates, and handling missing data, among others. Additionally, it can create data visualizations by displaying data in 11 different types of graphs and allows customization of the graphical output. Furthermore, it can export processed data in various file formats such as .csv, .pdf, .xlsx, and .JPEG.

CODEMASTER : A CODING GAME FOR PYTHON

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Computer Engineering

Abstract

In an era where technology plays a major role, learning programming has become an essential skill. However, traditional learning methods may not appeal to beginners. This project presents CodeMaster: A Coding Game for Python, a 2.5D puzzle-platformer designed to teach Python programming fundamentals through interactive gameplay. The game focuses on key topics such as variables, data types, conditions, loops, arrays, and algorithms. Players solve progressively challenging problems by writing and modifying Python code in a dystopian-themed environment that enhances emotional engagement. By integrating game mechanics with educational content, CodeMaster transforms coding education into an engaging experience. This project demonstrates the potential of game-based learning to make programming more accessible and effective.

Lethal Coding

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Advisor
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Computer Engineering

Abstract

Video games today are more than just entertainment; they have evolved into powerful educational tools that combine learning with engaging, interactive gameplay. This project seeks to explore that potential by merging the excitement of indie horror games with educational puzzles centered on Python programming. The goal is to teach players fundamental programming concepts such as syntax, variables, loops, functions, and algorithms by making Python puzzled designed into the game's progression.

Set in a horror-survival environment, players must solve these coding puzzles under pressure while managing threats from both digital and physical enemies. The atmosphere is tense and immersive, requiring players to not only think critically but also act quickly to survive. Game mechanics are heavily inspired by popular indie horror titles like, Five Night at Freddy's, Sophie's Curse and Welcome to the Game, combining puzzle-solving with survival elements such as resource management, environmental exploration, and hiding from enemies.

As players advance, the coding challenges grow increasingly difficult, encouraging the development of critical thinking, adaptability, and problem-solving skills in programming. The game is primarily developed in Unity, utilizing additional tools for 3D modeling, animation, and sound design to craft a deeply immersive experience.

Designed as a single-player experience, the game places heavy emphasis on coding puzzles as a means of progression and survival. By blending horror elements with educational content, the project offers players a unique way to learn Python programming fundamentals in a fun, challenging, and memorable environment.

LeftOwise: A Mobile Application for Food Waste Reduction

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Advisor
Boonyarit Changaival, Ph.D., Jaturon Harnsomburana, Ph.D.

Computer Engineering

Abstract

LeftOwise: A Mobile Application for Food Waste Reduction is a project focused on designing and developing a mobile application with the main purpose of reducing the food waste issue in households. The app provides users with a convenient way to manage their ingredients, track expiration dates, and recommend recipes to encourage cooking with available ingredients in their kitchen. Additionally, it assists in planning ingredient purchases for future meals. This project includes machine learning for ingredient recognition through object detection and optical character recognition from receipt images to enhance user experience in entering ingredients. The app aims to reduce the environmental impact due to food waste, and contribute to environmental sustainability, aligning with the United Nations Sustainable Development Goals (SDG) 12, which ensures sustainable consumption and production patterns, while also saving unnecessary household expenses.

Oh! My Mov

Ms. Kantinun Aunreuan, Mr. Thitiphong Thongsuk, Ms. Saranrat Suka

Advisor
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Computer Engineering

Abstract

Watching movies is a popular activity that provides entertainment and helps relieve stress. However, current movie recommendation systems often limit suggestions to broad genres such as horror, without considering the variety of sub-genres such as horror-comedy or supernatural thriller. As a result, users may miss opportunities to discover films that align with their specific preferences. Moreover, searching for movies by reading reviews from multiple sources can be complex and time-consuming.

Our project aims to develop a website-based movie recommendation system that can provide personalized movie recommendations based on user behavior, such as likes, dislikes, wish lists, and viewing history. The system can support movie searches based on keywords and show additional information like movie titles, cast, trailers, and viewing platforms.

The system employs a hybrid recommendation technique that combines Collaborative Filtering and Content-Based Filtering, along with the Light-FM library. Light-FM supports sparse data and allows model training using both user and item metadata, enabling recommendations that align with individual user behavior.
The system architecture is structured to use Node.js as the backend framework, Express.js, and EJS for client-side rendering and interface generation. Data management relies on MongoDB as its primary database. Elasticsearch is used in conjunction with Docker to facilitate efficient and scalable search operations. For security purposes, bcrypt is used by the system to hash passwords. Email verification using Nodemailer and One-Time Passwords (OTP) is used to facilitate user authentication during password recovery.

TagDoc: Document management system for lawyer

Mr. Jirakit Sripheng, Ms. Piyatida Donsila, Mr. Siwat Arunothaipipat

Advisor
Dr. Boonyarit Changaival , Dr. Jaturon Harnsomburana

Computer Engineering

Abstract

A web application developed for efficient management of legal documents and case files. Designed to support lawyers, law firms, and nonprofit organizations that assist individuals navigating complex or challenging legal processes, particularly in political and criminal cases.

Thyroid Nodule Classification using Machine Learning and DL

Ms. Suhani Mehta, Ms. Krisha Botadara

Advisor
Dr.Jaturon Harnsomburana, Ph.D, Asst.Prof.Dr.-Ing Priyakorn Pusawiro, Ph.D
Piyanit Wepulanon, Ph.D ,Dr. Aye Hninn Khine, Ph.D

Computer Engineering

Abstract

This research project investigates the application of deep learning and machine learning methodologies for the binary classification of thyroid nodules as benign or malignant using ultrasound images and corresponding XML metadata from the TDID US image dataset. The study aims to enhance diagnostic accuracy by comparing the performance of various computational models against the clinical benchmark of the Thyroid Imaging Reporting and Data System (TIRADS).

The project encompasses several stages, beginning with the extraction and preprocessing of clinical data from XML files, including the computation of nodule dimensions. Machine learning classifiers such as Logistic Regression, SVMs, Random Forests, and Gradient Boosting will be trained on this clinical data. Additionally, a hybrid approach will be explored, utilizing deep learning CNN models, including pre-trained architectures like InceptionV3, VGG16 and DenseNet, to extract image features which will then be combined with clinical data and fed into machine learning classifiers. Finally, a pure deep learning approach involving custom CNN architectures trained directly on ultrasound images will be implemented.

The performance of all developed models will be rigorously evaluated using appropriate metrics and compared against the binarized TIRADS scores from the dataset. This comparative analysis will provide valuable insights into the potential of different AI techniques to improve the accuracy and efficiency of thyroid nodule malignancy risk assessment, potentially aiding clinicians in making more informed decisions regarding patient management and reducing the need for unnecessary biopsies.

Virtual Reality Game about Ride a Robot : VRG 8285

Mr. Sitthidet Yamkhamang, Mr. Natthapon Tangsaensuk

Advisor
Mr. Jaturon Harnsomburana

Computer Engineering

Abstract

First Person Shooter, Game Design, Battle Robots, Virtual Reality Game (VR)

Placemate, Mobile application searching location for activity

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Advisor
BOONYARIT-CHANGAIVAL, JATURON-HARNSOMBURANA

Computer Engineering

Abstract

This project presents the development of "PlaceMate," a web application designed to recommend locations for various activities based on user interests through the use of tag-based classification. The system allows users to efficiently search for and select destinations aligned with their preferences. Key features include tag-based search, personalized and popular place recommendations, travel planning, and a "List to Go" function for saving desired locations. The application is developed using React for the frontend, Node.js and Express for the backend, PostgreSQL as the database, and Google Maps API for location data integration. Fuzzy Classification and Content-Based Filtering techniques are applied to enhance recommendation accuracy. Targeting users aged 18–29 years within Bangkok, PlaceMate successfully delivers an efficient platform for discovering, planning, and managing activity locations. The system is optimized for computers, smartphones, and tablets.

Alumni Service Channels for the Department of Computer Engineering

Keran Khan , Anawat Wantanapanich, Phurin Reongsang

Advisor
Asst.Prof.Dr.Jumpol Polvichai

Computer Engineering

Abstract

This project develops an alumni service platform for the Department of Computer Engineering using a graph database to connect alumni networks. Key features include news updates, messaging, statistics, and security measures, enhancing communication and strengthening alumni-department relations.

The Greeting Robot of Computer Engineering Department

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Advisor
Dr. Jumpol Polvichai

Computer Engineering

Abstract

In today's world, where technology plays a crucial role in driving innovation and enhancing organizational potential, the Computer Engineering Department recognizes its capacity to develop a robot that showcases its technological expertise and creates a positive impression on external stakeholders.

This project focuses on the development of a greeting robot that represents the department’s commitment to technological advancement. The robot is designed to perform key functions such as greeting visitors, providing information about various locations within the department, and moving autonomously within its designated area. By integrating advanced technologies such as facial recognition, obstacle avoidance, sensor-based data processing, and chatbot-inspired interactions, the robot serves as a testament to the department’s dedication to innovation and engineering excellence.

3D indoor scene reconstruction using 3D Gaussian Splatting

Ms. Pornprapa Chotewatcharin, Mr. Ronnakorn Lugsamipichate, Mr. Warrachote Ponpiboonlarp

Advisor
Kharittha Jangsamsi, Ph.D.

Computer Engineering

Abstract

This research proposed optimized techniques to improve 3D Gaussian Splatting (3DGS) for indoor scene reconstruction, a technique for generating 3D models that outperforms traditional methods like photogrammetry, LiDAR, and newer techniques such as Neural Radiance Fields (NeRF). Despite its advantages, 3DGS faces challenges in achieving high-quality reconstructions due to large datasets, complex environments, and uncontrolled lighting conditions.

To overcome these challenges,two main techniques and one preprocessing technique are introduced to enhance both visual quality and computational efficiency. In the state of preprocessing, Laplacian filter is applied to eliminate blurred frames from video recordings, ensuring only high-quality images are used for reconstruction. The proposed techniques for 3DGS are Edge-Guided Enhancement (EGGS), which assigns higher weights to edge regions in images, focusing Gaussian particles on these areas to improve rendering sharpness and preserve important details. EGGS can enhance scene quality without increasing computational cost during training or rendering. And the second technique is Pruning Techniques, which reduce model size and optimize performance by removing low-impact Gaussians based on opacity and gradient values.

The proposed approach is evaluated both performance and quality using metrics such as PSNR, SSIM, and LPIPS for visual quality, and FPS, memory consumption, and training time for efficiency according to previous studies. Experiments were conducted using a reconstructed indoor environment, with results compared to the original 3DGS implementation.

Website of categorized investment news, and forecasting potential impact on investment.

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Advisor
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Computer Engineering

Abstract

In an era where financial information is abundant and rapidly circulating, investors face the challenge of filtering and analyzing news content to make informed decisions effectively. Financial Sentiment Analysis has gained significant attention as a valuable approach in investment strategies. In response, the project team has developed a prototype website capable of aggregating 4 technology stock news consisting of AAPL, INTC, MSFT, and NVDA from Yahoo Finance and Nasdaq and automatically analyzing news sentiment. This system has the potential to help investors quickly grasp market sentiment trends and serve as a factor in investors' investment decisions. This study investigates and compares between the application of Large Language Models (LLMs) and FinBERT in the context of Financial Sentiment Analysis (FSA). Experiments were conducted using both financial news headlines and full news articles as input. The study highlights the effectiveness of prompt engineering combined with few-shot learning strategies, as well as the use of chunking techniques to handle texts exceeding the token limit of the models, aiming to improve classification accuracy. Experimental results show that, for headline-based sentiment analysis, the fine-tuned FinBERT model achieved an accuracy of up to 87%, while FinGPT—based on the LLaMA architecture with LoRA and enhanced via few-shot prompt engineering—achieved a higher accuracy of 93%. For full news articles, both models achieved similar performance, with accuracy around 70%

Thai Sign Language-to-text Translation Through Motion Gestures Recognition

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Advisor
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Computer Engineering

Abstract

Communication through Thai Sign Language plays an important role for the hearing-impaired population of Thailand. However, there is a shortage of Thai Sign Language interpreters that creates a communication gap between the hearing-impaired population and others. This project aimed to develop a model that utilizes computer vision and deep learning to translate Thai Sign Language into written Thai words, starting from dataset collection in video format, preparing data by performing landmark detection through MediaPipe, and engineering features to best facilitate the model. The developed model utilizes LSTM and GRU neural networks. Thai Sign Language gesture data were collected from two hearing-impaired individuals experienced in Thai Sign Language, covering 30 vocabulary words and one resting pose, totaling 31 categories. Each category consisted of 30 video samples. The dataset was divided into training, validation, and test sets in a 60:20:20 ratio respectively. The results demonstrate that the model effectively recognizes and translates Thai Sign Language, achieving 100% accuracy across all models, both single-layer and two-layer LSTM and GRU, on the test set, indicating a successful performance in recognizing and translating Thai Sign Language

An Improved Platform for Workflow Management in Maxillofacial and Orthopedic Analysis Systems

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Advisor
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Computer Engineering

Abstract

Producing patient-specific medical devices for maxillofacial and orthopedic surgeries requires close collaboration between the attending surgeons and development teams. OsseoLabs Co., Ltd., a manufacturer of such devices, has been using external platforms for workflow management but has encountered limitations in addressing the company's specific requirements, particularly in communicating with surgeons who are external to the organization. This project aims to develop a web application platform tailored to the company's specific requirements. Key features include project and task management, task assignment and progress tracking, commenting, file uploads, automated notifications, no-registration project tracking links for surgeons, and a workload overview to support informed and balanced task assignment decisions within the development team. User permissions are categorized into two levels, namely project managers and project members. The developed platform is expected to enhance coordination efficiency, support efficient task distribution, and improve systematic monitoring of the patient-specific medical device workflow while meeting the company's specific requirements.

Commercialized Cloud Platform Using MAAS

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Advisor
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Computer Engineering

Abstract

This project aims to create a commercialized cloud platform with MAAS (Metal as a Service) and LXD (Linux Container) as its core resource management system, by leveraging MAAS to efficiently manage bare metal servers, providing flexibility in hardware installation and easy scalability of compute, storage, and network resources, and using LXD to facilitate creation of virtual machine through Linux Container technology. Users can access services through a website to rent server resources such as CPU, RAM, and storage, and to configure and control the created virtual machine. The system also includes management of user costs and resources, with administrators able to monitor usage and financial information. This project seeks to integrate free and open-source software as an alternative to costly commercialized software such as VMware or Hyper-V, thus reducing operational costs.

Generative AI for Development of Business Report

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Advisor
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Computer Engineering

Abstract

This project aims to automate the creation of business reports with the help of generative AI. The system will generate SQL queries and visualize business data, and if users input Thai language, the system will translate Thai inputs into English using a combination of deep learning models and natural language processing (NLP). Using straightforward conversational inputs, the system allows non-technical users to create comprehensive business reports that include tables, charts, and descriptive summaries. The system is trained on ERP-related datasets and aligned with a real database schema to ensure accurate output. For the future plan to enhance the program by enabling users to customize their report outputs further. For instance, users could be given the option to select the type of chart they prefer before the system generates visualizations. In addition, a history and file management feature could be implemented, allowing users to revisit and re-download previously generated reports. These improvements would enhance the system’s usability and provide a more flexible and personalized reporting experience for business users.

Generative AI for PDF Form Converter

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Advisor
Dr. Kittipong Piyawanno

Computer Engineering

Abstract

The Generative AI for PDF Form Converter is a project developed through a web application called PaperlessTransform Application, aimed at solving the problem of time-consuming processes involved in converting PDF forms into web applications. This web application leverages artificial intelligence to analyze data types of input labels. As the demand for form conversion continues to increase, system developers are required to analyze a PDF forms structure, design corresponding database structures, create web application interfaces, and develop new systems. These tasks result in significantly increased work time and workload, causing personnel to spend time inefficiently. The goal of this project is to reduce the burden on system developers by automating parts of this workflow. The application is designed to process a PDF file, detect an input fields using parser, generate an input field data type using AI-powered text analysis, and generate web-based forms accordingly. In addition to form field detection, the system can store form data in a structured format suitable for web deployment, enabling a smoother transition from traditional documents to digital interfaces. The project team has focused on developing a robust system that not only identifies relevant form elements accurately but also simplifies the data handling and form creation process. After testing the web application, results show that it can detect input field within forms and store data at a basic level, demonstrating its practical effectiveness in real-world scenarios. Therefore, it can be concluded that this project addresses the problem of increased work time and inefficiency for system developers, offering an effective tool for automated form conversion and reducing the manual effort required in digitizing traditional forms.

Generative Web Design with AI

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Computer Engineering

Abstract

In today's digital world, having an attractive and easy-to-use website is very important for businesses. However, designing websites manually is time-consuming and can lead to inconsistent quality. This project aims to create an automated system that generates and evaluates web designs to support users, especially beginners. The system has two main parts: a design generator and an evaluation model. The generator extracts a color palette from a user's uploaded image and creates ten random HTML templates based on design principles like layout, font, and spacing. These templates are then converted into images for evaluation. To build the evaluation model, we collected a dataset of web template images and their download counts using web scraping. An Artificial Neural Network (ANN) was trained to rank the quality of web designs. While the system can generate different color styles and font combinations, the templates still share a similar overall structure, and the AI model can rank them by design quality. However, there are some limitations, such as occasional poor color contrast and simple layouts as well as the static web pages using only HTML. In the future, we plan to improve the random HTML generator, create more complex layouts, and deploy the full system as a web application.

Implementation of a Database for Homomorphically Encrypted Data

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Computer Engineering

Abstract

Homomorphic encryption enables computation on encrypted data while preserving the confidentiality of the underlying information. Despite its strong security guarantees, its application in database systems remains limited due to significant computational overhead, which impacts query performance. This work introduces Homomorphic BST, a database structure that integrates a Binary Search Tree (BST) optimized for homomorphically encrypted data, as a proof of concept. The design leverages the CKKS scheme, which supports approximate arithmetic on encrypted floating-point numbers, and organizes data in a vertical layout. Customized indexing techniques are employed to enhance the efficiency of query execution under encryption. The implementation was evaluated using datasets of varying sizes. Experiments focused on query execution time and benchmarked the system against a linear scan approach. Results indicate that Homomorphic BST achieves a meaningful reduction in query latency. These findings suggest that structurally optimized designs can help mitigate the computational burden typically associated with homomorphic encryption, supporting more practical applications in secure database systems. This proof of concept demonstrates the potential for applying more advanced data structures to homomorphically encrypted data in the future.

Implementation and Evaluation of a Distribution for Database Cluster Using Prime Number

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Computer Engineering

Abstract

This project addresses critical limitations of traditional horizontal scaling techniques particularly Consistent Hashing which is commonly employed for distributing data across multiple database nodes. In Consistent Hashing the addition of new nodes often leads to uneven data distribution as the system lacks mechanisms for automatic and uniform data reallocation. This non-uniformity becomes more pronounced as the number of nodes increases especially when the system approaches its upper scalability limit making further expansion difficult. Moreover, because data placement is not strictly deterministic, simultaneous failure of adjacent nodes on the hash ring can result in data loss thereby compromising the reliability of the system.

To overcome this limitation a deterministic data distribution model referred to as Prime Ring is proposed. This model utilizes prime number-based hashing to improve the accuracy and predictability of data allocation. It is designed to support seamless scalability and high fault tolerance by allowing database nodes to be added or removed without disrupting existing data placement. The algorithm was implemented in the Xtore repository and evaluated under controlled conditions using uvloop to ensure consistent network behavior. The evaluation focused on execution time, distribution uniformity and network load.

The experimental results show that Prime Ring can effectively overcome the key limitations of Consistent Hashing. It enables more uniform data distribution when new nodes are added, supports smooth and scalable system expansion even at high node counts and increases fault tolerance by ensuring deterministic data placement. These outcomes demonstrate that Prime Ring is a reliable and efficient strategy for data distribution that can be applied to a wide range of database architectures.

ModSec: Password Manager with Sandwich Hashing algorithm

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Advisor
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Computer Engineering

Abstract

The exponential rise in cyberattacks, data breaches, and credential theft has exposed critical vulnerabilities in traditional password practices. Weak, reused, and easily guessable passwords continue to be a major vector for unauthorized access, contributing to over 80% of confirmed security breaches. Despite increased awareness, poor password hygiene remains prevalent among users. This project proposes a secure, modern, and efficient password management system designed to address these issues through advanced cryptographic techniques and contemporary software development practices. The application focuses on three primary objectives: securely storing user credentials in an encrypted vault, ensuring that only the user can decrypt data via a master password, and implementing a zero-knowledge storage model, which ensures that even the service provider cannot access user data. To achieve this, we employed a modern technology stack including Wails (Go framework), Echo, PostgreSQL, ReactJS, and GORM. Cryptographic protocols such as AES, RSA, SHA, and Argon2 are integrated using the sandwich hashing algorithm, delivering multiple layers of protection during storage and transmission of sensitive data. This project also includes a comparative review of existing password managers such as LastPass, 1Password, Dashlane, and Bitwarden focusing on their encryption methods, usability, and known vulnerabilities. By identifying these limitations, the proposed system aims to improve security, transparency, and user control. Our implementation emphasizes privacy and usability, integrating layered encryption and user-centric design to foster better password practices. While theoretical analysis indicates strong resilience against database breaches and man-in-the-middle attacks, formal penetration testing and threat modeling remain future work to validate its security claims. This project contributes to the cybersecurity field by delivering a technically sound and user-friendly solution to digital credential management in an increasingly hostile threat environment.

Third-Party Chat Engine

Prommate Wudhikanakorn, Jutamas Poompruek

Advisor
Kittipong Piyawanno, Ph.D

Computer Engineering

Abstract

A Third-Party Chat Engine that brings together customer conversations from different platforms into one place. Powered by WebSockets, RESTful APIs, and Kafka, the system is scalable and enables smart routing and real-time messaging with a stateful architecture far beyond traditional stateless HTTP.

UI Evaluation Dashboard

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Advisor
Kittipong Piyawanno, Ph.D., Taweechai Nuntawisuttiwong, Ph.D.

Computer Engineering

Abstract

Since the COVID-19 outbreak in 2019, numerous businesses have been forced to shift their business operations to digital, whether it is expanding their sales channels online. Alongside this shift, careers related to this type of technology have also seen a significant rise in demand. For example, user interface and user experience (UI/UX) designers which are the career that we have given chiefly attention to in organizing this project. According to the U.S. Bureau of Labor, employment for Web Developers and Digital Designers is projected to increase by 8% from 2023 to 2033, a rate faster than the average for all occupations. Meanwhile, the number of new UI designers is also increasing rapidly. According to Nielsen, the workforce in these fields is expected to grow from 1 million in 2017 to 100 million by 2050. For this reason, we have recognized the shortage of tools that support UI designers in learning and understanding the principles of user interface design. We have decided to develop a website. There is a main page for users to upload images of the interface they have designed. Our website will then analyze the various elements of the interface to determine how well they align to the principles of user interface design that we have set. Once the website has completed its analysis, the results will be in the form of a dashboard that presents the scores along with some suggestions about the interface. This feedback will help UI designers to learn from and improve their work further.

BeginSec: Intro to Web Security

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Advisor
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Computer Engineering

Abstract

This project presents BeginSec: Intro to Web Security, a web application designed to teach fundamental web security concepts to cybersecurity beginners. The platform emphasizes interactive learning through structured Learning Paths, practical Hands-on Labs, and Capture the Flag (CTF) challenges that simulate real-world web vulnerabilities.

The system also features user accounts, a community forum for knowledge sharing, certification issuance upon course completion, and regularly updated cybersecurity articles. The learning content spans three key areas: foundational cybersecurity knowledge and career paths (including Red and Blue Team roles), basic web exploitation techniques (e.g., SQLi, XSS, Broken Access Control, Cryptographic Failures), and essential cyber threats and legal awareness relevant to daily life.

The platform is designed with a user-friendly interface, and an engaging learning experience. The development process follows Software Engineering principles using the Agile Kanban methodology to ensure an efficient and scalable solution. Learning outcomes are measured through Pretest/Posttest assessments and user satisfaction surveys, with performance indicators based on usability and knowledge improvement metrics.

This project aims to inspire interest in cybersecurity, foster self-directed learning, and contribute to increasing the number of skilled cybersecurity professionals in Thailand.

Web-Based Visualization Tool to Enhance Maxillofacial and Orthopaedic Surgeries

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Advisor
Kittipong Piyawanno, Ph.D., Taweechai Nuntawisuttiwong, Ph.D.

Computer Engineering

Abstract

This project aims to develop a web application for 3D visualization of facial and jawbones to assist in surgical analysis for oral cancer patients. The web application enables surgeons to precisely assess surgical positions, reduce delays in treatment planning, and enhance efficiency in managing large volumes of patient data through 3D rendering and plane-based cutting features from uploaded STL files. The web application supports three types of users: Surgeons, Technicians, and Admins. Surgeons can upload STL files of patient bone structures, visualize and interact with the 3D models, create cutting planes, perform virtual modifications, and approve finalized facial and jawbone models for surgical procedures. Technicians can manage and view case data for all patients. Admins can manage user accounts, control access permissions to the web application, and oversee patient case data. Additionally, the web application serves as a bridge between surgeons and OsseoLabs, facilitating efficient collaboration in the surgical planning process.

Dynamic Inquiry System for Hospital Department Recommendation

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Advisor
Assoc.Prof. Naruemon Wattanapongsakorn, Ph.D.

Computer Engineering

Abstract

This project has been developed to research the application of artificial technology in semi-automatic hospital department recommendation through a web-based service, aiming to simplify the appointment-making process for patients. It addresses the limitations of the traditional system, which can be redundant and resource-intensive. The process is classified into two parts, the inquiry system and the department prediction system. Basic health information and reported symptoms are collected and analyzed by the artificial model to suggest the most appropriate department for treatment, while dynamically selecting follow-up questions to improve prediction confidence. The input dataset contains symptom records labeled with disease outcomes, where each disease is mapped to its corresponding hospital department. Various models were researched and developed to help in both inquiry and prediction process, including XGBoost, long short-term memory (LSTM), and embedding-based deep learning models. Model performance was evaluated based on accuracy using partial features test data and XGBoost model results in best overall performance, both in partial features test data and full test data, at the highest accuracy of 99%. Ultimately, this project aims to enhance hospital treatment operations by providing patients with a general idea of the appropriate department to visit, thereby reducing wait times and confusion. It also provides staff with broader information about the patient's condition prior to the visit, allowing for more accurate treatment preparation.

Face Authentication Application for Mothers of Newborns

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Advisor
Assoc.Prof. Naruemon Wattanapongsakorn, Ph.D.

Computer Engineering

Abstract

This project introduces a web-based system for hospitals to authenticate mothers of newborns using face recognition. It integrates features that enhance workflow efficiency and system performance, such as Thai national ID card reading and dynamic profile management.

FaceMind

Mr. Kittapong Moosikerd, Mr. Nontapatt Rachasrimuang

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Computer Engineering

Abstract

Nowadays, Thai people increasingly face challenges with memory issues due to various factors such as brain degeneration, stress from work and daily life, and unhealthy lifestyle habits. These issues lead to difficulties in remembering even minor details, such as the location of stored items, appointments, or recently spoken conversations. If left unaddressed, these symptoms can escalate and severely impact daily living. A particularly concerning sign is forgetting the names of close acquaintances, such as family members, close friends, or even spouses. This issue is prevalent among elderly individuals or those with cognitive conditions like Alzheimer's disease, significantly affecting their quality of life and relationships.

Recognizing this problem, our team proposes FaceMind, a mobile application designed to assist users in recalling personal relationships through face recognition technology with a convolutional neural network. The application leverages machine learning and image processing techniques, particularly TensorFlow Lite, to enable accurate face detection and recognition. The system provides three core functionalities. First, it allows real-time face scanning to retrieve and display personal information, such as names and relationships. Second, it uses the Google Maps API to provide navigation assistance, helping users find their way home in cases of disorientation. Lastly, it records and organizes data for future use, enabling consistent memory reinforcement.

This Android mobile application is designed to benefit not only individuals struggling with memory issues but also their families, by facilitating better interaction and communication. Moreover, it aims to reduce stress caused by forgetfulness in daily life and enhance the overall quality of life for its users.

Interactive Game for Streamers

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Computer Engineering

Abstract

This research tackles the problem of low viewer engagement in live streaming by introducing an interactive horror game designed for real-time audience participation. The game enables viewers to influence gameplay by triggering events through Streamlabs donations, transforming them from passive viewers into active participants. This approach enhances immersion and encourages stronger emotional involvement between the streamer and their audience.

The game was developed using Godot 4 as the core engine, Node.js and WebSocket for backend real-time communication, and React.js for frontend interaction. To ensure an engaging player experience, the design was guided by frameworks like the MDA model (Mechanics, Dynamics, Aesthetics) and the Eight Kinds of Fun, which helped craft moments of suspense, surprise, and challenge. Viewer feedback and survey data from both streamers and audiences shaped the gameplay around horror and survival elements—focusing on relic collection, limited oxygen, and the threat of losing progress upon failure.

What sets this project apart is the gamified donation system, where viewer contributions directly impact the game by introducing environmental changes, enemies, or visual effects. This mechanic not only increases engagement but also creates new monetization opportunities for content creators under a "stream-to-earn" model. The final result is a seamless, low-latency system that redefines interactive streaming, merging gameplay and live audience input into a dynamic entertainment experience.

Adaptive Artificial Intelligence Agent in 2D Platformer Game Development

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Computer Engineering

Abstract

In recent years, the use of artificial intelligence (AI) in game development has gained significant attention, especially in enhancing gameplay and automation. However, most AI systems are developed for specific tasks and lack reusability across different game projects. This study aims to develop an adaptive AI agent for 2D platformer games using reinforcement learning. The agent is trained within a Unity-based environment to learn core player behaviors, such as movement, jumping, and obstacle avoidance. The system adopts Proximal Policy Optimization (PPO) for learning and is structured with modular components to support flexibility, scalability, and ease of integration. By separating action execution and decision-making through a modular design, the AI agent can be extended to support additional actions or different game mechanics. The trained agent is packaged as a reusable Unity asset, which can be implemented in similar 2D games to serve either as an intelligent NPC or an automated game tester. This approach helps reduce development time and technical complexity for indie developers aiming to integrate intelligent behavior into their games. The results demonstrate the potential of reinforcement learning in building adaptive game agents and contribute to making AI tools more accessible in the field of game development.

Inu2: Development of a Quality Management and Data Management System

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Computer Engineering

Abstract

The research describes the design and development of a web-based quality management system, “Inu2”, for the accreditation processes in engineering education under the guidelines of TABEE and ABET. This new iteration builds upon the previous version of the system, “Inu,” by introducing a radically restructured system architecture and placing primary focus on a complete user interface redesign to improve usability and modernize the system. It is now aligned with both the TABEE and ABET standards, whereas the earlier version supported only TABEE. The system is built on modern web technologies (Nuxt.js and Go Fiber) and uses MySQL to manage complex relational data while maintaining high performance. In addition to the redesign, further development was carried out to introduce key features such as graphical display of student learning outcomes, statistical analysis tools, and a QR-code based survey for indirect assessment evaluation. These features are to enhance the management of courses and compliance with accreditation requirements. While additional features such as document exports, batch import of student enrollments that do not exist in the system, the SINFO-grade synchronization were in the pipeline but never implemented due to the time constraints and technology migration coupled with the overhead of front-end restructuring. However, these advanced features would still be given priority in the next iterations of the system.

BLACK SANCTUM: Serious Game for learning Digital circuits design

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Computer Engineering

Abstract

Nowadays, digital technologies play a key role in education and national development, with increasing interest in computer-related fields. However, the shift to online learning after COVID-19 has introduced challenges such as reduced student motivation and engagement. To address these issues, this research presents the design and development of a serious digital educational game called Black Sanctum, which aims to improve the teaching and learning of fundamental digital circuit topics, particularly numeral systems and logic gates. The game was developed based on the LADDER model and utilizes the principles of Digital Game-Based Learning (DGBL) to provide an interactive and motivating experience. To enhance engagement, the game incorporates familiar gaming mechanics such as free movement within designated areas and immediate feedback. Specifically, in the numeral system section, players are required to solve puzzles by converting numbers between binary, octal, decimal, and hexadecimal systems, with progress measured by the total time spent completing tasks. Meanwhile, the logic gate section presents timed multiple-choice questions covering basic logic gates, including AND, OR, XOR, NAND, NOR, XNOR, and NOT, with scores used to assess learning outcomes. Although many players were able to understand the content while playing, some still experienced confusion regarding how to interact with certain game elements. Consequently, the developers identified the need to improve the tutorial design for both levels to make gameplay and learning objectives clearer, with future updates planned to improve accessibility and overall learning effectiveness.

Small Object Detection in Remote Sensing

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Computer Engineering

Abstract

Detecting objects in high-resolution drone and satellite images is vital for disaster response, urban planning, and environmental monitoring. Small object detection - the task of finding tiny targets that cover only a few pixels (e.g., cars, people, or rooftops) - is especially hard because these objects lack detailed features and often blend into cluttered backgrounds. We imply ISRYOLO, a super-resolution-assisted object detection framework that integrates super-resolution techniques, attention mechanisms (CBAM), pixel shuffle upsampling, ConvNeXtBlock, and Atrous Spatial Pyramid Pooling (ASPP). The proposed model enhances spatial feature representation and improves detection accuracy while maintaining computational efficiency. Experimental results on VEDAI dataset demonstrate that ISRYOLO outperforms existing object detection models in terms of mean Average Precision (mAP) and recall, making it a promising solution for real-time applications.

Career path guidance web application platform

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Advisor
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Computer Engineering

Abstract

Vision Career is a web app that uses machine learning to recommend university programs and career paths in Thailand. Analyzing users' personality and interests offers personalized guidance to help students make confident, informed academic and career decisions.

Collaborative grading and feedback delivering system

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Computer Engineering

Abstract

Evaluating student performance and providing feedback are crucial processes for developing skills and knowledge. However, current assessment systems often lack adequate support for collaborative evaluation involving multiple instructors. This frequently leads to redundant grading efforts, delays, and difficulties for students in clearly identifying their strengths and weaknesses from the feedback received.

This research introduces the development of a web application, the Collaborative Grading and Feedback System, designed specifically for multi-instructor collaborative assessment. The system consolidates comments and scores from all evaluating instructors into a single, unified set, clearly displaying the attribution of scores for each assessment component. This system aims to enhance student work development by accurately pinpointing areas for improvement and to facilitate a more efficient and streamlined evaluation process for instructors.

The developed system comprises key components, including: a module for student submissions (Submission Module), a module for instructors to create and manage grading criteria (Grading Criteria/Rubric Management), and an interface for conducting evaluations and providing feedback (Grading & Feedback Interface).

Platform for personalized technology education

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Abstract

Currently, online learning in technology has gained increasing popularity, especially in Thailand, where there is a lack of in-depth and comprehensive content. Learning from foreign sources often leads to misunderstandings due to language translation issues and language barriers. Therefore, the project team recognizes the importance of developing a learning platform in Thai language to make it easier for students and interested individuals to understand the content. This project aims to develop a web application that allows learners to access online technology content and features a point system that rewards learners for their progress, with the points redeemable for free courses. Additionally, the system integrates CRM (Customer Relationship Management) for managing users and CMS (Content Management System) for managing the content within the web application, supporting the platform's functionality. The expected outcome of this platform development is to provide quality and accessible learning resources for those interested in technology, enabling effective understanding of technology content without language barriers.

: Web-Based Laboratory Registration and Verification System

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Computer Engineering

Abstract

This project is the development of a Web-Based Laboratory Registration and Verification System to solve the problems of delays, complications, and risks from storing a large number of documents (approximately 400–500 sheets) caused by the old way of working. The developed system allows for the filing of applications, attaching documents, tracking status, and approval to be carried out online conveniently, quickly, and securely. The system is developed using Next.js technology for the front-end of the website and NestJS for the server-side management (Backend), using TypeScript to enhance code security, and PostgreSQL for data storage, and is connected to the ThaiD system for user identity verification. Key features include automatic document generation that supports digital signatures, a real-time operational status tracking system, and various notification systems within the website. The system is designed to support both general users and Provincial Electricity Authority (PEA) officials, with the Electrical Equipment Testing Division (E.E.T.) as the main agency for use and evaluation. The system is developed by dividing the operation into 2 phases, starting from collecting and analyzing the requirements, designing UX/UI, designing the database, developing, testing, and finally implementing the actual use, aiming to increase the efficiency, accuracy, speed, and transparency of the laboratory inspection and certification process.

TourinThai: A Web Application for Recommending Tourist Attractions to Foreign Tourists Using Sentiment Analysis from Text Data

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Computer Engineering

Abstract

The tourism industry in Thailand has experienced significant growth, with domestic tourism becoming a central focus. Despite Thailand's rich array of destinations, some regions—such as the northeastern area (Isan)—remain relatively unknown to international tourists. To address this, our team leverages sentiment analysis using Natural Language Processing (NLP) and Machine Learning techniques to analyze tourist reviews, which are vital indicators of service quality and visitor experience. These insights are presented through a web application designed to help international tourists make informed travel decisions.

The system architecture integrates several components. MongoDB, a document-oriented NoSQL database, is used to store information on northeastern attractions in a flexible JSON-based format. Web scraping techniques extract data from HTML-based websites and preprocess it into structured data for analysis. XGBoost, a high-performance gradient-boosting algorithm, is employed to enhance classification accuracy in sentiment prediction. For handling large text volumes, text summarization techniques are applied to condense reviews while preserving key information, improving readability and comprehension.

The platform also incorporates Elasticsearch for efficient retrieval and analysis of both structured and unstructured data, using distributed processing across nodes to optimize performance. On the front end, EJS, CSS, and JavaScript are used to create an intuitive and visually appealing user interface. Meanwhile, Node.js and Express.js are employed for back-end development to manage server-database interactions and data processing. This comprehensive system aims to promote lesser-known Thai destinations and enhance the travel planning experience for international visitors.

DEVELOPING A WEB-BASED TOOL FOR PREDICTING THE ANTIMICROBIAL RESISTANCE USING DATA FROM NATIONAL ANTIMICROBIAL RESISTANCE SURVEILLANCE CENTER, THAILAND (NARST)

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Computer Engineering

Abstract

Antimicrobial Resistance (AMR) is a global public health problem that is expected to result in 10 million deaths per year by 2050. In Thailand, National Antimicrobial Resistant Surveillance in Thailand (NARST) has collected data on bacterial antibiotic resistance from 2015 to the present. This study focuses on data from 11 medically important bacteria listed by the World Health Organization (WHO). This research aims to develop a dashboard for tracking the spread of antimicrobial resistance and develop a model to predict resistance trends in both time and space to support effective planning and control of antimicrobial resistance in bacteria on the NARST website. From time series data analysis, it was found that each type of bacteria has a different antimicrobial resistance pattern, which affects the selection of the appropriate model for predicting antibiotic resistance. Spatial analysis revealed that certain clusters of antibiotic resistance were concentrated in areas with high-resistance values, which tended to be located near other high-resistance areas. Furthermore, spatiotemporal analysis revealed that using a Bayesian Spatiotemporal Model to account for the relationship between space and time improved the model's accuracy in predicting antibiotic resistance trends. Temporal analysis showed that Pseudomonas aeruginosa resistant to Ceftriaxone had the lowest Weighted Absolute Percentage Error (WAPE) at 1.08%. Spatial analysis further indicated that Health Region 8 exhibited a higher tendency for antibiotic resistance compared to neighboring areas. Therefore, analyzing antibiotic resistance trends in both spatial and temporal dimensions can greatly benefit patient treatment and public health management in the long term, effectively reducing mortality rates associated with bacterial resistance.

Projecting future dengue cases associated with meteorological and socioeconomics factors in different infection severity levels in Thailand under climate change scenarios

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Computer Engineering

Abstract

Dengue fever, a vector-borne viral infection transmitted by the *Aedes aegypti* mosquito, remains a public health issue in tropical and subtropical regions, including Thailand. The severity of dengue outbreaks, ranging from mild cases to severe forms such as dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS), is influenced by climate change, which alters temperature and precipitation patterns, and exacerbated by socioeconomic factors such as poverty, low education, and low income. This study analyzes dengue incidence in relation to meteorological and demographic factors in Thailand from 2003 to 2021. We developed a multivariate spatiotemporal model using nine model combinations, applied to both quantifying associations and projecting future dengue risk under various climate change scenarios within different severity levels across four time periods from 2021 to 2100. The models were evaluated using one of two Bayesian model selection techniques. Monthly dengue surveillance, meteorological, and socioeconomic data were aggregated at the provincial level, and an exploratory data analysis (EDA) was conducted to derive insights. The predicted values from the models were then utilized to compute relative risk (RR) and identify hotspot provinces at risk of dengue outbreaks. A dashboard interface was created to enable the visualization and analysis of health outcomes. The results of this study indicate that dengue fever peaked during the rainy season, with outbreaks occurring at the borders and extending inland. There were significant associations between the incidence of dengue and minimum temperature and mean years of schooling. Spatiotemporal modeling projected an increasing dengue risk under the future climate change scenarios, implying a combined influence of meteorological and socioeconomic factors on dengue dynamics in Thailand.

Mathematical Modeling and Time-series Modeling for Predicting Dengue Infection Between Thailand and South Korea

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Computer Engineering

Abstract

Dengue fever poses a serious health risk in many countries, especially due to its potential for life-threatening internal bleeding. With global warming, conditions are becoming more favorable for mosquito reproduction, which may worsen the situation. Thailand is endemic for dengue fever, while South Korea, though not an endemic region, has the third-largest number of travelers infected, primarily from Thailand.

Therefore, creating predictive models for dengue patient numbers in both countries is crucial for effectively planning and reducing disease transmission between Thailand and South Korea. This study selected the Two-patch SEI-SEIR Model, Linear Regression, SARIMAX, Holt-Winters, and Prophet models, which are suitable for time series data. Additionally, cross-correlation and time-series clustering were employed to group data at the regional level to enhance model accuracy.

The study found that the Two-patch SEI-SEIR model more accurately predicts dengue cases in Thailand than in South Korea, largely due to its reliance on Thailand's weather data. Optimizing population mobility parameters between countries is required to enhance predictive accuracy. For the Time-series models, the result of South Korea shows that the Prophet model incorporating Thai weather variables outperformed other models, achieving the lowest test error scores with an RMSE of 2.84, MAE of 2.11, and WAPE of 26.12%. In contrast, for Thailand, the SARIMAX model, which excluded Thai weather data but incorporated COVID-19 outbreak period information, outperformed alternative approaches, yielding a test RMSE of 1681.71, MAE of 985.01, and WAPE of 25.33%. However, the development team has created a web app to provide information and display the results of predicting the number of dengue patients in both Thailand and South Korea. The application is accessible and user-friendly over the internet.

Web Application and Machine Learning for Predicting Cardiometabolic disease Among People Living in Urban and Rural Areas (Princess Chulabhorn's Health Volunteer Project)

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Abstract

Cardiometabolic diseases are a group of conditions with rapidly increasing incidence worldwide, particularly in developing countries. These diseases significantly impact quality of life and rank among the leading causes of mortality globally. This research aims to develop a web application utilizing machine learning technology to predict and screen for cardiometabolic disease risks, specifically type 2 diabetes and hypertension, to enhance prevention effectiveness, particularly in areas with limited access to medical services. The study used health data from the Princess Chulabhorn's Health Volunteer Project, covering both urban community (Laksi, Bangkok, 420 samples) and rural community (Ban Luang District, Nan Province, 447 samples), developing a web application for health data collection encompassed basic information, behavioral patterns, and laboratory test results. The research applied 6 machine learning models: K-Nearest Neighbors, Support Vector Machines, Random Forest, Extreme Gradient Boosting, Light Gradient Boosting Machine, and Neural Network. Results showed that the Extreme Gradient Boosting model performed best compared to other models, with diabetes prediction achieving 92% accuracy, 90% recall, and 72% F1-Score, while hypertension prediction achieved 75% accuracy, 86% recall, and 77% F1-Score. When the Extreme Gradient Boosting was implemented in the web application and tested with 10 users who had been diagnosed by physicians, the application's predictions aligned with medical diagnoses at 100% for diabetes and 80% for hypertension. Additionally, user satisfaction assessment of the web application revealed 85% satisfaction, particularly regarding ease of use. This indicates that the web application can be applied as a preliminary screening tool for the general public and Chulabhorn volunteers to help predict and screen for cardiometabolic disease risk groups in communities with limited medical personnel. Furthermore, the data obtained can be used for public health policy planning, such as prioritizing risk groups or planning disease prevention at the community.

AUTOMATED INVENTORY COUNTING USING MOBILE-CAPTURED IMAGES AND AI

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Computer Engineering

Abstract

In today's competitive business landscape, companies are striving to optimize warehouse management processes to reduce costs and enhance operational efficiency. Osotspa Public Limited Company (OSP), a leading Thai beverage company, faces significant challenges with manual inventory counting, which leads to discrepancies between physical stock and system records. This project proposes an innovative solution to automate the inventory counting process by developing a mobile application that utilizes Artificial Intelligence (AI) and object detection models to accurately count cartons in warehouse environments. The app allows users to capture images via their mobile devices, which are then processed through cloud-based AI algorithms to identify and count stock-keeping units (SKUs) in real time. Through this approach, a comprehensive evaluation of three state-of-the-art object detection models YOLOv11, DETR, and Detectron2 was conducted based on multiple performance metrics. YOLOv11 achieved the highest average precision (0.962 at an Intersection over Union [IoU] threshold of 0.50 to 0.95) and demonstrated robust recall, even in scenarios involving occlusion or partial visibility of cartons, making it the most effective model for this application. This solution aims to reduce manual labor and improve accuracy. Additionally, the system generates detailed inventory reports, facilitating seamless integration with existing warehouse management workflows. By leveraging AI for automated inventory management, this project has the potential to significantly improve the accuracy and speed of inventory counts, benefiting OSP and similar organizations in the logistics and e-commerce sectors. The project's scope includes the development of the mobile application, AI model training, and deployment, with the potential for future integration of drone technology to further enhance scalability and efficiency.

Innovative Home-Based Finger Joint Rehabilitation: Motion Detection Technology with Web Application Integration

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Abstract

Effective finger joint rehabilitation is essential following injury or in managing certain conditions, as impairment can significantly affect an individual's quality of life. Traditional methods of finger joint rehabilitation present limitations such as the requirement for frequent clinical visits and difficulties in ensuring exercise accuracy during home practice. To address these challenges, this project develops a system for finger joint rehabilitation by utilizing Wi-Fi enabled sensor gloves with a web-based application for data visualization and analysis. The system enables patients to perform physical therapy without direct supervision from occupational therapists. Finger joint movement patterns are captured by Inertia Movement Unit (IMU) sensors on the gloves and compared to the reference patterns to provide real-time feedback shown on the web application. Occupational therapists can also manage schedules and monitor patient progress via the web application. The proposed system thus facilitates improved accessibility to effective rehabilitation, supports precise execution of therapeutic exercises, and enables streamlined remote management of patient care.

CustomAI

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Computer Engineering

Abstract

CustomAI is an end-to-end web-based platform designed to simplify creating and customizing artificial intelligence (AI) models from image datasets. The platform enables users who don't have a technical background to develop their model, task-specific models for applications such as image classification, object detection, and segmentation. By addressing the limitations of AI model customization and removing the barriers of programming expertise, CustomAI offers an accessible solution for users to explore, learn, and build custom AI solutions tailored to their specific needs.

The platform supports a comprehensive workflow for creating an AI model from image datasets, including dataset preparation, configurable image preprocessing, feature extraction, data augmentation, model architecture definition, training, and result evaluation. All components are seamlessly integrated through an intuitive user interface, enhanced by interactive tutorials and guided model-building processes. The platform supports supervised learning and allows fine-grained control over hyperparameters, data splits, and model structures without requiring any code. The system is developed using a robust technology stack comprising Docker for containerization, Next.js for client-side, ElysiaJS for server-side, Python with FastAPI for AI service, RabbitMQ for message queue, AWS S3 for file storage, and PostgreSQL for database.

Key features of CustomAI include image annotation tools, real-time preprocessing and augmentation previews, a drag-and-drop model builder for convolutional neural networks, and training metrics and evaluation results after training. Developed under the Agile methodology (Scrum). The system's usability was evaluated through a user survey to ensure ease of use and the inclusion of all necessary functions. CustomAI not only enables non-experts to harness the power of AI but also fosters a deeper understanding of machine learning principles through hands-on experience and integrated learning modules.

DEVELOPMENT OF A SINGLE-PLAYER COMPUTER GAME COMBINING ACTION-ADVENTURE AND RESOURCE MANAGEMENT SYSTEMS

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Computer Engineering

Abstract

Monstersmith is a single-player action-adventure game developed in Unreal Engine 5. Players take on the role of a blacksmith who hunts monsters to gather rare materials and craft weapons for adventurers. The game blends thrilling combat, resource management, and a charming fantasy world.

Employees' Engagement and Learning Hub Website and Mobile Application

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Abstract

Human resource management at SCGC's affiliated startup faces challenges due to the lack of integrated platforms for managing employee satisfaction and learning resources. The existing platforms do not meet user experience standards and are missing essential functionalities, making it difficult for HR employees to efficiently access morale data and manage learning initiatives. This situation increases the workload for HR, reducing their ability to provide support. Without these tools, employee engagement may decline, resulting in lower job satisfaction. Developing a user-friendly learning hub would address these challenges by offering personalized development opportunities, improving HR processes, and enhancing employee growth and organizational performance.

The project focuses on two key areas across two platforms: Human Resource Management (HRM) on UniCulture and Human Resource Development (HRD) on UniLearning. UniCulture allows employees to participate in daily and yearly morale surveys, as well as 360-degree assessments, while providing managers and admins with dashboards to track and analyze satisfaction and feedback. Additionally, a machine learning model is integrated to analyze satisfaction from open-ended survey responses.

Meanwhile, UniLearning concentrates on providing employees access to various learning resources, courses, and quizzes. Machine learning is employed to personalize video course recommendations based on individual preferences, enhancing the learning experience. Furthermore, another machine learning model supports career aspiration insights, allowing managers to explore career paths based on skills and interests, facilitating better promotion and development decisions. The system supports four primary roles: Admins, Managers, Employees, and Outsiders.

The expected outcomes include increased engagement, improved access to development opportunities, enhanced morale tracking, and more accurate data-driven HR decisions. The outcomes will be evaluated through a user survey to gather feedback on usability, satisfaction, and overall system effectiveness. By addressing current challenges and adding interactive tools, the platform will improve Ant HR's ability to support employee development and organizational growth.

FitChoose

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Computer Engineering

Abstract

In contemporary society, increasing attention is being paid to personal attire, as it serves as a reflection of an individual's image and personality. One of the primary challenges of an individual’s faces is the compatibility between clothing items and their body shape. Moreover, visiting physical stores to shop for clothing may not be feasible for everyone due to time constraints and the associated travel costs. To address these concerns, this project proposes FitChoose, a mobile application that leverages Artificial Intelligence (AI) to support users in making outfit decisions tailored to individual users. The application provides a virtual fitting experience by allowing users to upload images of clothing items they wish to try on. It then analyzes and suggests appropriate pairings based on the style of selected garments, helping users visualize potential outfits in a realistic manner. Additionally, FitChoose maintains a record of previous outfit combinations and styling suggestions, thereby enabling continuous and user-specific fashion support.

REAL-TIME OPERATING SYSTEM FOR ATMEGA328P(EMBEDDEDSYSTEM)

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Assoc.Prof. Prapong Prechaprapranwong , Ph.D

Computer Engineering

Abstract

Embedded systems utilizing microcontrollers like the ATMega328P are integral to applications ranging from consumer electronics to industrial automation. Despite its popularity for its simplicity, energy efficiency, and cost-effectiveness, the ATMega328P often relies on basic looping structures or interrupt-driven designs. These conventional methods limit the efficiency, responsiveness, and scalability of embedded systems, making them unsuitable for modern real-time applications such as sensor monitoring, communication protocols, and motor control. Studies reveal that nearly 30% of embedded systems in real-time scenarios experience delays or inefficiencies due to inadequate task scheduling and resource management.

This project aims to address these limitations by developing a lightweight Real-Time Operating System (RTOS) tailored for the ATMega328P microcontroller. The proposed RTOS will enable efficient multitasking, timely execution of critical processes, and improved resource management. By overcoming the constraints of traditional task management methods, this solution will enhance the performance of time-sensitive applications, offering engineers, developers, and industries a more reliable and scalable embedded system platform. Ultimately, this RTOS will serve as a foundation for advancing real-time embedded systems and unlocking new possibilities for precision-focused applications.

An alternative autopilot drone system for assisting ambulances and emergency vehicles

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Computer Engineering

Abstract

The objective of this project is to develop a prototype web application with a drone control system to assist emergency medical service (EMS) personnel. During the project, our team conducted research and analysis based on real-world problems to guide the design and development. The focus is on applying drone technology to real-life situations, including aspects of control, navigation, field communication, and the development of artificial intelligence by using Ultralytics YOLOv8 Model with custom dataset for autonomous navigation systems. The project is expected to serve as a foundation for creating know-how in using drones for emergency medical operations, as well as a guideline for future improvements and practical applications of the technology.

Evaluation and Comparison of EEG Encoding Methods for Seizure Classification in Spiking Neural Networks

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Advisor
Prapong Prechaprapranwong, Ph.D., Asst. Prof. Rajchawit Sarochawikasit

Computer Engineering

Abstract

The representation of electroencephalogram (EEG) signals within Spiking Neural Networks (SNNs) is essential for developing SNN models that can be deployed on low-power neuromorphic hardware suitable for real-time devices. This study provides a comprehensive evaluation and comparison of six spike encoding techniques—rate Coding, threshold-based representation (TBR), step-forward Coding, Ben's Spiker Algorithm (BSA), phase Coding, and burst Coding—in the classification of epileptic seizures from EEG data. Utilizing the CHB-MIT dataset, EEG signals were preprocessed using the Short-Time Fourier Transform (STFT) and subsequently converted into spike trains through each encoding method by using only the magnitude of the STFT. The encoded data were then input into a convolutional SNN architecture implemented with snnTorch, and performance was evaluated based on several criteria: classification accuracy, precision, recall, F1-score, Brier loss, sparsity, and signal fidelity by computing root mean square error between the original signal and reconstructed signal. Results suggest that BSA provides balanced performance across most classification metrics with high accuracy and F1-score, whereas Rate Coding exhibits lower recall than most spike encoding methods. Phase Coding demonstrated the highest sparsity, but with moderate accuracy trade-offs. Step-Forward Coding achieved the best signal fidelity with the lowest RMSE, while TBR balanced computational efficiency and classification performance. Burst Coding showed promising results for detecting rapid signal transitions but required more computational resources than other methods. These findings enhance the understanding of how spike encoding affects SNN-based EEG classification, with significant implications for developing efficient and accurate neuromorphic seizure detection systems.

Neuromorphic Processor Implementation on FPGA

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Advisor
Dr. Prapong Prechaprapanwong, Asst.Prof. Rajchawit Sarochawikasit

Computer Engineering

Abstract

In recent decades, machine learning has seen remarkable progress, particularly with the evolution of neural networks into deep learning models with many layers. These networks are broadly categorized into Artificial Neural Networks (ANNs) and the newer Spiking Neural Networks (SNNs). However, as neural networks grow increasingly complex, they encounter significant limitations when implemented on traditional Von Neumann architectures, where the processing and memory modules are separated. This separation causes a constant transfer of data (called the "Von Neumann bottleneck") between the two modules, leading to delay and inefficient energy usage due to data transfer, This problem become more severe in large, data-intensive systems like deep neural networks. SNNs offer a promising alternative by mimicking biological neurons, communicating through spike trains and activating only upon receiving new input spikes, enabling more energy-efficient computation. While specialized hardware like Intel’s Loihi chip has been developed to accelerate SNN operations using neuromorphic principles, its limited commercial availability restricts broader experimentation and research.

To address this challenge, we propose simulating an SNN-capable hardware environment using a Field-Programmable Gate Array (FPGA). This approach aims to make SNN research more accessible by leveraging widely available hardware, promoting further exploration of low-power, biologically inspired neural computing models. During the development process, we encountered hardware limitations on the Basys 3 FPGA board, which required scaling down the system significantly. The number of processing cores was reduced from 16 to 4, and the arithmetic bit-width was decreased from 32 bits to 16 bits to fit within available resources. Despite these constraints, the implementation provides a functional proof-of-concept for accessible and energy-efficient SNN acceleration using FPGA platforms.

Roverant

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Advisor
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Computer Engineering

Abstract

Security operations in large facilities often require personnel to simultaneously patrol areas and monitor CCTV systems, leading to fatigue, inefficiency, and potential human error. This project introduces the Roverant Security Guard Mobile Robot, designed to autonomously patrol designated areas, significantly enhancing security coverage and operational efficiency. Roverant leverages advanced technologies, including simultaneous localization and mapping (SLAM), real-time thermal imaging, and camera integration, specifically to monitor and detect temperature anomalies in server rooms.

The system comprises two main components: the mobile robot equipped with a Raspberry Pi 5 for computational tasks, an RPLiDAR sensor for precise navigation, a thermal camera to accurately monitor temperatures, and high-resolution cameras for real-time surveillance; and a user-friendly web application built using Next.js and FastAPI frameworks. This web interface provides real-time monitoring, video feeds, and remote control capabilities to security personnel. Communication between the robot and the web application is facilitated via wireless protocols, ensuring real-time data exchange and responsiveness.

Preliminary testing demonstrates Roverant's capability to autonomously navigate indoor environments, effectively detect and monitor temperature conditions in server rooms, and transmit critical data swiftly to the monitoring platform. Early trials have also identified areas for improvement, particularly in WebSocket communications and computational load management, with proposed solutions already in progress.

Ultimately, Roverant represents an innovative integration of mobile robotics, thermal imaging, and web technologies, designed to significantly improve server room monitoring by automating repetitive tasks and reducing human error. The successful deployment of Roverant, supported by PostgreSQL for robust data management, is expected to offer reliable solutions for critical infrastructure monitoring in diverse indoor environments such as data centers, corporate offices, and educational institutions.

FinTrack: Application for Expense Management and Budget Tracking

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Computer Engineering

Abstract

Abstract

Today, personal financial transactions are growing quickly in the digital world. Many people are looking for clear and easy-to-use money management apps. However, most current apps do not have automatic systems or support working with others, which makes it harder to manage personal finances. This project aims to develop a mobile application that helps users manage expenses and track their budget. It uses Optical Character Recognition (OCR) technology to make the process easier and allow users to better understand their financial habits.
This application can read data from E-Slips from six major Thai banks: Kasikorn Bank, Krungthai Bank, Siam Commercial Bank, Bank of Ayudhya, TTBThanachart Bank, and Government Savings Bank. It uses TesseractOCR to automatically read and record expense information from the slips. This reduces the need to enter data manually and helps improve the accuracy of income and expense tracking. The app also supports working with others through two types of shared spaces: the Expense Workspace for small group spending, and the Project Workspace for setting and managing budgets together. These features help make shared money management more transparent and organized.
The development process includes: (1) studying background information and planning the system structure, (2) gathering user requirements, (3) designing the interface and database, (4) creating the OCR module to read Thai-language E-Slips, (5) building the app using Flutter (Dart) with Node.js/Express and MongoDB on Microsoft Azure, and (6) testing for performance and security. The final application not only helps users record and review their expenses easily, but also encourages better saving habits.

Keywords: Expense management app, OCR, E-Slip

Muay Thai Immersive Interactive Video System

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Computer Engineering

Abstract

Thailand is renowned for its cultural richness, with Muay Thai standing out as a globally recognized martial art. In recent years, both public and private sectors have increasingly supported sports tourism initiatives to attract international visitors. According to the Public Relations Department (2024), sports tourism has the potential to generate up to 3 trillion Baht in revenue, highlighting its national importance. Despite this potential, technological integration in Thai sports tourism remains limited, affecting its appeal and accessibility on an international level. This project proposes to develop an interactive Muay Thai video system by integrating image processing, object detection, gesture recognition, and gesture control technologies. Users will perform basic Muay Thai movements, which the system recognizes and triggers an animated virtual opponent generated using Rokoko motion capture, retargeted in Blender, and deployed in Unity. The system enhances user engagement by simulating combat scenarios and records each session, allowing users to download a personalized video by scanning a QR code. The video will be available for 24 hours before being automatically deleted. The development team expects that this project will evolve into real-world applications that help promote sports tourism in Thailand. It also aims to serve as a foundation for further research and development in gesture recognition systems and the application of technology in sports tourism.

EFFECT OF QUANTUM RANDOM NUMBER ON META-HEURISTIC ALGORITHMS' INITIALIZATION

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Computer Engineering

Abstract

Currently, meta-heuristic algorithms play a vital role in solving complex optimization problems. Many new algorithms, inspired by natural behaviors or mathematical principles, have been developed to improve optimization processes and achieve faster convergence. owever, the crucial initialization step, which can greatly influence optimization outcomes, has received relatively little research attention. Although initialization schemes can enhance convergence speed or solution quality by starting near optimal solutions, they typically ely on synthetic entropy sources rather than true natural randomness. This research focuses on the impact of using quantum truly random numbers in the initialization phase of three meta-heuristic algorithms: Genetic Algorithm (GA), Particle Swarm Optimization (PSO), nd Artificial Bee Colony (ABC), compared to the traditional alternative of pseudo-random numbers. We employ quantum random number generators, implemented via quantum circuits and quantum experiments, which derive entropy from fundamental quantum henomena. Our findings reveal that quantum random numbers exhibit weaker statistical randomness according to standard randomness tests (NIST statistical test suite), compared to high-quality pseudo-random numbers that are specifically designed to pass such ests. owever, the Friedman test indicates that using the quantum random numbers in the Genetic Algorithm's initialization has a significant improvement when solving the CEC2021 benchmark problems (Congress on Evolutionary Computation 2021), compared to initialization ith pseudo-random numbers. In contrast, for the other two algorithms—Particle Swarm Optimization and Artificial Bee Colony—the application of quantum random numbers does not lead to a statistically significant improvement in optimization performance.

REVAMPING THE SERVICES OF THE FAST TRACK APPLICATION

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Computer Engineering

Abstract

The Fast Track application serves as a cornerstone of Tokio Marine Life Insurance (Thailand) PCL's digital ecosystem, empowering insurance agents with a comprehensive point-of-sale tool for offering diverse insurance packages and riders. However, the application's reliance on an aging .NET 4 framework and associated technologies now presents significant hurdles in terms of performance, scalability, and ongoing maintenance. To address these challenges and ensure the system can effectively support future growth and evolving customer expectations, this project, "Revamping the Services of the Fast Track Application," proposes a comprehensive modernization initiative.

The primary objective of this project is to significantly enhance the Fast Track application's responsiveness, reliability, and deployment efficiency through a strategic upgrade of its core technologies and underlying architecture. This endeavor includes a critical upgrade of the Fast Track API to the latest .NET 8 framework, which promises substantial improvements in performance and concurrency handling. Concurrently, the project will focus on optimizing the database architecture to seamlessly accommodate the new API requirements, thereby resolving existing performance bottlenecks and bolstering the system's ability to scale effectively. Furthermore, the user interface will undergo a significant transformation through the migration of the existing frontend from Cordova and JavaScript to the modern Flutter framework, ensuring an enhanced user experience across all devices. The Master Website for system administration will be developed utilizing the Angular framework. The project will be executed in a structured two-phase approach: an initial research phase dedicated to in-depth system analysis and strategic planning, followed by a comprehensive implementation phase encompassing development, rigorous testing utilizing Grafana k6 for performance validation, and deployment. The anticipated outcomes of this project include a revitalized Fast Track application characterized by markedly improved performance, enhanced scalability, simplified maintainability, and ultimately, a superior experience for both Tokio Marine's insurance agents and their valued customers.

SYNCHRONIZE DUST MEASURING DEVICE WITH SERVICE ROBOT

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Advisor
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Computer Engineering

Abstract

Cleanliness in microelectronics manufacturing is crucial as microscopic dust particles can damage sensitive products. This project aims to develop an automated system using service robots to measure dust levels efficiently. The system integrates the SOLAIR 1100LD dust article counter with the KEENON T6 robot, controlled by a Raspberry Pi, and a Dashboard for real-time data display. The solution reduces human labor, enhances accuracy, and minimizes time spent on daily dust measurement. This project improves cleanliness standards n production processes, while increasing efficiency and safety in the industrial environment.

Chatbot to Facilitate Medical Personnel and Engineers

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Computer Engineering

Abstract

Nowadays, communication between doctors and engineers, especially in the medical manufacturing sector, involves handling a large amount of detailed information during meetings. However, important details can often be lost due to the overwhelming amount of discussion and human error. In addition, doctors need to track the production status of medical products and estimate production times to plan surgeries effectively. Communicating and retrieving such information manually causes delays and reduces work efficiency.

Our project develops a system that utilizes Automatic Speech Recognition (ASR) and Large Language Model (LLM) technologies to convert meeting audio into text and automatically summarize the key discussion points. Doctors and engineers can interact with the system via web application interface, where users can upload meeting audio, generate meeting summaries, track the production status, and estimate production times easily. The system not only helps in reducing the time needed for note-taking and communication but also improves the accuracy and speed of production planning. Users can conveniently retrieve summaries or inquire about production status by typing simple queries through Chat, and the results will be processed and responded to immediately by the chatbot system.

Advancing Deep Learning Techniques for Precision Segmentation and CBCT Data Harmonization in Maxillofacial and Orthopedic Surgery

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Computer Engineering

Abstract

Oral cancer is a malignancy with a rising incidence rate, severely impacting patients' lives, especially in advanced stages. Surgical resection of malignant tissues is often necessary, leading to the loss of jaw and facial bones. Consequently, bone replacement devices play a crucial role in restoring patients' quality of life. Creating these devices relies heavily on Cone-Beam Computed Tomography (CBCT) scans, which provide detailed structural information of bones. However, CBCT data often vary significantly in quality and resolution due to differences in equipment and imaging protocols, posing substantial challenges to the segmentation process and increasing the risk of errors.

This project aims to develop a deep learning-based segmentation system for jaw and facial bones from CBCT data, following two key strategies: (1) enhancing data quality through Adaptive Windowing, Gamma Correction, and Normalization to improve consistency and highlight bone structures; and (2) designing a novel model architecture, "IncepU-Next," which applies Multi-Axis Dynamic Fusion to better capture intricate three-dimensional bone structures while reducing computational and memory demands.

The performance of IncepU-Next was evaluated against state-of-the-art benchmark models using Dice Similarity Coefficient and boundary-based metrics on real-world CBCT datasets. Results demonstrated that IncepU-Next achieved superior spatial accuracy while significantly reducing memory consumption.

The outcomes of this project enable the creation of highly personalized three-dimensional models, allowing for more precise surgical planning, reduced preparation time, minimized risks of error, and improved long-term outcomes in facial reconstruction. Beyond oral cancer treatment, the system also supports urgent surgical planning for facial trauma patients and rehabilitation for individuals with congenital craniofacial anomalies. Overall, this project highlights the integration of artificial intelligence (AI) technologies to advance the precision, efficiency, and sustainability of medical treatments.

COLLABORATIVE NOTE-TAKING APPLICATION

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Computer Engineering

Abstract

This project aims to develop a real-time collaborative note-taking application for the Android operating system, specifically addressing the challenges students face with traditional, individualistic note-taking methods and limited collaboration tools. Most existing applications are designed for solo use and lack robust real-time collaboration features. Additionally, many Android-based note-taking apps suffer from performance issues and offer a suboptimal user experience. The proposed application leverages real-time collaboration technology, enabling users to seamlessly write, edit, and share notes in shared rooms. Key features include friend invitations to collaborative rooms, document management, undo/redo functionality, and text color customization. These features are designed to support efficient group work, improve communication, and foster collaborative learning among users.

Thai Fake News Detection With LLM Integration For Web Application

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Computer Engineering

Abstract

We develop an explainable fake news detection system using an LSTM-BERTa-MDeBERTa ensemble, RAG, and LLMs. It classifies news, explains decisions via chain-of-thought reasoning, and summarizes articles from crawled sources to enhance transparency.

Synthetic CT images from cone beam CT for adaptive radiotherapy in the pelvic region

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Computer Engineering

Abstract

Currently, cancer treatment using Adaptive Radiation Therapy (ART) techniques enhances the precision of radiation delivery, reducing the risk of side effects to normal tissues and increasing the accuracy of radiation alignment with patients' anatomical changes. However, patients require repeated Computed Tomography (CT) imaging, which increases radiation exposure and the workload of medical staff. This research proposes using Cone Beam Computed Tomography (CBCT) imaging from patient position verification for adaptive planning in the pelvic region. Nevertheless, CBCT images are of lower quality and exhibit Hounsfield Unit (HU) discrepancies, making them unsuitable for direct treatment planning.

This study employs synthetic imaging techniques using deep learning methods, such as Contrastive Unpaired Image-to-Image Translation (CUT) and Kolmogorov-Arnold Networks (KANs), to improve image quality. The research team anticipates that the results will provide high-quality CBCT images suitable for treatment planning, reduce patient radiation exposure, and alleviate the workload of medical staff in the planning process.

Keywords: Adaptive Radiation Therapy, Synthetic Computed Tomography, Cone Beam Computed Tomography, Unpaired Image-to-Image Translation, and Kolmogorov-Arnold Networks

Web Application for Staging Classification of Pressure Ulcers

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Computer Engineering

Abstract

Pressure ulcers are injuries to the skin or underlying tissue caused by prolonged pressure, leading to impaired blood circulation, tissue hypoxia, and an increased risk of serious complications. Staging classification of pressure ulcer often relies on the subjective judgment of medical personnel, which may vary with individual experience and lead to inconsistent assessment. This project aims to develop a web application to assist in pressure ulcer staging from photographic images using deep learning techniques, including image classification and object detection. Five image classification models, two object detection models, and a mixed model approaches were evaluated. Among these, the YOLOv11 model (code 11A), an object detection model, achieved the highest performance, with an F1-score of 0.80. Therefore, this model was subsequently implemented in the development of web application. The developed web application reduces bias-related errors in staging assessments and provides a structured system of patient data storage to facilitate clinical care and future research.

Development of a Big Data Platform within the Information System of the client's organization

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Computer Engineering

Abstract

The scope of the project focuses on designing and developing a big data platform with an ETL data pipeline to support data analytics by integrating various data sources and collecting structured data for analysis. The platform will incorporate algorithms for data processing, data quality improvement, and trend and pattern detection. Additionally, API development will facilitate integration with BI dashboards and AI models. The project will also ensure efficient data flow in the backend and enable effective database management.

Development of a Medical Consultation System Using AI With a Focus on LLM Technologies

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Computer Engineering

Abstract

Pretraining Large Language Models (LLMs) on massive corpora has become the cornerstone of modern natural language processing. However, LLMs often struggle in domain-specific settings, especially in specialized fields such as medical anatomy, where general nowledge is insufficient for accurate question answering. One technique used to address this limitation is Retrieval-Augmented Fine-Tuning (RAFT), which combines document retrieval with domain-specific fine-tuning. While RAFT improves performance by grounding esponses in relevant documents, it faces a key limitation: contextual fragmentation. When documents are split into chunks for retrieval, important contextual cues may be lost, impairing the model's understanding. To overcome this, we propose a new approach, ontextual etrieval-Augmented Fine-Tuning (CRAFT), which extends RAFT by enriching each chunk with adjacent context and explicitly incorporating both relevant (oracle) and irrelevant (distractor) content during fine-tuning. This strategy helps the model better discern meaningful nformation and reason within domain-specific boundaries. We constructed a bilingual (Thai-English) synthetic dataset derived from USMLE-standard medical texts. The documents are chunked and embedded to support semantic retrieval. We further augment the data ith hain-of-Thought (CoT) reasoning to guide the model through stepwise inference. Our chosen base model, Qwen2.5-7B Instruct, is fine-tuned using LoRA for efficiency. Experimental results show that the CRAFT-enhanced model outperforms all baselines across multiple enchmarks, achieving the highest scores in BLEU (20.78), ROUGE-1 (0.50), ROUGE-L (0.48), BERTScore (0.785), and SQuAD-f1 (32.67). These results surpass those from standard supervised fine-tuning, RAG, and Graph-RAG, highlighting CRAFT's effectiveness in both recision and contextual understanding. The resulting system supports offline deployment, making it suitable for privacy-sensitive or resource-constrained environments. This work offers a scalable, multilingual approach to adapting LLMs for specialized medical domains and contributes a structured methodology for domain adaptation in clinical NLP.

Development of a web application for screening skin diseases With mobile phone images using the CIELAB color system

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Computer Engineering

Abstract

With the rapid advancement of mobile phone camera technology in the digital age, the utilization of mobile images in preliminary healthcare applications has emerged as a promising approach. This project proposes the development of a web-based application for the screening of skin diseases using mobile phone images, incorporating the CIELAB color space which closely resembles human visual perception along with deep learning techniques. A Convolutional Neural Network (CNN), integrated with Transfer Learning, is employed to classify skin conditions from digital images.

The dataset utilized comprises 3,689 images obtained from open-source repositories, categorized into four groups: acne (1,255 images), normal skin (1,104 images), eczema (729 images), and psoriasis (601 images). Preprocessing procedures include the conversion of image color space from RGB to CIELAB, followed by normalization and standardization to maintain color consistency. To address class imbalance, data augmentation techniques were applied, ensuring an even distribution of image samples across all categories. Furthermore, hyperparameter tuning specifically adjustments to learning rate, batch size, and dropout was conducted to optimize the model's performance.

The model's effectiveness was evaluated using standard performance metrics, including Accuracy, F1-score, and AUC-ROC, all of which demonstrated strong classification capability across the four skin disease categories. The proposed web application provides a user-friendly platform for preliminary skin disease assessment, supporting early detection, reducing patient burden at healthcare facilities, and improving access to dermatological evaluation in resource-limited settings.

Development of platform for computational drug screening using structural-based virtual screening approach

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Computer Engineering

Abstract

This project aims to develop a computational platform for structure-based virtual screening (SBVS) to identify potential drug candidates interacting with influenza virus proteins. Influenza is a major infectious disease that continues to affect populations worldwide, with mutations and drug resistance posing significant challenges to treatment. Traditional drug development is time-consuming and costly; therefore, computational methods such as SBVS have become crucial for accelerating the discovery of effective therapeutics. In this study, we focused on analyzing the interaction between small molecules and RNA-dependent RNA polymerase (RdRp) of the influenza virus using molecular docking techniques with AutoDock Vina. Ligands from the ZINC database were screened, and the compounds with the highest binding affinity were identified. The top candidates, including Retapamulin, Deslanoside, and Ouabain, demonstrated strong binding potential and interactions with key amino acids at the active site of the target protein. Based on these findings, we developed a user-friendly platform that allows laboratory personnel to perform docking experiments without deep computational expertise. The platform supports protein and ligand uploads, custom grid box settings, visualization of 3D structures, and binding affinity ranking. By simplifying the SBVS process, this system enables rapid and efficient drug screening, reducing the complexity and technical barriers often encountered in traditional computational drug discovery workflows.

Query Assist

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Computer Engineering

Abstract

In today's fast-paced business world, data plays a critical role in driving decision-making, solving problems, and improving operations. However, relying on specialists to retrieve data can be both costly and time-consuming. To address this challenge, Query Assist is proposed as a tool to simplify data access, enabling users to efficiently retrieve information from databases without requiring SQL expertise. Designed for fast-growing travel technology companies like Agoda, Query Assist aims to save time, reduce costs, and conserve resources while improving data accessibility.

Query Assist leverages Large Language Models (LLMs) and LangChain as its core technologies. LLMs are used to debug SQL queries, answer questions about table data, and translate natural language inputs into SQL queries. LangChain provides a robust framework for building agents that understand user inputs, generate responses, and interact with data. By integrating metadata from OpenMetadata, the tool ensures accurate column and table selection, enabling informed decision-making. This innovative solution is designed to enhance SQL operations, streamline data retrieval, and empower users to access data quickly and effectively, thereby driving efficiency and productivity in data-driven organizations.

Recruitment Platform for Direct Hire Decentralize Job & Indirect Hire (Freelance/Temporary Job)

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Computer Engineering

Abstract

The recruitment industry faces significant challenges due to inefficient processes, fragmented systems, and the increasing complexity of matching candidates to job opportunities. These inefficiencies result in delays, higher costs, and mismatches between job requirements and candidate skills, impacting companies, recruiters, and job seekers alike. This project, the recruitment platform of Ant HR, aims to address these issues by developing a centralized, role-based solution that connects companies, headhunters, and talented individuals.

The platform integrates a web application, a mobile app, and an AI-driven job matching tool to optimize the hiring process. Key features include real-time communication, intelligent form filling, and AI-powered job matching to align candidate profiles with employer needs. By providing a seamless and efficient recruitment experience, the platform reduces hiring costs and time for companies, simplifies job matching for headhunters, and enhances accessibility for job seekers. The initial launch will focus on the Thai labor market, with future expansions planned to include multilingual support and advanced functionalities. This innovative approach streamlines recruitment, benefits multiple stakeholders, and addresses critical inefficiencies in the current hiring ecosystem.

Spatiotemporal pattern and association with risk factors of Foodborne illnesses in Thailand

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Computer Engineering

Abstract

Foodborne diseases (FBDs) are a major global public health concern. However, long-term and population-level analyses in Thailand remain limited. The objective of this study is to perform a spatiotemporal analysis of three nationally notifiable foodborne diseases. —food poisoning, typhoid fever, and paratyphoid fever—across Thailand from 2006 to 2023. It explores the relationships between disease distribution patterns and potential climatic and socioeconomic risk factors. Additionally, an interactive dashboard was developed using R Shiny to visualize these trends and associations. Monthly surveillance data from 77 provinces were analyzed using spatiotemporal hierarchical models, incorporating lagged climatic variables (rainfall, humidity, and temperature) and area-based socioeconomic indicators (education, income, and poverty). A two-step model selection process was employed to identify the most appropriate likelihood functions, random effect structures, and explanatory covariates. Results revealed that food poisoning was the most prevalent and widespread FBD, with persistent clustering in the northeastern region and seasonal peaks in January. In contrast, the incidence of typhoid and paratyphoid fever showed a marked decline over time, with regional hotspots mainly in the earlier years. Higher educational attainment was consistently associated with lower FBD risk, while associations with income and poverty were more complex and varied by disease and province. Climatic factors demonstrated moderate and temporally consistent associations with disease incidence; however, spatial heterogeneity limited predictive performance at finer geographic scales. In conclusion, climatic and socioeconomic factors jointly play a complex role in shaping foodborne disease patterns in Thailand. The developed dashboard provides a useful tool for researchers and public health practitioners to explore these dynamics. This study suggests strengthening food safety interventions during high-risk periods, enhancing geographically focused surveillance efforts, and integrating socioeconomic data into disease monitoring systems to reduce disparities and improve control strategies. Continued research utilizing individual-level and longitudinal data is recommended to deepen understanding and inform more targeted intervention strategies.

Web application for lung cancer screening from Demographic data and Low-Dose CT scan images using Artificial Intelligence in Thailand

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Advisor
Asst.Prof.Dr. Santitham Prom-on, Asst.Prof.Dr. Wiriya Mahikul
Dr. Natthaya Triphuridet

Computer Engineering

Abstract

Non-communicable diseases (NCDs) are currently one of the main causes of death globally, especially cancer, which is the leading cause of death both internationally and in Thailand. Of all the malignancies, lung cancer has the greatest death rate. The low-dose CT medical images used in the present lung cancer screening method need to be diagnosed by specialists. However, a lack of medical staff and a high workload may lead to delays and increase the risk of errors. Therefore, artificial intelligence (AI) technology is being employed to improve accuracy and decrease workload. This study employed and further expanded deep learning skills and image processing to develop a web application for lung cancer screening in Thailand using data from low-dose CT scans, demographic data, and patient risk behaviors. Across the study, it shows that the model performs more efficiently when images are used along with tabular data in terms of reducing Type I error, improving accuracy, precision, and recall than when image data is used individually. After that, embed the model into the web application to make it simpler to utilize by medical personnel. The purpose of this study focuses on precisely and efficiently predicting the risk of acquiring lung cancer to assist medical personnel in screening and reduce the limitations in Thailand's public health system.

Application for Group Travel Planning and Coordination (PlanIT

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Advisor
Asst.Prof. Suthathip Maneewongvatana , Ph.D.

Computer Engineering

Abstract

PlanIT is a mobile application designed to simplify group travel planning by addressing challenges like collaborative itinerary creation, real-time updates, and expense management. Unlike existing travel apps that focus on individual needs, PlanIT prioritizes group dynamics with features such as shared itineraries, group messaging, and AI-driven personalized recommendations.
Built on Human-Centered Design principles, PlanIT leverages artificial intelligence and machine learning to enhance user satisfaction by tailoring suggestions to group preferences. This report explores the application's innovative tools, competitor analysis, and its ability to meet user needs, showcasing PlanIT as a comprehensive solution for stress-free and efficient group travel planning.

Generative AI for library's recommendation services

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Advisor
Asst. Prof. Dr. Suthathip Maneewongvatana

Computer Engineering

Abstract

Traditional library recommendation systems primarily suggest books based on a user's borrowing history or patron profile, and typically limit suggestions to titles already available within the library. These systems lack the ability to generate rich explanations about the recommended books or to expand the search to related titles beyond the library's holdings. To address these limitations, this project leverages Generative AI, specifically a Large Language Model (LLaMA3-70B-8192), to generate contextual descriptions of recommended books and to suggest relevant external titles that may better match a user's interests. The system is integrated with a LINE chatbot, allowing users to interact naturally and receive enhanced, personalized book recommendations supported by AI-generated content. This system also connects with KMUTT library management system allowing users to attach the suggested list for acquisition.

COSMOS: AI-DRIVEN PERSONAL PLANNER WEB APPLICATION FOR INCREASED PRODUCTIVITY AND MOTIVATION

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Advisor
Dr. Taweechai Nuntawisuttiwong, Ph.D.

Computer Engineering

Abstract

In modern digital environments, many users struggle with managing time, maintaining focus, and linking daily tasks with long-term goals. Common issues include task overload, low motivation, and lack of planning structure. To address these problems, Cosmos is developed as a web-based personal planner powered by artificial intelligence. It integrates task tracking, goal management, and productivity tools within a single platform, designed to support individual performance and time allocation.

Cosmos applies user-centered design and follows agile software development practices. The system uses machine learning models, including BERT for natural language understanding and Gradient Boosting for task classification and prioritization. Core features include AI-assisted task labeling, Pomodoro timers, goal breakdown tools, streak tracking, and productivity dashboards. Cosmos is implemented using Next.js for the front end and ElysiaJS for the backend API. It relies on PostgreSQL for data persistence, supports authentication, and connects with Google Calendar for schedule synchronization. CI/CD pipelines and automated testing ensure system reliability.

User testing showed improvements in task clarity, alignment between tasks and personal goals, and reduced cognitive load. Cosmos functions as both a planning assistant and a decision support system for task and time management. Current limitations include limited classification accuracy in ambiguous inputs and desktop-only availability. Planned improvements include mobile support, model tuning, and expanded behavioral analytics.

E-Learning for Health

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Computer Engineering

Abstract

Lack of knowledge about health and wellbeing, combined with the fragmentation of information from sources such as social media, government officials, and news remains a significant obstacle among Thai citizens. To address this issue, we propose the solution of an online learning platform that provides a wide range of educational media. We aim to make it easier to research and learn health-related topics by organizing information in one place and also to give users more personalized learning experience through interactive tools like quizzes, assessments, and progress tracking to support their learning journey.

The application includes two websites. The main website for learners to access content and services. The back office for authorized staff to manage content on the platform. These are built using the AstroJS framework and Go REST API server. SQLite is used as the database, and media files are handled through MinIO. Lastly, Redis is a caching storage for JWT tokens.

The platform is deployed on a virtual machine and includes all the key features such as a learning section, blogs, banners, and authentication. The back office website provides a wide range of management operations including creation, edition, deletion, and retrieval of contents of the application such as learning materials, blogs, banners, and users. We implemented a custom JWT access and refresh token system that provides robust security and allows for tailored security configurations. However, due to cookie's port isolation limitation, JWT tokens are shared between the main and back office websites, making it impossible for a user and an admin to remain active on their respective platforms simultaneously. In the future, the application can be expanded to include discussion forums, events, and jobs features, offering users more options to cater to their specific needs.

Eating Disorder website with AI-powered Personalized Avatar Creation

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Advisor
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Computer Engineering

Abstract

Eating disorders are complex mental health conditions that require early intervention and increased public awareness. To address this issue, this project proposes "EatAware", an interactive web application designed to educate users through accessible resources, statistical data, and AI-driven personalized avatar creation. The main objective is to visualize the potential impacts of eating disorders and promote early detection.

EatAware employs machine learning techniques to generate cartoon-style avatars from user-uploaded images, simulating physical and mental changes associated with various stages of eating disorders. Key features include dynamic animations, bilingual content presentation (Thai and English), and interactive tools to support personalized learning experiences.

Evaluation results indicate that the integration of advanced visualization significantly enhances user engagement and understanding of the topic. EatAware effectively bridges modern technology and mental health education, making a meaningful contribution to individual and community awareness. Future development plans include expanding avatar customization options, improving predictive modeling accuracy, enhancing computational efficiency, and incorporating additional multilingual support to broaden user accessibility.

StreamInsight

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Computer Engineering

Abstract

One Bangkok has an extensive CCTV network that generates massive amounts of video data, most of which remains unused. This wastes storage and increases costs. By transforming this untapped data into actionable insights, new opportunities can emerge, including improved security, better customer understanding, and more efficient operations.

The StreamInsight project focuses on developing a web application that converts real-time video data into actionable visualizations. It leverages the SenseTime API, which provides raw data from over 5,000 CCTV cameras within One Bangkok. To process and visualize this data, we use Flask as the backend framework, which connects to InfluxDB for time-series data storage. Data is queried and preprocessed using the InfluxDB client, while further analytics and transformation are performed using the Pandas library. The frontend is built with Next.js, ensuring an interactive and responsive user experience.

To ensure scalability and reliability, a database is integrated to store raw data from the SenseTime API, acting as a data provider to reduce API load during high-demand periods. The processed data is then presented through a user interface, offering real-time insights for various operational needs. Therefore, the goal of this project is to reduce resource consumption, including cooling water, electricity, and storage costs, by transforming raw data into actionable insights. This enables organizational users to enhance security and optimize business operations. To achieve this, we developed a web application that provides real-time data analysis and monitoring within a smart city environment.

In conclusion, StreamInsight demonstrates how large-scale CCTV data can be converted into valuable insights, improving operational efficiency, security, and customer behavior analysis. By integrating AI from third-party API (SenseStudio), analytical data, scalable data management, and an intuitive UI, StreamInsight provides a practical solution for smart city management, setting a foundation for further advancements in AI-driven video analytics.

Internship Hub for Computer Engineering Students

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Computer Engineering

Abstract

Finding suitable internship opportunities remains a significant challenge for computer engineering students, who often lack access to centralized information and effective channels for tracking announcements from relevant companies. Moreover, the absence of intelligent tools to recommend positions that align with students' skills and interests further complicates their preparation for entering the job market.

This project presents the design and development of a web application that aggregates internship opportunities through web scraping from multiple company websites. The collected data is organized into a user-friendly, searchable platform. In addition, the system integrates machine learning techniques to analyze student profiles—including resumes and stated interests—and recommend appropriate internship positions tailored to individual qualifications.

The application also provides data visualization features, offering insights into the timeline of internship postings and emerging trends across various career fields. These features aim to assist students in making more informed decisions regarding their internship search. Ultimately, this system enhances students' chances of securing internships that match their professional aspirations and contributes to their readiness for future employment.

Modeling of radiation-induced DNA damage using Monte Carlo track structure simulation

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Dr. Rajchawit Sarochawikasitan

Computer Engineering

Abstract

DNA is regarded as a sensitive target for ionizing radiation, susceptible to damage through direct energy deposition or the subsequent production of free radicals through water radiolysis within the cellular environment. The mechanistic simulation of radiation-induced DNA damage facilitates the quantitative prediction of radiobiological effects. However, such simulations typically require several hours or days, rendering them inefficient for parameter adjustment or practical implementation.
a Python program designed to simulate radiation-induced DNA damage in a 216-bp DNA double-helix segment underwent reoptimization to enhance computational speed. Atomic coordinates from a Protein Data Bank (PDB) file were retrieved and positioned randomly within a working volume. Nucleotide centers and radii were precomputed using Numba-accelerated (@njit) routines. Charged particles, specifically 200 MeV protons, and hydroxyl (OH) radical positions were retrieved from Geant4-DNA simulations. For each event, a spatial filter identified potential nucleotides impacted by charged particle tracks or damaged by OH radicals using vectorized NumPy distance calculations and a per-atom Van der Waals distance verification. Energy depositions (E_dep) exceeding a 17.5 eV threshold and probabilistic OH hits were recorded strand-wise and subsequently classified into single-strand breaks (SSB), double-strand breaks (DSB), complex lesions (SSB+, 2SSB), and higher-order DSB variants (DSB+, DSB++) employing Numba-optimized loops. Workloads were distributed evenly across available CPU cores using Python's multiprocessing.Pool, thereby eliminating Python overhead by grouping static PDB preprocessing outside the per-file loop. On a test dataset comprising 3,200 PDB files and 50,000 charged particle tracks, the program executed a comprehensive damage profile—including per-DNA SSB/DSB counts, total energy deposition, and hit statistics—within minutes, a significant improvement from the previously reported hours-long execution time prior to code optimization. This modular framework possesses the capability to be expanded to accommodate diverse DNA lengths, radiation spectra, or damage-threshold criteria, thereby transforming it into a versatile tool for extensive radiobiological damage assessment.

Inspira: Web Application for Exhibition Discovery and Recommendations

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Computer Engineering

Abstract

Activity-based tourism, particularly exhibition visits, is gaining popularity worldwide. However, users still face challenges in accessing accurate, up-to-date, and comprehensive information about exhibitions. This project presents the development of a web application designed to collect and organize exhibition data from multiple sources, thereby supporting both discovery and travel planning. The platform targets users interested in a wide range of exhibitions—such as those in art, science, technology, and culture—and focuses on delivering reliable and current information to enhance participation efficiency. Users can access the system when searching for new exhibitions during their free time or when planning trips in advance. In addition, the application addresses the needs of users who wish to record their visit experiences and receive personalized activity suggestions through an integrated recommendation mechanism. The system also supports wishlist functionality and event reminders to ensure a more engaging and seamless user experience.

We deployed Express.js for server-side development, Next.js for client-side rendering, Docker for containerization, and Elasticsearch for efficient information retrieval. MongoDB is utilized as the NoSQL database. Additional modules such as Scrapy and Selenium for web scraping, Mongoose for database management, bcrypt.js and JSON Web Tokens (JWT) for authentication and security, and Nodemailer for email verification are incorporated to enhance system functionality. Furthermore, machine learning techniques, specifically Term Frequency-Inverse Document Frequency (TF-IDF) and Support Vector Machines (SVM), are applied for precise exhibition categorization.

Key features of the application include real-time search powered by Elasticsearch, automated route planning utilizing the Google Maps API and GTFS public transport data, user-generated exhibition reviews and ratings, personalized activity recommendations, and automated data updates conducted biweekly via web scraping. Additionally, a notification system alerts users to upcoming events they have favorited.

Web Application Dashboard for Back Sensor Quality Inspection

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Computer Engineering

Abstract

Currently, data collection for back sensor quality inspections is conducted through manual documentation. The data collection process is cumbersome and not conducive to tracking and analyzing trend data to evaluate the success of plans. Additionally, preparing summary reports for presentation to managers or visiting clients remains complex and time-consuming. This project aims to develop a system that enhances the efficiency of data management by providing employee performance information in real-time and presenting summarized results as a dashboard through a web application. The system will integrate hardware design and precision to support operations with efficiency.
Keywords: Web Application, Dashboard, Quality Inspection of Back Sensors, Hardware Control, Real-time Data Collection

Development of filtration process for BSA solution

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Advisor
Asawin Meechai

Chemical Engineering

Abstract

This project focused on identifying the optimal process settings for concentrating and performing diafiltration on a 100-liter solution of bovine serum albumin (BSA) within a time limit of three hours. The starting solution had a BSA concentration of 1 g/L, dissolved in phosphate-buffered saline (PBS) containing 250 mM NaCl. The goal was to reach a final concentration of 5 g/L BSA in PBS, but with a reduced salt level of 137 mM NaCl.

Considering BSA's molecular weight of 66.5 kilodaltons, membranes with a 10 kDa cutoff (Ultracel® by Merck Millipore) were selected. Initial optimization work was conducted using Pellicon® XL cassettes (50 cm^2 surface area), and the process was later scaled up and confirmed using Pellicon® 3 cassettes (88 cm^2), to verify scalability.

To find the optimal conditions for protein concentration, tests were run on BSA solutions at both 1 g/L and 5 g/L concentrations. Each solution was evaluated at feed flow rates of 3, 5, and 7 LPM/m^2, under varying transmembrane pressures (TMP). These experiments led to the identification of 28 psi TMP and 7 LPM/m^2 feed flow rate as the optimal parameters.

Further analysis showed that a BSA concentration of 5 g/L was ideal for efficient diafiltration. The flux data collected during small-scale trials helped in estimating the necessary membrane area and solution volumes for full-scale application. When tested at a larger scale using Pellicon® 3 cassettes, 1.2 liters of the BSA solution was successfully concentrated and underwent buffer exchange in 2 hours and 58 minutes, achieving a recovery rate of 81%.

Based on these findings, to process 100 liters of BSA under the same conditions within the allotted 3 hours, a membrane area of at least 0.63 m^2 using 10 kDa Ultracel® filters is recommended.

Shelf-Life Determination of The Freeze-Drying Coffee

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Advisor
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Chemical Engineering

Abstract

This research focused on determining the Shelf -Life of Freeze-Dried coffee. The Shelf-Life of the Freeze-Dried coffee is analyzed by the Accelerated Aging Method.The storage condition was accelerated by setting the testing temperatures at 45°C and 55°C. The physical degradation is assessed by measuring moisture contents and water activity, while the chemical degradation is evaluated by measuring caffeine contents, caffeic acid contents, chlorogenic acid contents, and volatile compounds in coffee. The total phenolic content is measured using the Folin-Ciocalteu method, and the antioxidant activitiy is assessed through DPPH and FRAP assays. Sensory degradation is also assessed through taste testing to evaluate the quality of the coffee powder.

Revamping an existing bioethanol separation system into a reactive distillation system to produce ethyl acetate.

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Chemical Engineering

Abstract

Thai ethanol industry experienced reduced ethanol consumption during the COVID-19 pandemic in B.E.2562, and long-term challenges from the growing popularity of hybrid and electric vehicles. However, ethanol is tightly regulated and sales to distributors for transport fuels are subject to the provisions of the 2000 Act on sales of oil fuels. Using ethanol in the industry is also only possible with the permission of the Liquor Distillery Organization. Thus, this project was carried out enhancing the value of ethanol, which may be oversupplied in near future, by transforming it into ethyl acetate, a green solvent which is more valuable. The study was carried out using Aspen Plus V.12 software, starting with the economic assessment of an existing ethanol production plant. An ethyl acetate production process was then designed using type II reactive distillation column configuration employing Amberlyst 70 as the solid acid catalyst for the esterification of ethanol and acetic acid. The design objective is to minimize both reactive and stripper column diameters by varying the reflux ratio of reactive distillation and the bottom to feed ratio of the stripper column The expected outcome is to achieve ethyl acetate with a purity of at least 99.5% mol. The shifting in production from ethanol to ethyl acetate will be analyzed whether it could uplift the current ethanol industry into a new business or not.

Keyword: Reactive Distillation / Existing Ethanol Production / Ethyl acetate / Simulation / Aspen plus

Electrospun Nanofibers of Copper Catalysts for Electrochemical Reduction of CO2 in a Flow Cell

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Chemical Engineering

Abstract

The CO_2RR (Carbon Dioxide Reduction Reaction) is expected to play a critical role in the future for climate change mitigation, sustainable chemical production, and industrial decarbonization. Despite these, research and investment in CO_2RR are challenging due to the high efficiency and selectivity of current catalysts. This research has been conducted on the electrospun nanofibers of a copper catalyst for CO_2RR in a flow cell, aiming to enhance the selectivity of the petrochemical products such as formic acid, methanol, etc. The effects of Cu catalyst loading and applied potential in a flow cell were studied on the Faradaic efficiency (FE) and production rate in CO_2RR. The Cu loadings of 20%, 30%, 40%, and 50% on Polyacrylonitrile (PAN) catalysts were synthesized under a potential voltage of 20kV and a flow rate of 0.5 ml/min. The electrochemical reduction was carried out under applied potentials in the range of -0.5 to -1.7 V vs. RHE in a flow cell using $NaHCO_3$ as an electrolyte. Catalyst characterization was used to analyze the physical and chemical structure of the catalysts by using X-ray diffraction (XRD) and scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM-EDS). The results showed that the 40 wt% Cu catalyst had an appropriate structure with an average particle size of 0.84 ± 0.01 µm. Liquid and gas products from CO_2RR will be analyzed using high-performance liquid chromatography (HPLC) and gas chromatography (GC), respectively. At the applied potential of -1.1 V, the 40% Cu catalyst exhibited the highest Faradaic efficiency (FE) of 48.68% for formic acid.

Extraction of Cellulose Nanofibrils from Aloe Vera Peels

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Assoc. Prof. Dr. Somnuk Jarudilokkul

Chemical Engineering

Abstract

Aloe vera is renowned for its diverse medicinal properties, including its use as a laxative and its effectiveness in promoting the healing of gastric ulcers and burns. As a result, it is widely utilized in the pharmaceutical, cosmetic, food, and beverage industries. However, these industries generate substantial amounts of aloe vera peel waste, which contributes to environmental degradation. Repurposing this waste offers a sustainable solution to waste management, enhances economic value, and supports environmental conservation. This study aims to investigate methods for preparing cellulose fibers and extracting cellulose nanofibers from aloe vera peels through hydrolysis, as well as to examine the characteristics of the resulting nanofibers. Two approaches of cellulose fiber preparation were explored: one involving the removal of pectin and oil using hydrochloric acid, followed by lignin removal with sodium hydroxide; and the other involving boiling and cuticle removal. Although boiling presents a safer method, the process involving HCl and NaOH produced higher-purity cellulose fibers. For the extraction of cellulose nanofibers via hydrolysis, experiments were conducted at 30 °C and 50 °C for durations of 6 and 24 hours. The results indicated that the process was successful. The samples showed signs of disintegration but remained distinguishable in pieces. Notably, samples treated at 50 °C exhibited a greater degree of disintegration compared to those treated at 30 °C.

Modification of polyethersulfone membranes with dopamine and polyethylenimine to enhance the separation of lithium ions from mixed metal solutions

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Chemical Engineering

Abstract

Lithium-ion batteries are vital to the electric vehicle industry but generate waste containing valuable and hazardous metals. This study modified polyethersulfone (PES) membranes to selectively separate lithium ions from mixed metal solutions by surface polymerization with dopamine (DA), polyethyleneimine (PEI) of varying molecular weights, and glutaraldehyde (GA) crosslinking. Membrane properties were characterized pre- and post-modification, and separation performance was evaluated using synthetic solutions of lithium, cobalt, nickel, and manganese (500 ppm) at 3 bar. The results demonstrate that increasing the PEI molecular weight enhances ion rejection, with the best membrane achieving rejection rates of 4.29% (Li^{+}), 71.48% (Co^{2+}), 74.75% (Ni^{2+}), and 68.35% (Mn^{2+}).

Synthesis of rigid polyurethane foam from caster oil polyol with lignin addition

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Chemical Engineering

Abstract

This research aims to study the synthesis of rigid polyurethane foam using castor oil polyols with lignin extracted from the kraft process as an addition. The effect of the percentage of lignin addition on the properties of rigid polyurethane foam was also studied. The percentage of lignin addition were ranged from 0% to 5% by weight of the castor oil polyol. In the first step of the experiment, the castor oil polyols were prepared through the transesterification of raw castor oil with triethanolamine. It was found that the hydroxyl value of castor oil polyols was increased from 154.31 to 435.66 mgKOH/g. Then, the rigid polyurethane foam was synthesized through the polymerization of the castor oil polyols with a lignin addition, using polymeric methylene diphenyl diisocyanate (PMDI). In terms of lignin characterization, it was discovered that lignin had aromatic phenol rings, with an estimated particle size of 50 micrometers, as characterized by SEM and FTIR analysis. Lignin addition could increase the number of nucleation cells, grow the new bubble, and stabilize the cell structure of rigid polyurethane foam. This resulted in smaller cell size and decreased density as the lignin content increased. The compressive strength decreased with increasing lignin content, while the thermal properties remained constant. Moreover, it was found that the use of castor oil polyols could improve degradation in hydrolysis reactions and landfills.

CHE08

evelopment of the wastewater treatment system for a coffee process

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Chemical Engineering

Abstract

A wet coffee processing method is a water-intensive process that generates wastewater with high levels of biochemical oxygen demand (BOD), chemical oxygen demand (COD), nitrogen, and suspended solids, directly impacting the environment. Wastewater from traditional processing facilities is typically discharged into natural seepage ponds, leading to contamination of natural water sources and the emission of unpleasant odors. A production capacity of 100 kilograms of coffee cherries per day generates approximately 950 liters of wastewater. This study developed a prototype of the wastewater treatment system that is simple to operate and suited to community contexts. The system integrates coagulation-flocculation processes with constructed wetlands, ensuring that the treated wastewater meets local community discharge standards. It is designed for easy maintenance by local users and can be adapted for household-level applications. By combining multiple treatment processes and encouraging community participation, the system is expected to effectively mitigate environmental impacts and enhance sustainable ecological stewardship in the community, aligning with the principles of Clean Energy, Eco-Friendly, and Zero Waste.

Utilization of Lignin from Agricultural Waste for Enhancing Performance of Natural Rubber Composite

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Chemical Engineering

Abstract

The growing demand for sustainable materials has spurred research into using lignin a natural polymer derived from agricultural waste as a reinforcing filler in natural rubber composites. This study explores the extraction of lignin from sugarcane bagasse through an alkaline process using varying concentrations of sodium hydroxide (10%, 20%, 30%, and 40% w/v) to optimize both yield and purity. The chemical structure of the extracted lignin was confirmed via Fourier Transform Infrared Spectroscopy (FTIR), which revealed characteristic functional groups such as C=O, C–O of syringyl ring, C–H of aromatic deformation in syringyl ring, C–C and C–O of guaiacyl ring consistent with those found in commercial lignin [1]. Thermogravimetric Analysis (TGA) was conducted to assess thermal stability, identifying three primary degradation stages: moisture loss, structural decomposition, and residual breakdown. Lignin extracted with 20% NaOH showed the highest thermal stability. Natural rubber composites incorporating this lignin were evaluated for their physical properties in accordance with ISO standards, including tensile strength (ISO 37), aging resistance (ISO 188), and hardness (ISO 7619) [2]. Results were benchmarked against composites containing the conventional antioxidant 6PPD and Wingstay L. The findings indicate that lignin extracted from sugarcane bagasse can effectively replace synthetic antioxidants, delivering comparable mechanical strength and durability. These results underscore lignin’s potential as an eco-friendly reinforcing agent for sustainable, high-performance rubber products, such as sports flooring.

Keywords: Natural Rubber Composites, Sugarcane Bagasse, Sustainable Materials, Antioxidants

Biocoke Production from Ash-reduced Durian Peel through Carbonization at 1000°C for Iron Reduction Applications

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Chemical Engineering

Abstract

This research focuses on utilizing durian peel as a biomass feedstock for biocoke production through carbonization at 1000 °C for 3 hours in an inert atmosphere. The carbonization process decomposes organic matter, resulting in reduced moisture content and increased total carbon and fixed carbon content. However, it also leads to an increase in ash content. To address this, a pretreatment process involving leaching was investigated to reduce ash content before carbonization. Various leaching reagents deionized water, acetic acid, and calcium hydroxide were studied under different liquid-to-solid ratios (10:1, 20:1, and 40:1), leaching times (15, 30, 60, and 90 minutes), and temperatures (35 °C and 85 °C). The optimal condition was leaching with acetic acid at a liquid-to-solid ratio of 20:1 for 30 minutes at 35 °C, which reduced ash content by up to 90.84% and increased volatile matter content. The leached durian peels were then subjected to carbonization. Among the reagents tested, citric acid leaching yielded the highest fixed carbon content (89.46%), significantly reduced ash content (2.28%), increased total carbon (90.75%), and lowered oxygen content (7.01%), indicating enhanced fuel properties compared to untreated biocoke. Furthermore, the resulting biocoke demonstrated potential as a reducing agent in iron reduction processes.

Solvent extraction of xanthone from mangosteen

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Advisor
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Chemical Engineering

Abstract

Xanthones, particularly alpha-mangostin and gamma-mangostin found in mangosteen pericarp, have attracted considerable attention due to their potent antioxidant, anti-inflammatory, and anticancer properties. This research focuses on the extraction of alpha-mangostin and gamma-mangostin from dried mangosteen peel using 95% v/v ethanol as the solvent in combination with pressure-assisted extraction. The objective is to investigate the factors affecting the extraction process and analyze the chemical composition of the extract, enabling the identification and quantification of beneficial compounds. The study explores extraction parameters including temperature (70°C, 80°C, and 90°C), extraction duration (1, 2, 3, and 4 hours), and pressure (1 and 2 barg). The extraction yield is also compared with that obtained from Soxhlet extraction under conditions of 78.1°C for 4 hours. The results indicate that longer extraction times lead to higher yields of extract from dried mangosteen peel. The extract was then filtered and analyzed by Thin Layer Chromatography (TLC) to confirm the identity of alpha-mangostin and gamma-mangostin.

Enhancing of Protein Concentration from Conditioned Medium and Characteristic Analysis

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Ms. Napat Ruchkupt

Advisor
Assoc. Prof. Dr. Kwanchanok Viravaidya-Pasuwat

Chemical Engineering

Abstract

Chronic wounds, particularly in patients with diabetes and circulatory disorders, present significant challenges in healing due to impaired tissue regeneration. Recent advancements in stem cell technology and the application of Conditioned Medium (CM) containing proteins and bioactive molecules secreted by stem cells have gained attention for enhancing wound healing. This study aims to increase the protein concentration in CM derived from Mesenchymal Stem Cells (MSCs) using Tangential Flow Filtration (TFF) to achieve a fivefold concentration, making it suitable for chronic wound treatment. The research methodology includes filtering CM through TFF, analyzing protein concentration using the Bradford protein assay, and assessing additional components via nanoparticle analysis. In preliminary testing, Bovine Serum Albumin (BSA) was used to validate the filtration process. The TFF system achieved only a 3.158-fold concentration of BSA, falling short of the fivefold target. This suggests potential limitations in the current filtration conditions. Factors contributing to the suboptimal results may include non-ideal filtration conditions such as ambient temperature affecting protein stability, and a degraded membrane with reduced Normalized Water Permeability (NWP), which impacts filtration efficiency. Additionally, maintaining protein quality under experimental conditions proved challenging. These findings indicate that optimization of TFF parameters, membrane integrity, and environmental control is crucial to reliably achieve the desired concentration of CM for therapeutic use in wound healing.

The study of purification of alpha-amylase from rice callus culture

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Advisor
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Chemical Engineering

Abstract

Alpha-amylase is an important enzyme widely utilized in the food and pharmaceutical industries for its ability to hydrolyze large starch molecules into smaller sugars. In recent years, plant cell cultures such as rice callus have gained attention as alternative platforms for enzyme production due to their scalability and safety. This study aimed to evaluate and compare purification methods for alpha-amylase produced from rice callus cultures, focusing on ammonium sulfate ($(NH_4)_2SO_4$) precipitation at 40%, 60%, and 80% saturation, and anion exchange chromatography using DEAE-Cellulose as the stationary phase. Purification efficiency and enzyme properties were assessed through gel electrophoresis for protein molecular size, Bradford assay for total protein concentration, and enzymatic activity measurement using the 3,5-dinitrosalicylic acid (DNS) assay. Results showed that ammonium sulfate precipitation significantly improved protein concentration, enzymatic activity, and sample purity. Precipitation at 40% saturation yielded the highest specific activity (79.69 U/mg) and a purification fold of 2.53, outperforming the 60% and 80% conditions. Bradford assay also confirmed that 40% precipitation most effectively reduced contaminating proteins. Gel electrophoresis revealed a major protein band around 44 kDa, presumed to be alpha-amylase. In conclusion, ammonium sulfate precipitation at 40% saturation proved to be an effective, simple, and scalable method for enhancing the purity of alpha-amylase from rice callus cultures, supporting the potential of plant cell platforms for industrial enzyme production.

The design and production of filtration equipment set for conducting workshops in Chemical Engineering

Sombat Srisuklorm, Asadawut Naicharoen, Kairawin Burapongbundit

Advisor
Asst. Prof. Dr. Kantharakorn Macharoen, Dr. Kiattinatapon Juengchareonpoon

Chemical Engineering

Abstract

In response to the growing industry demand for skilled personnel and the shortage of training equipment in educational institutions, this project developed a filtration device for chemical engineering hands-on workshops to support up-skilling and re-skilling efforts. The project comprised three phases: design, fabrication, and application. First, plate and frame filter press were designed using Autodesk Inventor Professional 2024 and fabricated from ABS plastic to produce 3D model with a rubber gasket and polypropylene filter medium. The compact assembly measured 13 × 13 cm, with each plate or frame having a thickness of 1 cm. The structure was secured tightly using eight bolts, which helped minimize water leakage. Second, performance testing varied filtration conditions including pressure (5, 10, and 15 psi), rice flour suspension concentration (1–3% wt/wt), and the number of filter medium (2 and 4). Optimal results were achieved at 10 psi, 2% wt/wt concentration, and 2 filter medium, achieving a turbidity reduction of 98–99%. Finally, the device was integrated into chemical engineering workshops, enhancing participants' theoretical understanding and practical skills in the filtration

Electrodeposition of Silver and Cobalt oxide on carbon cloth as catalysts for Unitized Regenerative Fuel Cells (URFCs)

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Advisor
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Chemical Engineering

Abstract

This study explores the electrodeposition of silver (Ag) and cobalt oxide (Co3O4) onto carbon cloth (CC) as a cost-effective alternative to platinum-based catalysts for unitized regenerative fuel cells (URFCs), which operate in both electrolysis and fuel cell modes. The development of efficient bifunctional oxygen electrodes is critical to addressing the sluggish kinetics of the oxygen evolution reaction (OER) and oxygen reduction reaction (ORR), key limitations in URFC performance. Silver electrodeposition was carried out using silver nitrate (AgNO3) solutions at concentrations of 10, 20, 40, 60 and 80 mM in 0.1 M sodium nitrate (NaNO3). The process was performed in a three-electrode electrochemical cell under constant potential at –0.1 V and pulsed potential with duty cycles of 33% and 50%. Scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDX) analyses revealed that optimal deposition occurred at 10 mM AgNO3 and a 33% duty cycle, yielding Ag particles with an average diameter of 13.38 ± 5.66 µm. Increasing AgNO3 concentration led to higher mass loading of Ag.

To enhance deposition quality, the carbon cloth substrate was pretreated using a H2SO4/HNO3 mixture to increase surface hydrophilicity and nucleation sites. Large-area deposition was performed in a flow reactor at –1.35 V on a 3.5 × 3.5 cm2 area to overcome resistance associated with scale-up. Under these conditions, silver particles with an average size of 4.04 ± 0.91 µm and 1.03 ± 0.35 µm were formed. Following silver deposition, cobalt was electrodeposited using cobalt nitrate (Co(NO3)2) solutions at concentrations of 10, 20, 40, and 60 mM onto the Ag/CC substrate. Cobalt was then converted to cobalt oxide via electrochemical activation in 0.1 M potassium hydroxide (KOH).

The resulting Ag/Co3O4/CC composite electrodes demonstrated promising characteristics for bifunctional catalytic activity, suggesting their viability for high-performance URFCs.

Development and Characterization of bio-surfactants demulsifiers for enhanced crude oil separation

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Advisor
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Chemical Engineering

Abstract

The use of chemicals to separate water and oil is a widely adopted method for evaluating process efficiency. However, these chemicals can pose environmental risks and create waste disposal challenges due to their synthetic components. This study proposes the use of natural, environmentally friendly demulsifiers derived from rice husk (RH) and lotus leaf (LH) extracts. The study compares the performance of these natural extracts—specifically sticky rice husk and regular rice husk—processed through hydrothermal methods. Similarly, lotus leaf extract is also prepared using hydrothermal processing. The effectiveness of these extracts is evaluated using emulsion-breaking tests on samples composed of 70% oil and 30% water. The properties of the extracts are characterized using techniques such as Fourier-transform infrared spectroscopy (FTIR), X-ray photoelectron spectroscopy (XPS) and field emission scanning electron microscopy (FESEM) Currently in the experimental phase, this study aims to investigate the effectiveness of natural demulsifiers in breaking water-oil emulsions. Preliminary results and ongoing comparisons with commercially available demulsifiers are being conducted to assess their performance against standard benchmarks. This natural-based approach shows promise as a sustainable alternative to conventional chemical methods, with significant potential for future industrial applications.

Synthesis of CuCoFeSe–CuCoSe Yolk-shelled Microrods for Supercapacitors Application

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Advisor
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Chemical Engineering

Abstract

The growing demand for efficient and sustainable energy storage systems has driven significant interest in the development of high-performance supercapacitors. They offer advantages such as rapid charge/discharge rates, high power density, and long cycle life. However, improving their energy storage capacity remains a challenge. In this study, CuCoFeSe–CuCoSe yolk-shelled microrods (CCFS-CCS) were synthesized through a multi-step process. The synthesis process begins with a metal-organic framework (MOF) containing iron, specifically Materials Institute Lavoisier-88A (MIL-88A). Subsequently, ion exchange with cobalt (Co) and copper (Cu) was performed to obtain a CuCo layered double hydroxide (LDH) nanocage structure that encapsulates CuCoFeLDH microrods, resulting in CuCoFeLDH–CuCoLDH yolk-shelled microrods (CCFLDH–CCLDH). These microrods were then converted into CCFS–CCS through a selenization reaction, varying the CCFLDH–CCLDH to selenium powder ratio (1:1, 1:3 and 1:5) at an annealing temperature of 600°C under a nitrogen atmosphere.

Electrochemical performance was evaluated using a three-electrode system in a 6 M KOH electrolyte. Cyclic voltammetry (CV) measurements showed that the average specific capacitance increased from 142.4 F/g (1:1) to 165.8 F/g (1:3) and 255.1 F/g (1:5), representing improvements of approximately 17% and 79%, respectively. Similarly, galvanostatic charge/discharge (GCD) tests at a current density of 1 A/g demonstrated that the sample at a 1:5 ratio achieved the highest specific capacitance of 194.5 F/g, compared to 89.3 F/g and 68.8 F/g for the samples at ratios of 1:1 and 1:3, respectively. Additionally, electrochemical impedance spectroscopy (EIS) analysis indicates that the sample at a 1:5 ratio exhibited the lowest charge transfer resistance (Rct) in the range of 91.2–107 mΩ, suggesting improved charge transfer kinetics.

The findings in this study demonstrate that increasing selenium content effectively enhances the electrochemical properties of CCFS materials. Therefore, the CCFS synthesized at a 1:5 Se ratio are strong candidates for use in next-generation high-performance supercapacitors.

Design and Construct of Dynamic Continuous Stirred Tank

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Chemical Engineering

Abstract

These project presents the design and development of a laboratory-scale Dynamic Stirred Tank system intended for use in the CHE481 Chemical Engineering Laboratory course. The apparatus serves as a scaled-down model of industrial stirred tank systems and is capable of being configured in both interacting and non-interacting systems. A key feature of the design is the adjustable elevation of each tank, which enables the systematic investigation of critical hydrodynamic parameters including pressure drop, liquid level distribution, and flow rate under varying gravitational head conditions. The design strategy emphasizes passive hydraulic balancing across tanks by leveraging height differentials to minimize energy consumption and enhance flow control, thus offering a practical alternative to conventional pump-driven systems. System dynamics were evaluated through controlled disturbances introduced as pulse and step inputs, using potassium permanganate as a tracer. The transient response of the system was monitored via spectrophotometric analysis of sampled concentrations at predefined intervals. The resulting data were subsequently compared with theoretical predictions to assess model validity and the performance of the proposed design. This work contributes to the advancement of experimental tools for process control education and offers insights into the design of efficient multistage stirred tank systems.

Preparation of Thermo/Magnetic responsive hydrogel for Drug Delivery

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Advisor
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Chemical Engineering

Abstract

Cancer remains one of the leading causes of death globally, with traditional treatments like chemotherapy often causing severe side effects due to their inability to selectively target cancer cells. This issue has prompted the development of new materials and technologies aimed at improving treatment precision, especially through drug delivery systems that release medications directly at the target sites. This study focuses on the development of hybrid materials responsive to temperature and magnetic fields for targeted cancer drug delivery. The hybrid material in this research consists of Fe_3O_4 nanoparticles coated with a copolymer, PNVCL-co-HEMA, which exhibits temperature-responsive behavior. When exposed to different temperatures, this material can alter its structure and control the release of drugs when exposed to external magnetic fields. The chemotherapeutic agent used in this study is doxorubicin (DOX), a widely used drug in cancer treatment. The hybrid material is designed to regulate DOX release at temperatures close to human body temperature, as PNVCL has a lower critical solution temperature (LCST) between 33-35°C. By combining temperature and magnetic responsiveness, this material allows for precise control over drug delivery, targeting the site while minimizing side effects caused by systemic drug distribution. The synthesis of Fe_3O_4 nanoparticles was performed, and X-ray Diffraction (XRD) analysis confirmed the presence of Fe_3O_4. While some imperfections in the crystals were observed, the results were consistent with theoretical expectations. Fourier Transform Infrared (FTIR) spectroscopy further identified functional groups related to both Fe_3O_4 and the copolymer. The study results suggest that the hybrid material PNVCL is a promising candidate for drug delivery applications.

Study of appropriate operating conditions for 2AP in pandan leaves tea by tray dryer

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Chemical Engineering

Abstract

In contemporary Thai society, tea has become increasingly popular for both refreshment and its perceived health benefits. Pandanus amaryllifolius (pandan) is a local herbal plant with high potential for development into a herbal tea product. Pandan is abundant in Thailand and valued for its distinctive aroma, primarily derived from 2-acetyl-1-pyrroline (2AP), along with its antioxidant properties associated with polyphenolic compounds. Traditionally, it has been widely used in Thai cuisine, desserts, and beverages.

Due to the short shelf life and preparation time required for fresh pandan leaves, the development of dried pandan tea presents a practical alternative. This study investigates the changes in 2AP content during the drying process at four different temperatures (50, 60, 70, and 80 °C), using a tray dryer at an air velocity of approximately 0.1 m/s. Samples were collected at various intervals to monitor moisture reduction and the fluctuation of 2AP content. Additionally, chlorophyll, color values, total phenolic content, and antioxidant activity (using ABTS and FRAP assays) were analyzed in fresh leaves, dried leaves, and brewed pandan tea.

The results indicate that both drying temperature and duration significantly affect 2AP concentration. At each temperature, 2AP levels increased to a peak before declining. Lower temperatures, at 50 °C, required the longest time to reach maximum 2AP content, whereas higher temperatures reduced this time. Notably 2AP was still detectable via GC-FID at the final stage of drying, suggesting potential isomerization or partial degradation rather than complete loss. Considering the target moisture content of 10% (wet basis) per herbal tea standards, drying at 50 °C was most effective in preserving 2AP in dried pandan leaves.

The study of Imatinib deactivation using various chemicals

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Chemical Engineering

Abstract

Cancer, especially chronic myeloid leukemia (CML) and gastrointestinal stromal tumors (GIST), significantly impacts global health. Imatinib is used to treat these cancers by inhibiting cancer cell growth, but its industrial production generates wastewater containing pharmaceutical active ingredients (APIs), which pose environmental and health risks. Therefore, it is crucial to treat wastewater contaminated with drugs to minimize these adverse effects.

This study investigates the deactivation of Imatinib in simulated wastewater using six deactivating agents: sodium hypochlorite (NaOCl), hydrogen peroxide (H2O2), sodium bisulfite (NaHSO3), sodium hydroxide (NaOH), hydrochloric acid (HCl), and potassium permanganate (KMnO4). Imatinib (10 µg/mL, 50 mL) and deactivating agents (10 µg/mL, 50 mL) were mixed in a 100 mL amber bottle, agitated, and sampled every 5 minutes for 2 hours. The absorbance of samples was measured using a UV-Vis spectrophotometer, with the experiment repeated three times at Chulabhorn Royal Pharmaceutical Manufacturing Facility (CPM).

The results showed that NaOCl was the most effective, reducing Imatinib concentration from 5.217 µg/mL to 3.152 µg/mL, achieving 39.59±8.03% deactivation. H2O2 was the second most effective, reducing concentration from 5.110 µg/mL to 4.922 µg/mL (3.68±2.16%). NaOH and HCl showed minimal deactivation, reducing concentrations by 1.02±1.29% and 1.56±1.60%, respectively. NaHSO3 showed a negative result (-0.301±0.79%), and KMnO4 had the worst result, increasing Imatinib concentration from 4.873 µg/mL to 5.668 µg/mL (-16.33±0.51%).

In conclusion, NaOCl is the most effective deactivating agent for Imatinib in simulated wastewater from the pharmaceutical production process. The other five deactivating agents exhibited partial deactivation of Imatinib. This study helps identify the most suitable deactivating agent for wastewater treatment in the pharmaceutical industry. Further research should explore varying concentrations, advanced techniques (HPLC, LC-MS, FTIR), and environmental impacts of deactivating agents in industrial wastewater treatment.

Fabrication and Operation of Unitized Regenerative Fuel Cells (URFCs)

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Chemical Engineering

Abstract

This study investigates the design and operation of unitized regenerative fuel cells (URFCs), which operate reversibly as both fuel cells and electrolytic cells. The research focuses on the development and evaluation of oxygen electrode catalysts composed of silver nanowires (AgNWs) and cobalt oxide (Co_3O_4) applied onto different porous transport layer (PTL) substrates such as carbon cloth and carbon paper.

The primary objective is to enhance the bifunctional performance of the oxygen electrode, thereby identifying optimal catalyst compositions deposited onto PTL materials for efficient URFC operation.

The methodology comprises electrode fabrication, and component assembly, followed by electrochemical characterization using polarization curve, chronoamperometry and electrochemical impedance spectroscopy (EIS), measurements.

Results demonstrate that the AgNW: Co_3O_4 ratio greatly influences the current density and overall performance in both fuel cell and electrolysis modes. A 6:4 ratio of AgNWs to Co_3O_4 deposited on carbon cloth yielded the highest current densities and superior electrochemical performance among all tested configurations. Carbon cloth emerged as the most effective PTL substrate, significantly enhancing oxygen electrode activity. Moreover, this electrode structure also shows excellent stability as the performance only drops by several percent over the course of the experiment. Furthermore, catalyst loading was shown to be a critical parameter, directly impacting the energy efficiency and output of the URFC system.

This study provides valuable insights into the material optimization of bifunctional electrodes and supports the development of more efficient and economically viable URFC technologies for renewable energy applications.

Modified membrane for Li recovery from battery leaching solution

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Advisor
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Chemical Engineering

Abstract

This research aimed to investigate the modification of polyethersulfone (PES) membranes for the selective separation of lithium ions from cobalt and nickel ions in leaching solutions derived from spent lithium-ion batteries. The membrane surface was modified using polyethylenimine (PEI) and trimesoyl chloride (TMC) via interfacial polymerization. PEI solutions with molecular weights of 1,800 Da and 25,000 Da at concentrations ranging from 0.25 to 2.00 wt% were applied to PES membranes for 4 minutes. The membranes were then reacted with TMC in n-hexane at concentrations of 0.05–0.25% w/v for 4 minutes. After the reaction, the membranes were cured at 60°C for 15 minutes and soaked in 2-propanol for 1 hour.

The modified membranes were tested using a synthetic leaching solution containing 0.46 g/L lithium chloride (LiCl), 0.47 g/L cobalt chloride ($CoCl_2$), and 0.47 g/L nickel chloride ($NiCl_2$) at pH 1. Membrane properties such as chemical structure, surface morphology, and hydrophilicity were characterized using Fourier Transform Infrared Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM).

Separation performance was evaluated in a stirred dead-end filtration system under a pressure of 4 bar. The results of this study will help determine the optimal membrane modification conditions and may contribute to enhancing the efficiency of lithium recovery from battery leachates. The modified membranes are expected to exhibit high flux, excellent lithium-ion retention, and good acid resistance.

Development and characterization of silver nanoparticle-coated wound dressings

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Chemical Engineering

Abstract

Wound infections are a major concern in healthcare, especially for patients with chronic wounds or burns. Silver nanoparticles (AgNPs) are well known for their antibacterial properties, which help prevent infections and support the healing process. In this study, AgNPs were synthesized using different methods, including chemical reduction and UV-assisted synthesis. These nanoparticles were then incorporated into wound dressings by soaking them in AgNP solutions or through an in-situ reaction with silver nitrate ($AgNO_3$) under UV light. The amount of silver in the dressings was measured using atomic absorption spectroscopy (AAS), while scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDS) were used to analyze surface characteristics and elemental composition. The antibacterial activity of the AgNP-coated dressings was tested against E. coli and Staphylococcus aureus. The results provide useful information for developing effective antimicrobial wound dressings that can help reduce infections and promote better healing.

Keywords:
Silver nanoparticles, Wound dressing, Antibacterial, Chronic wounds, UV synthesis

Development of thermoresponsive PVDF membrane grafted with NVCL for oil/water separation

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Advisor
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Chemical Engineering

Abstract

This research aims to develop a thermoresponsive polyvinylidene fluoride (PVDF) membrane grafted with N-vinylcaprolactam (NVCL) to enhance the efficiency of oil–water separation, with a particular focus on applications in the palm oil industry, where wastewater is typically rich in oil content. Traditional separation techniques often face limitations in handling emulsified oil due to membrane fouling and lack of adaptability under varying operational conditions. By introducing thermoresponsive properties to the PVDF membrane, the study seeks to improve its antifouling capability and operational efficiency under temperature fluctuations. The membrane was synthesized via surface-initiated free radical polymerization and characterized using Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), atomic force microscopy (AFM), and contact angle measurements to assess surface chemistry, morphology, and wettability. Performance evaluations were conducted using synthetic oil-in-water emulsions in a dead-end filtration setup, with key metrics including permeate flux, rejection rate, and flux recovery ratio. The experimental results confirmed that the PVDF-g-NVCL membrane exhibited significantly improved fouling resistance and separation performance at elevated temperatures, attributable to its temperature-responsive switching behavior. This study highlights the membrane's potential as a reliable, sustainable, and adaptable solution for oil-laden wastewater treatment in industrial applications.

Design and Construction of Adsorption Process for Chemical Engineering Laboratory

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Chemical Engineering

Abstract

Adsorption is a fundamental process in which particles adhere to a material's surface, with broad applications in various chemical engineering applications. Despite its significance, KMUTT's Chemical Engineering department currently lacks a laboratory dedicated to adsorption. This project addresses that gap by designing and constructing a hands-on adsorption experiment tailored for undergraduate education. In the experiment, water vapor is used as the adsorbate and silica gel as the adsorbent. Air is introduced into the system via a pump and regulated through a flow meter, with two humidity conditions: ambient and humidified at approximately 90-95% humidity, enabled through a custom-built humidifier. The moist air flows through a column containing 300 grams of silica gel. Outlet humidity is recorded every 10 seconds, producing breakthrough curves for analysis. Water adsorption on silica gel exhibits multilayer behavior, resulting in breakthrough curves with steep initial rises and gradually flattening slopes. This leads to extended breakthrough periods, making it impractical to capture the full curve during a standard lab session. Instead, each trial is run until the concentration ratio (C/C_0) reaches approximately 0.5, after which the curve can be reliably extrapolated for its remaining trends. Key parameters, including the column dimensions, breakthrough time (tb), and stoichiometric time (ts), are extracted through trend line construction and curve integration. The breakthrough curves from both humidity conditions and scaled-up results were compared, revealing that under the same operating conditions, humidified air requires a larger column due to higher moisture loading under identical operating conditions. This lab provides a much-needed practical component to KMUTT's curriculum, offering students hands-on experience with real-time data, adsorption dynamics, and scale-up calculations. It equips future chemical engineers with critical skills in adsorption design and industrial process analysis.

Process Simulation of Lactic Acid Esterification in Reactive Distillation Column: Effects of Reboiler Duty and Alcohol

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Chemical Engineering

Abstract

This study investigates the effects of reboiler duty on the esterification of lactic acid using three alcohols: methanol, ethanol, and butanol in a reactive distillation column. The main objective was to evaluate how variations in reboiler duty and alcohol type influence reaction and separation. The results showed that methanol and ethanol achieved high conversion rates, with methanol demonstrating the highest conversion rate. While butanol providing the highest product purity however, it requires the least reboiler duty compared to the reboiler duty range for methanol and ethanol. From the result, the reboiler duty did not significantly affect the reaction, as the conversion rates for each alcohol showed almost no difference. These findings are critical for optimizing reactive distillation columns in bio-based chemical production, particularly in lactic acid esterification. The study contributes to the design of more energy-efficient and sustainable processes for green chemical manufacturing, particularly in the production of biodegradable esters like polylactic acid.

Treatment of Concentrated Rubber Wastewater Using a Laboratory-Scale Aerobic Membrane Bioreactor

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Chemical Engineering

Abstract

Treatment of Concentrated Rubber Wastewater Using a Laboratory-Scale Aerobic Membrane Bioreactor

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Abstract

Thailand's concentrated rubber industry, a key tire and automotive production supplier, generates high-strength wastewater that challenges conventional treatment systems. Traditional methods like the Conventional Activated Sludge (CAS) process face limitations in space, efficiency, and sludge management. Membrane Bioreactor (MBR) technology has emerged as a more effective solution, offering compact design, superior effluent quality, and better handling of concentrated industrial wastewater. This study evaluates the performance of a lab-scale aerobic MBR system treating concentrated rubber wastewater under flow rates of 5, 10, and 15 mL/min using a series membrane setup. Microorganisms cultivated to an MLVSS of 3,000 mg/L in synthetic wastewater are applied, with treatment efficiency assessed via COD, BOD, sulfate, TKN, and chloride removal. The result shows that the lowest flow rate (5 mL/min) will achieve the highest removal efficiencies due to increased contact time and organic loading optimization. The findings aim to support the future application of MBR technology in space-limited, high-strength wastewater treatment.

Keyword: Membrane Bioreactor (MBR), Aerobic treatment, Organic loading rate, Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Chemical (TKN), Mixed Liquor Volatile Suspended Solids (MLVSS)

Study of CHO-K1 Cell Culture in Serum-Free Media with Supplementation

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Chemical Engineering

Abstract

Serum-free media (SFM) are increasingly utilized in CHO-K1 cell culture due to improved consistency, safety, and regulatory compliance. However, the absence of essential protein precursors such as L-glutamine presents challenges in maintaining cell viability and productivity. Given the high cost and instability of L-glutamine, this project aimed to identify cost-effective and functional alternatives. The study focused on supplements known to support protein synthesis and reduce oxidative stress, including L-arginine, wild-type rice (Oryza sativa subsp. japonica cv. Nipponbare) callus extract, rice callus culture media, L-glycine, and Chu/Gamborg (NB) basal medium with 3% sucrose. Initial screening compared two commercial SFM formulations (Media A and Media B), both containing L-glutamine. Media B demonstrated superior CHO-K1 cell growth and was selected for subsequent experiments. CHO-K1 cells were cultured in 6-well plates (2 mL per well) at 37°C, 5% CO_2, 80 rpm for 9 days. In the first phase, supplementation with 5% NB media and L-arginine significantly improved cell viability, reduced doubling time, and increased IgG production, reaching 8.37 mg/mL by Day 9. Building on these results, the second phase investigated the interaction between NB media (5%, 7.5%, 10%) and L-arginine (1 mM, 3 mM, 5 mM) using a Minitab-designed experimental setup. The combination of 7.5% NB media and 3 mM L-arginine (Run 5) produced the highest viable cell count (2.22×10^6 cells) and IgG yield (8.15 mg/mL), exceeding the L-glutamine control (7.69 mg/mL). Although cell viability in Run 5 was slightly lower (76% vs. 84% in control), the enhanced productivity and favorable cost analysis underscore the synergistic potential of these two supplements. Putting together, this study demonstrates that NB media and L-arginine supplementation offer a cost-effective and efficient alternative to L-glutamine in CHO-K1 cell culture, with significant benefits in cell growth and recombinant protein production.

Small hydrofoil ship

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Mechanical Engineering

Abstract

The development of water transportation technology is gaining attention due to its cost-effectiveness and environmental benefits. This research focuses on designing and building a small radio-controlled hydrofoil vessel featuring a fully submerged hydrofoil to reduce drag and lift the vessel above water at speeds up to 30 km/h. The study involved a theoretical review, hydrofoil design, computational simulations of lift and drag forces, and real-world water trials. Employing the NACA4412 profile in a canard layout improved lift distribution and operational stability, while a gyro stabilizer-maintained balance during movement. Test results confirmed successful hydrofoil lift-off, enhanced stability, and a 35.18% reduction in energy consumption compared to conventional displacement sailing, demonstrating the potential of small hydrofoil ship as practical and efficient solutions for future sustainable water transportation.

Keywords: Small Hydrofoil Ship, Fully Submerged Hydrofoil, Canard Layout, Drag Reduction, Wireless Control System

Vibration energy harvester using a magnet-array-based on rotor

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Mechanical Engineering

Abstract

This project presents an innovative approach to harvesting energy from mechanical vibrations by converting them into electricity through a vibration-to-rotation mechanism utilizing a magnet array. The system operates by converting the reciprocating motion of a free-moving magnet, which vibrates along a linear path, into rotational motion. This is achieved through magnetic repulsion or attraction with a fixed magnet array mounted around the edge of a cylindrical rotor. The induced rotational motion drives an electromagnetic generator, enabling the production of electrical power from ambient vibrations. Vibration is a form of renewable energy that is often overlooked despite its obtaining in both natural and human-made environments. Unlike solar or wind energy, vibrations can be harvested continuously from sources such as engines, industrial machines, urban traffic, or structural oscillations. This makes vibration energy harvesting particularly attractive for powering low-power devices, especially in remote or inaccessible locations. The proposed system targets applications such as wireless sensor networks, IoT devices, and health monitoring systems that require sustainable and maintenance-free power sources. The
design emphasizes simplicity, durability, and energy conversion efficiency, allowing it to be integrated into a variety of use cases with minimal structural modification. In preliminary testing, the prototype with a linear array magnet was able to generate an output of 76.02 mV and power output is 5.772 mW under a vibration frequency of 4 Hz and amplitude of 40 mm. These results suggest the system's viability for real-world deployment in environments where low-frequency vibrations are present. Overall, this work contributes to the field of micro-energy harvesting by demonstrating a practical and scalable solution for converting otherwise wasted vibrational energy into useful electrical power.

The Development of a Prototype Propulsion System for a CubeSat

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Mechanical Engineering

Abstract

Space exploration technology has advanced rapidly in recent years, with private sectors playing a key role, particularly in developing small satellites like CubeSats for low-cost scientific missions. This study aims to design a propulsion system for CubeSats to improve attitude control and extend mission duration. The system consists of a propellant tank, reaction chamber, and nozzle, using hydrogen peroxide (H_2O_2) over 95% as the monopropellant. The bladder tank design ensures stable pressure and prevents contact with the pressurized gas. Hydrogen peroxide undergoes catalytic decomposition in the reaction chamber via a manganese dioxide (MnO_2) catalyst, producing oxygen, water, and heat, which causes rapid gas expansion to generate thrust. Vacuum tests under 1.0 mL/min fuel flow conditions showed pressure peaking at 3.0 bar, and temperature rising from 75°C to 125°C, indicating efficient decomposition. The propulsion system achieved an average thrust force of 70 mN and a Specific Impulse (Isp) of 290 seconds, reflecting high fuel efficiency relative to similar systems. Some thrust reduction was observed, likely due to catalyst degradation or thermal management issues. Overall, the propulsion system demonstrates potential for CubeSat missions requiring low, precise thrust and can be further developed to enhance orbital maneuverability.

Study of patient-specific medical devices with different porous architectures

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Advisor
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Mechanical Engineering

Abstract

Patient-specific implants (PSIs) have gained attention in orthopedic treatments due to their ability to match individual anatomy, reducing the risks of implant loosening, injury, and postoperative complications. Traditional implants, designed based on average bone properties, often fail to accommodate the mechanical variability among patients, particularly those with conditions such as osteoporosis. The complexity and heterogeneity of bone tissue underline the need for implants customized not only in shape but also in mechanical properties to enhance mechanical compatibility and long-term success.

This research focuses on designing PSIs using 2D CT scan data. Hounsfield Unit (HU) values extracted from CT images are converted into local elastic modulus values through established correlations, generating a 3D point cloud representing the local elastic modulus of bone. A 3D bone model reconstructed from CT images is then utilized for implant design. Finite Element Analysis (FEA) is employed to study the mechanical response, comparing models based on localized elastic modulus to those using simplified average modulus values. Results demonstrate that incorporating local elastic properties more accurately predicts real-world bone damage. Additionally, FEA is used to investigate the interaction between bone and implants with varying Young's modulus, ranging from 4 GPa (bone-like) to 110 GPa (Ti-6Al-4V). The models are divided along the y-axis to assess the average von Mises stress, and the stress difference between the bone and implant models are calculated for each zone. The findings reveal that lower stress differences occur at the implant ends with stiffer implants, while more compliant materials reduce stress differences in the central region.

By applying a graded implant design strategy based on Gyroid TPMS structures aligned with local bone modulus, the stress difference is reduced by 47% compared to traditional commercial implants. This strategy effectively minimizes stress shielding, enhances implant longevity, and reduces the risk of osteoporosis and bone fracture.

Improving the quality of product inspection processes

Ms. Jidapa Suwansiri, Ms. Prapatsorn Aramchai

Advisor
Dr.Aeksuwat Nakwattanaset

Tool and Material Engineering

Abstract

The demand for high-quality and reliable products has continuously increased, leading to quality control in the production process becoming a key factor in an organization’s competitive capability. This project aims to study the issues occurring in the product quality inspection process and improve the inspection process to enhance efficiency and reduce the number of defects passing through to the next station. The study and analysis focus on the quality inspection process between Q-Gate 5 and Q-Gate 6, where a lack of inspection during assembly was identified as a major factor contributing to product defects. The project team proposed a solution by adding an additional quality inspection station, Q-Gate 5.1, to reinforce inspections during the process. The results show that the Defect Per Unit (DPU) before the installation of Q-Gate 5.1 exceeded the company’s standard threshold. However, after the installation of Q-Gate 5.1, the DPU decreased to meet the company’s standard, demonstrating that the addition of the inspection station helped reduce defects and improved the overall efficiency of the product quality inspection process.

Improving productivity by improving the mold installation process in the automotive parts production line

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Advisor
Dr.Aeksuwat Nakchill

Tool and Material Engineering

Abstract

This project aims to increase the production efficiency of injection machines by reducing the time in the mold adjustment process of the plastic injection machine. From the survey of the plastic injection process of Wichian Dynamic Industry Co., Ltd., it was found that the setup efficiency of the plastic department in July and August 2024 was 68.87% and 69.12%, respectively. The reasons for the low setup efficiency were the mold adjustment process of the plastic injection machine. The time-consuming steps include 1. Preparing equipment and molds, 2. Disconnecting/connecting water lines, and 3. Walking to pick up equipment from different places. Therefore, a solution to this problem is proposed using the principle of rapid machine adjustment (Single Minute Exchange of Die: SMED) to separate mold adjustment activities into internal and external work to reduce the time for changing the plastic injection machine mold. The results of the improvement showed that the setup efficiency of the plastic department in September and October increased to 82.95% and 81.28%, respectively.

Improving Instrument Panel and Airbag Chute Channel Fixture For Tensile Testing

Ms. Tunyarat Palakawong Na Ayuttaya

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Tool and Material Engineering

Abstract

Currently, within the automotive industry, tensile testing between the Instrument Panel and Airbag Chute Channel is conducted to guarantee their ability to adhere to each other. However, the fixture used for tensile testing is heavy and poses many usability issues due to the fixture's design that directly affects the results. This research proposes a method to reduce unnecessary parts of the fixture structure by studying the usage of the current fixture during testing to identify unnecessary structural components and operational issues leading to analysis, planning, and the design of a new fixture that is lighter and more efficient for testing. Post-production inspection will integrate software methods such as Finite Element Analysis (FEA) as an additional option to assist in both design and validation, recording the design data as a template for future fixture designs for tensile testing. As a result of this operation, the weight of the fixture was successfully reduced by up to 35.42 percent, while its efficiency and safety were further improved. Moreover, the data obtained from Finite Element Analysis (FEA) will be considered for the design of future fixtures and will also be recorded in the fixture template designs for tensile testing.

Study for Time Reduction of Parts in Machining Process

Kitthaya Samranjit

Advisor
Surasak Suranuntchai

Tool and Material Engineering

Abstract

The purpose of this engineering project is to reduce working time in order to improve the efficiency of clamping workpieces and lower production costs. The project team identified a problem where the production time for each workpiece was excessively long due to the lack of standardized cutting processes. This led to certain steps taking more time than necessary. The team analyzed the problem using a fishbone diagram and explored potential improvements using the 5W1H technique. Based on the findings, the team standardized the cutting process, particularly focusing on improving the back end cutting step of the workpiece. From the research and improvements, it was found that the working time could be reduced from 38.36 minutes per piece to 34.79 minutes per piece, a reduction of 3.57 minutes or approximately 9.31%. This improvement also resulted in a reduction of production costs by 17.23THB per piece.

Development of Wear Measurement Techniques for Low-Pressure Gasoline Injectors Using White Light Interferometer (WLI) Technology

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ผศ. นพดล คุ้มอนุวงศ์

Tool and Material Engineering

Abstract

This research project aims to enhance the analysis of wear values in the Armature component of gasoline fuel injectors. Armature lifts the injector needle, allowing fuel delivery into the combustion chamber, where it is ignited by the spark plug. Collisions with a Stopper during operation cause wear on the Armature's surface, making wear monitoring essential for diagnosing issues and developing solutions using White Light Interferometry (WLI).

Current inspection methods lack sufficient accuracy and reliability due to inadequately studied fixtures and measurement variables. This study identifies the root causes of wear and improves the inspection process through fixture redesign and parameter refinement.

The results show a significant reduction in WLI operational time and provide a reliable comparison of wear values before and after improvements, contributing to more accurate assessments of wear depth.

Problem Solving Of Short Shot Steering Disc Parts From Injection Process In Seat Belt Products.

Ms. Pantita Patisang

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Assoc. Prof. Dr. Manisara Phiriyawirut

Tool and Material Engineering

Abstract

This project studied about addresses short shot defects in injection-molded steering disc components for seatbelt systems and develops inspection method in quality control process to prevent defective parts from reaching subsequent production stages. Prior to corrective actions numerous defective parts were found that escapes the quality control process to the customer's assembly process. Using the 7 Quality Control Tools (7 QC Tools), the root causes were identified excessively high injection molding temperatures and an ineffective inspection process. Corrective measures, including optimizing molding temperature and redesigning the inspection method in quality control process were implemented. As a result, short shot defects were eliminated and the new quality control process effectively prevented defective parts from advancing improving overall product quality.

The development of a web application for collecting and sending data for real-time displays to eliminate non-value-added activities.

Mr.Pasin Jankham

Advisor
Dr. Aeksuwat Nakwattannaset

Tool and Material Engineering

Abstract

The development of a web application for application in the production line is a significant step in introducing automation to enhance work efficiency in line with the industry 4.0 approach, which focuses on integrating digital technology into the production process to increase flexibility and efficiency at every stage. This engineering project aims to develop a web application that can receive and send data for real-time display, focusing on reducing non-value-added activities in the production process, which is a key factor in reducing waste and improving the overall efficiency of the production line. The developed system has been implemented in the Starter RA2.0 and RA2.2 production lines of Denso (Thailand) Co., Ltd., Bang Pakong factory, to compare the efficiency between the pre- and post-improvement processes. The performance results show that the developed web application can reduce non-value-added activities by 43.33% compared to the previous method. Additionally, the system has 100% accuracy in data display and stability in operation throughout the 21-day real-world testing period.

Improvement process in Kit Supply Main Line for reduce waste process and balance operator in line.

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Advisor
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Tool and Material Engineering

Abstract

This project focused on waste reduction and operator balancing within the Kit Supply Main Line. Key issues, including heavy Dolly handling and inefficiency, were analyzed using Work Study, fishbone diagram, and Why-Why Analysis. Solutions such as AGV implementation and workload balancing enhanced overall efficiency.

Improving the manufacturing process of motorcycle headlights

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Advisor
Assistant Professor Dr. Sirinthorn Thongsang

Tool and Material Engineering

Abstract

The automotive industry is highly competitive, requiring continuous improvements in efficiency. This study aimed to enhance the manufacturing process of Honda Wave 110i motorcycle headlamps by reducing production time and ensuring process continuity. It began with an analysis of the plastic processing stage, followed by the optimization of the plastic injection molding machine settings. These adjustments were tailored to the specific characteristics of the components. A quality inspection was conducted in October and November 2024, involving 40 randomly selected samples from a total of 1,200 units. The inspection found zero defects, confirming the effectiveness of the improved quality control measures implemented during the plastic processing stage.

Improve the rivet bracket process by reducing manpower and optimizing the process to increase productivity

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Advisor
Dr.Ratchanee Paisan

Tool and Material Engineering

Abstract

This project aims to improve the production process of the Rivet Bracket 890. The current Takt Time is 25 seconds, but actual cycle times at the Assy and Rivet & Check Jig stations are 33 and 31 seconds, respectively, creating a bottleneck that prevents the company from meeting production targets. To resolve this, the team analyzed the production line, identified inefficiencies, and applied the ECRS (Eliminate, Combine, Rearrange, Simplify) principle to reduce non-value-added activities.

As a result, the Assy station's cycle time was reduced from 33 to 21 seconds (27.9%), and the Rivet & Check Jig station from 31 to 18.5 seconds (29.3%). These changes significantly boosted productivity. The Assy station's output increased from 818 to 1,285 pieces per day (57.1%), while the Rivet & Check Jig station rose from 870 to 1,459 pieces per day (67.7%). Working days were reduced from 20 to 13 days at the Assy station and from 19 to 11 days at the Rivet & Check Jig station. Cost savings followed: the Assy station's cost decreased from 8,000 THB to 5,200 THB (35%), and the Rivet & Check Jig station from 7,600 THB to 4,400 THB (42%). With cycle times now under the Takt Time, the process can meet customer demand efficiently.

Development of the quality for color matching inspection process in an automotive paint shop through the application of Poka-Yoke.

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Assoc.Prof.Dr. Surasak Suranuntchai

Tool and Material Engineering

Abstract

This project aims to Development of the quality for color matching inspection process in an automotive paint shop through the application of Poka-Yoke. SAIC Motor-CP Co., Ltd. identified a problem in the color shade inspection process at the Finesse and Buy Off stations, where both stations utilized the same inspection method, yet yielded inconsistent results. These inconsistencies led to defects caused by inaccurate inspections. The implementation approach began with collecting all relevant data from the color shade inspection process, followed by root cause analysis using a Fishbone Diagram and the Why Whys analysis to identify the true root causes of the problem. Subsequently, a risk assessment was conducted for each step using the FMEA (Failure Mode and Effects Analysis) method. A Poka-Yoke device was then designed for installation at key inspection points, including: 1. Front left fender 2. Front right fender 3. Lower side panel (left) and 4. Lower side panel (right). After the design phase, the device was tested, results were evaluated, and it was implemented at the actual inspection stations. A standard operating procedure was also developed to ensure consistent use, thereby improving the process efficiency and achieving the project’s objectives.

The results showed that the application of Poka-Yoke increased the stability of the color shade conformity inspection process. The number of vehicles with mismatched inspection results between the Finesse and Buy Off stations was reduced from an average of 27 vehicles per month to just 8 vehicles per month, representing a 70.37% reduction. Additionally, the average inspection time per vehicle was reduced from 125.18 seconds to 101.27 seconds, saving 23.91 seconds per vehicle.
Keywords: color matching, Poka-Yoke, Inspection, Automotive paint shop

Strategies for Reducing Waste Percentage in the Injection Molding Process of Cover Knee Airbag

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Tool and Material Engineering

Abstract

This project aims to analyze and resolve the causes of defects to reduce the percentage of waste generated during the plastic injection molding process of the Cover Knee Airbag component. Various engineering tools were employed in the study, including Check Sheet for data collection throughout the experiment, Bar Chart for comparing the number of each type of defect before and after corrective actions, Pareto Diagram for prioritizing which types of defects should be addressed first, Fishbone Diagram for identifying potential causes of the defects, and 5 Whys Analysis to determine the true root cause, based on the actual causes identified from the Fishbone Diagram. Before implementing any corrective actions, the total defect rate was found to be 39.6%, with flash at the parting line and ejector marks on the parts accounting for 69.7% of all defects. The target was to reduce the total defect rate to 20%. After conducting the analysis and implementing corrective measures, the defect rate was successfully reduced to 12%, and the specific types of defects that were addressed were no longer observed.

Improvement of Transportation System and Equipment for Truck Cabs Transfer Between Factories

Mr. Panusm Rattanajareet, Mr. Prakarn Sirivech, Mr. Jirapat Siriviriyapoon

Advisor
Asst.Prof.Dr. Ussanee Kampoon

Tool and Material Engineering

Abstract

This project addressed the high costs and carbon emissions associated with transporting truck heads between factory buildings under the original 5-year operational plan. The proposed solution involved replacing outsourced trucking services with small electric trucks, integrated with overhead cranes for efficient material flow to the production line. Feasibility was assessed using computer simulations, which indicated an increased investment of 27.91 million Baht (from 3.98 million) but a significant reduction in annual operating costs from 12.82 to 3.81 million Baht, yielding a payback period of 2.89 years. Furthermore, the shift to electric vehicles resulted in a substantial decrease in carbon dioxide emissions from 76.89 to 4.36 tons per year, a 94.33% reduction. Utilizing QCDS principles and engineering simulation tools (SolidWorks, SketchUp, Excel), this project demonstrates a financially viable and environmentally responsible approach to optimizing logistics, enhancing operational efficiency, and supporting the company’s sustainability goals.

Improving and reducing waste in the manufacturing process of car back seat frame parts

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Tool and Material Engineering

Abstract

The automotive parts manufacturing industry is currently facing several critical challenges, including an economic downturn and the rapid emergence of electric vehicles, which are steadily gaining market share. These circumstances have significantly impacted automotive parts manufacturers in Thailand, resulting in declining sales while production costs remain the same or have even increased. Siam Senater Co., Ltd. is among the affected companies.

This engineering project aims to improve production efficiency and reduce waste through the implementation of the Toyota Production System (TPS), which emphasizes lean manufacturing and cost reduction by eliminating non-value-added activities. The pilot production line selected for this study is the IMV-640A, focusing on the product “Frame Sub Assembly Rear Seat Back No. 4.”

The study involved a comprehensive analysis of the actual production process and working environment. Tools such as Work Site Control, Material and Information Flow Chart (MIFC), standard work documentation (San Ten Set), and the Yamazumi Chart were utilized. The MIFC was analyzed to identify information and material stagnation points, which were compiled into a Stagnation List. Additionally, the San Ten Set and Yamazumi Chart were reviewed to assess workforce efficiency and production balance.

Based on the findings, improvements were made to the production process targeting the identified issues. The results demonstrated that implementing TPS in the pilot product line led to a 20.92% reduction in inventory volume, a 34% decrease in storage space usage, complete elimination of unnecessary component transportation (100% reduction), a 214.3% increase in production capacity, and a 34.8% reduction in overall lead time.

Keywords: Waste Reduction, Toyota Production System (TPS), Lead Time, MIFC

Improving Efficiency in Data Summarization through Digitalization using Power BI and RPA from Yokoten

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Tool and Material Engineering

Abstract

This project aims to develop a system that enhances the efficiency of data summarization and analysis within an organization by integrating digital technologies. Specifically, Power BI is used for creating interactive dashboards, and Robotic Process Automation (RPA) via UiPath is applied to automate repetitive data retrieval tasks. The main objectives are to reduce report preparation lead time and improve the accuracy of decision-making through real-time, reliable data. Initially, the manual process required employees to retrieve data from the L2L system and prepare reports, consuming an average of 52 minutes per day. The new system automates the data retrieval process using RPA and displays the results via Power BI, allowing users to interpret and utilize the information efficiently. Experimental results show that the new system reduces working time to just 2 minutes per day, achieving a 96% reduction in lead time. Additionally, data accuracy significantly improved by eliminating human errors. User satisfaction was high, with 94% of users reporting that the system was practical, convenient, and beneficial for decision-making.

A study of changing nylon glass fiber 50% from virgin grade to re-cycle grade inside view mirror

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Tool and Material Engineering

Abstract

This engineering project aims to study the feasibility of changing 50% Nylon Glass Fiber (PA6-GF50) plastic pellets from virgin to recycled grade in the production of car side mirror bracket parts by analyzing the work process using the flow process chart principle, starting from studying the properties of both virgin and recycled PA6-GF50 plastic pellets, then injecting the side mirror parts and conducting tests according to the factory's standards, including Thermal Cycle Test, Vibration Test, Performance Installation, and Appearance Check.

The results of the study found that the parts made from recycled plastic pellets can pass all the specified standard tests and have no impact on the production process or actual use. This resulted in the study reducing the cost of purchasing plastic pellets by 1,303,500 Bath or 26.8% compared to virgin pellets.

Reducing the cost of calibrating measuring instruments from external calibration service rooms

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Tool and Material Engineering

Abstract

Calibration of measuring instruments plays a crucial role in quality control and ensuring accuracy in manufacturing processes, particularly in industries that rely heavily on consistent measurements to meet product standards. However, outsourcing calibration services to external providers often incurs significant costs, including direct expenses such as calibration fees and transportation, as well as indirect costs such as downtime when instruments are unavailable for use. This study aims to assess the feasibility and evaluate the outcomes of establishing an in-house calibration laboratory as a means to reduce these costs. A comparative cost analysis was conducted between external and internal calibration approaches using empirical data from a case study in a manufacturing facility that routinely uses measuring instruments in its operations. The results indicate that although the initial investment required to set up an in-house calibration lab—covering equipment, reference standards, and personnel training—is relatively high, it can significantly reduce overall expenses in the long term. Moreover, having an in-house facility enhances flexibility in instrument management, minimizes production downtime, and strengthens the organization's capability in maintaining consistent quality control. Additionally, it contributes positively to compliance with standards such as ISO/IEC 17025 and ISO 9001. This research offers valuable insights to support strategic decision-making for organizations that rely heavily on measurement tools and seek to improve cost efficiency and sustainable quality performance.

Poka-yoke check muffler wrong option by vision camera

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Tool and Material Engineering

Abstract

This project aims to develop a muffler assembly inspection system using a vision camera to enhance inspection efficiency, reduce errors from incorrect or reversed assembly, and lower production costs. The system was designed to accurately detect correct workpieces by setting image-based parameters and applying an initial acceptance threshold of 70%.

Experimental results show that when correct workpieces were used, the system achieved an average matching rate of 90.24%. In contrast, incorrect workpieces yielded an average matching rate of only 56.62%, which is below the acceptable threshold. This indicates that the system can effectively distinguish and reject faulty parts. Further recommendations include optimizing lighting conditions, adjusting the camera's position, and integrating machine learning technologies to improve accuracy and system flexibility in future applications.

Improvement of PADS X03 Autopilot GNC to the level comparable with human pilot

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Advisor
Asst. Prof. Dilok Sripaphai

Tool and Material Engineering

Abstract

In this project, we have chosen to research about develop a safe unmanned aircraft system and increase the limitations of the Veronte Autopilot system, which is an automatic navigation system available in current unmanned aircraft, which relies on remote control, such as drones. This system uses the GNC principle, which consists of Guidance, Navigation and Control working together as a loop to control the UAV system. Our research, we conducted research through the operation of the PDAS X03A, which is a model that we have tested and found to be reliable, compatible with the autopilot system, has a strong structure, and is easy to use. It is often used for training new flight instructors. In testing this aircraft, we used a PID Controller program to control the aircraft's automatic system, including using a Fight Simulator to simulate the flight path before taking it to test in the field.

From the test results, it was found that overall, the efficiency of the controller was not as expected, but it was in a good range. It is necessary to adjust various values to achieve balance, such as controlling the path to be within a specified distance. The results from this research can be used to develop the model structure and adjust settings for further development in the future.

Effects of Ultrasonic Treatment and Bismuth Addition on the Microstructure and Machinability of Aluminum-Magnesium-Silicon Alloy AA6061

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Tool and Material Engineering

Abstract

This project aims to investigate the effects of adding 1 wt.% bismuth combined with ultrasonic melt treatment and ultrasonic treatment with hydrogen gas purging on the microstructure, hardness, machinability, and wear resistance of AA6061-T6 containing 0.8 wt.% Fe. The study found that bismuth addition had a significant influence on microstructural evolution, particularly on the morphology of the Al-Fe-Si intermetallic phase, which is a dominant compound in high-iron AA6061 alloys. In its untreated form, this phase typically appears as long plates or Chinese script-like morphologies. However, with the addition of bismuth, the intermetallics transformed into a needle-like morphology. Moreover, the combination of bismuth addition and melting treatment had a pronounced effect on both the distribution and size of bismuth particles and intermetallic compounds. The bismuth particles became finer and more uniformly dispersed, while the Al-Fe-Si phase transformed into smaller, well-dispersed needle-like structures. Additionally, the elongated or rod-like Al-Fe phases were refined to smaller sizes, and the Mg2Si phase was also slightly reduced in size, leading to a more refined overall microstructure. Despite the improvement in microstructural refinement, the average hardness of the alloy tended to decrease significantly due to the inherent softness of bismuth phases. These findings highlight the importance of optimizing casting conditions and alloying element additions to enhance the microstructure and mechanical properties of high-iron AA6061-T6 alloys, making them more suitable for machining applications in industrial.

Comparison of Carbon Nanotube and Carbon Black Mixed in Resin for 3D Printing of Healthy Heel Insoles

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Asst. Prof. Dr. Sirinthorn Thongsang, Ms. Bussayarat Kengkla

Tool and Material Engineering

Abstract

The purpose of this engineering project was to compare carbon nanotubes (CNTs) and carbon black (CB) mixed with elastic resin for the production of healthy heel insoles using digital light processing (DLP) 3D printing technology. The concentrations of CNT and CB were varied at levels of 0, 0.1, 0.2, and 0.3 wt%. The printed specimens were tested for compressive strength, compression set, and hardness. The results showed that the resin containing 0.1 wt% CNT exhibited the best mechanical properties, achieving the highest compressive strength (3.2 MPa), a hardness of 45 Shore A, and the lowest compression set (3.8%). Consequently, the resin composite with 0.1 wt% CNT was selected for producing healthy heel insoles with good shock absorption properties, which can be custom-designed and manufactured based on individual anatomical profiles.

Simulation of Calcium Carbonate Decomposition on Stainless Steel 304 Using Electrochemical Techniques

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Tool and Material Engineering

Abstract

Conventional methods for cleaning offshore oil rigs, such as high-pressure water jetting and underwater scrubbing, are costly and pose safety risks to personnel. To address these limitations, this study explores an alternative approach by simulating coral formation on oil rig structures and investigating the electrochemical dissolution of calcium carbonate (CaCO3) from austenitic stainless steel 304 using a pulse current technique. Firstly, CaCO3 crystals were formed on stainless steel surfaces via a direct current (DC) electrochemical method, applying a voltage of 5 V for 48 hours in a solution containing 18 mmol/L sodium bicarbonate (NaHCO3) and calcium chloride (CaCl2). Subsequently, the resulting CaCO3 layers were subjected to a pulse current electrochemical process for dissolution. The experimental setup consisted of a stainless-steel anode coated with CaCO3 and a graphite cathode. A current of 250 mA was applied over 8 hours with a 50% duty cycle at varying pulse durations (10, 20, 30, and 40 seconds). pH measurements were recorded to assess the influence of pulse duration on the dissolution process. Results indicated that a 40 second pulse duration at 8 hours achieved the highest efficiency in removing CaCO3 from the stainless-steel surface. These findings suggest the potential of pulse current electrochemistry as a safer and more cost-effective alternative for marine structure maintenance.

Surface Coating of Carbon-based Materials for Electromagnetic Interference Shielding

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Dr. Marisa Ketkaew

Tool and Material Engineering

Abstract

Electromagnetic interference shielding materials are an important protection for electromagnetic waves on electronic devices and damage to human health. Although the metal materials are currently used because of their outstanding of electromagnetic interference shielding properties, they are limited by heavy weight, low corrosion resistance, and high production costs. Therefore, carbon materials are interesting to develop for electromagnetic interference shielding materials because of the similar shielding properties to metals, especially the lightweight, high corrosion resistance and easy forming. For this engineering project, the properties of electromagnetic interference shielding were studied on the carbon-based materials. Firstly, carbon films were prepared from the carbon ink solutions that were the mixing of graphite and acetylene carbon black powder in different ratios. Then, the carbon ink solutions were coated on the surface of polyethene terephthalate plates by the blade coating technique. After that, the prepared carbon films were investigated on morphology by Scanning electron microscope. To study the shielding properties of the carbon films, the electrical conductivity property was studied and then, the electromagnetic wave shielding was tested using an Electromagnetic field meter. The results showed that the prepared carbon films can protect the electromagnetic waves. Furthermore, the shielding properties increased with the increase of acetylene carbon black powder in the carbon ink solution. In this engineering project, indicated that the possibility of developing carbon-based material as an Electromagnetic interference shielding material.

Key words: Acetylene carbon black/ Carbon films/ Carbon ink solution/ Electromagnetic interference shielding materials / Graphite

Improving thermal radiation of nanopore anodic aluminum oxide film on Aluminum-Magnesium-Silicon AA6061 alloy by adding Copper (II) oxide nanoparticles

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Advisor
Asst. Prof. Onnjira Diewwanit

Tool and Material Engineering

Abstract

Nanoporous anodic aluminum oxide (NPAAO) can enhance thermal emissivity to develop the passive cooling system. The purpose of this research is to improve the thermal radiation of the surface of Aluminum-Magnesium-Silicon AA 6061 using a nanoporous anodic aluminum oxide film and to study the effect of adding Copper (II) oxide nanoparticles to the film by ultrasonic dipping process. AA6061-T6 sheets were anodized in 0.3M oxalic acid at 20°C using 40V, 60V D.C. power for durations of 2, 4, and 8 hours. The surface morphology of the AAO films, specifically pore size, size distribution, and thickness, was examined using Field Emission Scanning Electron Microscopy (FESEM) and image processing software. The study revealed that increasing anodization duration led to a more consistent nanopore size and a thicker anodic oxide layer. Additionally, the increased voltage has led to a larger nanopore size of anodic oxide film and the formation of a highly ordered nanopore structure with a regular shape but increased inter-pore distance. The size of the CuO nanoparticles is in the range of 35 to 50 nanometers. Therefore, the appropriate pore size for added should be more than 35 nm and applying a voltage of 60 V for 8 hours results in a percentage area in that range as high as 86.56%. A nanoporous film can increase the emissivity of the substrate from 0.3 to 0.93, compared with a polished alloy surface. Copper (II) oxide (CuO) nanoparticles were added to the anodic oxide film and their presence was confirmed by X-Ray Diffraction (XRD). Furthermore, these nanoporous AAO films exhibited significantly improved thermal emissivity compared to the polished alloy.

Cushioning Materials based on a Crosslinked Tapioca Starch Laminar Composite Foam reinforced with Crosslinked Chitosan-coated Cotton Fabric

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Tool and Material Engineering

Abstract

Cushioning materials based on a crosslinked tapioca starch laminar composite foam reinforced with crosslinked chitosan-coated cotton fabric was developed for use as impact protection. This material was designed to be environmentally friendly, biodegradable, and to improve water resistance through chitosan molecular crosslinking. This study focused on improving the foam's impact resistance and hydrophobicity by varying the amount of citric acid used as a crosslinking agent at levels of 0, 25, 50, and 100 percent by weight of chitosan. The laminar composite foam was composed of crosslinked tapioca starch foam layers, enhanced with tetraethoxysilane (TEOS) to improve adhesion between the starch foam and the cotton fabric. The structure was then reinforced with cotton fabric and coated with citric acid-crosslinked chitosan. The laminar composites were formed using a hot compression molding process under two conditions: (1) coating chitosan before molding, followed by heat treatment to induce crosslinking between chitosan and citric acid, and (2) coating after molding. The properties were analyzed in terms of morphology, physical and mechanical properties, and water resistance. The results showed that coating chitosan before molding produced stronger composite foams compared to coating after molding. Increasing the citric acid content resulted in a decrease in water contact angle and water resistance, which was lower than that of chitosan without crosslinker. In contrast, coating chitosan after molding led to noticeably more brittle foam, although the trend in water resistance remained similar.

The development of biopolymer coatings from lignin for paper packaging and the study of their biodegradation properties in soil

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Advisor
Dr. Weerawan Laosiripojna , Dr. Bongkot Hararak

Tool and Material Engineering

Abstract

The use of single-use plastics packaging has increased due to the COVID-19 pandemic. Therefore, paper is a natural biodegradable alternative. However, it has limitations in terms of water and oil permeability and tear resistance. This research studies the coating of paper with polybutylene succinate (PBS) plastic mixed with lignin in the proportions of 100/0, 90/10, 80/20, 70/30, 60/40 and the chemical structure of the lignin was modified with palmitoyl fatty acid by esterification reaction. The SEM was then used to examine the microstructural features. PBS/BG-modified 90/10, 80/20, and 70/30 were found to have a homogeneous surface and good coating dispersion, which decreased the paper's porosity. Also, PBS/BG-modified_60/40 had the maximum water contact angle according to the water contact angle test because of the high quantity of modified lignin, which indicates its hydrophobicity and improves surface water resistance. PBS/BG-modified_80/20 had the lowest water absorption test value, 50.62 g/m², which indicated good water permeability protection and biodegradation under biological composting conditions as defined by ISO20200:2004standards. On day 28, PBS/BG-lignin_60/40 was discovered to have undergone significant degradation, and by the time the specimens were stored for 56 days, the majority had totally disintegrated.

Study on Mechanical Properties of Carboxylated Nitrile Rubber Latex Added Oxidized Starch.

Ms. Tunyawarin Pudchathammakul, Ms. Suparat Supadol, Ms. Namfon Thungrit

Advisor
Asst. Prof. Dr. Sirinthorn Thongsang, Dr. Promsak Sa-nguanthammarong

Tool and Material Engineering

Abstract

This engineering project aims to study the mechanical properties of Carboxylated Nitrile Butadiene Rubber (XNBR) modified with oxidized starch to develop biodegradable nitrile rubber gloves. Corn starch was incorporated into XNBR at 0, 10, 20, 30, and 40 phr and molded using a dipping process. To modify the starch, 35 wt% hydrogen peroxide at 15, 30, and 45 g was used as the oxidizing agent. The oxidized starch was blended into the XNBR and processed using the same dipping method. The results showed that the formation of carboxyl groups increased with a higher content of hydrogen peroxide. Although the mechanical properties of composites containing oxidized starch were lower than those with unmodified starch, the samples incorporating 10 and 20 phr of oxidized starch still met the requirements of TIS 2725-2559.

Improvement of electrified wear and oxidation resistance in JIS SUJ2 high carbon steel by surface coating.

Mr.Piyatouch Premprach, Mr.Supakorn Thaikongdham, Ms. Sarunporn Ditprasert

Advisor
Asst. Prof. Onnjira Diewwanit, Dr. Pijarn Jornsanoh

Tool and Material Engineering

Abstract

This project focuses on improving the resistance to electrical wear and oxidation of high-carbon steel JIS SUJ2, a critical material for bearings in electric vehicle (EV) motors. One of the major challenges in EV motor bearings is the accumulation of electrical charge and subsequent discharge, leading to electric discharge sparks that accelerate wear and promote oxide film formation on the surface, ultimately reducing bearing lifespan. This study investigates the effects of Diamond-Like Carbon (DLC) and Chromium Nitride (CrN) coatings, applied using the Physical Vapor Deposition (PVD) process, to enhance electrical resistance and minimize spark-induced wear. A comparative analysis of these coatings will provide insights into their effectiveness in preventing electrical wear, offering a potential solution for extending the durability of EV motor bearings and advancing electric vehicle technology.

The development of lignin-biopolymer coating for slippery surface plastic packaging.

Yanason Pitivitoonvorarat, Nawaporn Yordsing, Siripimol Lumlerdkerdkarn

Advisor
Dr. Weerawan Laosiripojana, Dr. Bongkot Hararak

Tool and Material Engineering

Abstract

This engineering project aims to develop a biodegradable coating for plastic packaging that features a slippery surface by adding modified lignin. The lignin was chemically modified via esterification with palmitoyl, and its structure was analyzed using Fourier-transform infrared spectroscopy (FTIR). A polybutylene succinate (PBS) solution was blended with the esterified lignin in varying ratios of 100/0, 90/10, 80/20, 70/30, and 60/40, then applied as a coating on plastic surfaces. The coated plastics were examined using scanning electron microscopy (SEM), as well as water contact angle and sliding angle measurements. Results indicated that coatings containing PBS and modified lignin increased the water contact angle and enhanced surface slipperiness compared to uncoated plastics. Biodegradability tests revealed that the chemical modification of lignin had minimal impact on its biodegradability relative to unmodified lignin, supporting its potential as an effective biopolymer coating for slippery, eco-friendly plastic packaging.

Biodegradable Electrospun PLA/PBS Blend Nanofibers Incorporated with Cellulose Nanofibrils for High-performance Air Filtration.

Mr. Thanachok Sangkhet, Mr. Tanakron Pariyavarakul, Mr. Narubodee Sivipapong

Advisor
Assoc. Prof. Dr. Manisara Phiriyawirut

Tool and Material Engineering

Abstract

This engineering project investigates the development of air filter media using electrospun polymer blend fibers composed of polylactic acid (PLA) and polybutylene succinate (PBS). To enhance fiber performance, cellulose nanofibrils (CNF) were incorporated. The polymer solution was prepared at a concentration of 17 wt% with a PLA/PBS ratio of 95:5, using a mixed solvent of dichloromethane (DCM) and dimethylformamide (DMF) in a 3:1 ratio. CNF was added to the polymer blend solution at concentrations of 0%, 0.5%, and 1% by weight, and dispersed using ultrasonication. Additionally, 5% tetraethyl orthosilicate (TEOS) was added to the CNF dispersion to improve CNF distribution. Electrospinning was carried out at an applied voltage of 16 kV with a needle-to-collector distance of 18 cm. Morphological analysis showed that the PLA/PBS fibers exhibited smooth surfaces. Upon the addition of CNF, no visible aggregation of CNF particles outside the fibers was observed. The average fiber diameter for neat PLA/PBS was 1,458 nanometers, which decreased to 660 nanometers when 0.5% CNF was added. However, the fiber diameter increased to 1,482 nanometers with the addition of 1% CNF. Filtration efficiency tests revealed that the PLA/PBS fibers containing CNF at both concentrations demonstrated higher performance compared to neat PLA/PBS fibers and even outperformed commercial HEPA filters under certain test conditions.

Effect of Nanocellulose Fiber Content on Properties of Recycled Polyvinyl Chloride Films

Mr. Kittitee Huadchai, Mr. Kantapong Chaisrimarn, Mr. Surapol Mongkhonkhun

Advisor
Assoc. Prof. Dr. Manisara Phiriyawirut , Assoc. Prof. Dr. Jatuphorn Wotthikanokkhan

Tool and Material Engineering

Abstract

This engineering project studies recycled polyvinyl chloride (rPVC) films blended with nano fibrillated cellulose (NFC). The objective of this project was to study and improve the properties of rPVC films that are used like non-recycled PVC films. The PVC compound was blended with NFC using an internal mixer. Before blending, the NFC was treated with a silane coupling agent. It was then compressed into thin films by the compression molding process. The NFC was added at concentrations of 0%, 0.5%, 1%, and 1.5% by weight relative to the PVC films. This project presents the changes in film appearance, Young's Modulus, tensile strength at maximum load and elongation at break. The experiment's results showed that the rPVC films were more yellow than the non-recycled PVC films. However, the addition of NFC reduced the yellowing in the rPVC films. In terms of tensile properties, adding NFC improved the tensile strength of rPVC films to a certain level, depending on the amount of NFC used. The results showed that adding NFC improved the tensile strength of rPVC films, equal to non-recycled PVC films. The addition of 1% NFC by weight relative to the weight of PVC film resulted in the highest tensile strength.

Effects of synthesis temperature on the morphology of MoS_2 and performance of MoS_2 cathode in zinc ion batteries

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Advisor
Dr. Pijarn Jornsanoh, Asst.Prof.Dr. Chiraporn Auechalitanukul

Tool and Material Engineering

Abstract

Zinc-ion batteries (ZIBs) offer a promising alternative to lithium-ion batteries due to their superior safety profile, cost-effectiveness, and abundant resource availability. However, ZIBs currently suffer from lower specific capacity, limiting their widespread adoption. This research focuses on improving ZIB performance by optimizing cathode active materials, specifically the metallic 1T phase of molybdenum disulfide (1T-MoS_2). The effects of synthesis temperature on the morphological characteristics and electrochemical performance of 1T-MoS_2 were investigated. The metallic 1T-MoS_2 was successfully synthesized via a simple one-step hydrothermal method and subsequently employed as a cathode active material in ZIBs. The findings indicate that temperature influences the particle size, crystallinity, and interlayer spacing, which in turn affects the performance of ZIBs. The optimal synthesis conditions were identified at 180°C (24-hour duration), which produced MoS_2 with the largest interlayer spacing (1.028 nm) and highest crystallinity (82.41%). When used as a cathode active material, this 180-MoS_2 delivered a substantial specific capacity of 120 $mA\cdot h\cdot g^{-1}$ at 0.5 $A\cdot g^{-1}$ current density while maintaining 100% coulombic efficiency over 50 cycles.

Using of devulcanized ethylene propylene diene monomer rubber to produce speed bumps.

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Advisor
Asst. Prof. Dr. Sirinthorn Thongsang, Miss. Bussayarat Kengkla

Tool and Material Engineering

Abstract

This project investigates the use of devulcanized ethylene propylene diene rubber (EPDM) in speed bump applications. According to TIS 2726-2559, rubber compounds with 0, 20, 40, 60, and 80 phr of devulcanized EPDM were made and tested. The results indicated that while permanent set dropped, hardness and compression modulus increased with increasing EPDM concentration. Due to internal bonding inside the devulcanized rubber, tensile strength and elongation at break decreased when more than 40 phr was added. While abrasion resistance declined with increasing EPDM concentration, mechanical characteristics stayed constant with accelerated aging.

Synthesis and Electrochemical Characterization of Copper-Cobalt Nanofiber for Catalyzing Nitrate Reduction Reaction

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Advisor
Asst. Prof. Dr. Chiraporn Auechalitanukul, Asst. Prof. Dr. Ryan McCuiston

Tool and Material Engineering

Abstract

This project presents the synthesis and electrochemical characterization of copper-cobalt alloy nanofibers as catalysts for the electrochemical reduction of nitrate to ammonia, a compound essential to agriculture, industry, and emerging energy systems. Compared to the conventional Haber–Bosch process, nitrate reduction offers a more energy-efficient and environmentally friendly route for ammonia production. Copper-cobalt nanofibers were fabricated via electrospinning and calcined at 400 °C, 500 °C, 600 °C, and 700 °C to investigate the effect of calcination temperature on their structural and catalytic properties. Cyclic voltammetry identified -1.3 V as the optimum reduction potential for all samples, ensuring selective nitrate conversion with minimal side reactions, while chronoamperometry quantified catalytic activity and charge transfer. The nanofibers calcined at 600 °C exhibited the highest current density, ammonia yield, and Faradaic efficiency, achieving 46.44 mg h^{-1} $mgcat^{-1}$ by catalyst mass and 7.22 mg h^{-1} cm^{-2} by surface area, with a Faradaic efficiency of 65.99%. UV-Vis spectrophotometry confirmed the successful conversion of nitrate to ammonia, and calculations based on both catalyst mass and geometric area highlighted the enhanced activity of the nanofiber structure. Compared to conventional electroplated copper-cobalt catalysts, the nanofiber-based catalyst demonstrated up to 253.73% higher ammonia yield by surface area, highlighting the advantages of the nanostructured morphology and increased surface area. These findings show the potential of copper-cobalt nanofibers as efficient electrocatalysts for nitrate reduction and contribute to developing sustainable technologies for wastewater treatment and decentralized ammonia production.

Prototyping Innovation of Needle-Less Electrospinning Machine for Nanofiber Fabrication

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Advisor
Assoc. Prof. Dr. Surawut Chuangchote

Tool and Material Engineering

Abstract

In the manufacturing of nanofibers, nanofibers are produced through conventional spinning processes. The conditions of mass production cause the complexity of parameter optimization and tool modification. So, the prototyped electrospinning machine was to improve these situations using the developed feature of spinneret which are stainless steel rods instead of needles. The needle-based and other type of needleless electrospinning techniques have been compared in this work. The greatest condition led to reaching fiber diameter in a range of 150 – 350 nm.

Shaving die design to produce octagonal hole from circle hole.

Ms. Parinyachat Phasit , Mr. Worawat Paengjai, Ms. Suthasinee Sitthimahasap

Advisor
Prof.Dr. Sutasn Thipprakmas

Tool and Material Engineering

Abstract

The purpose of this research is to design and create a shaving die for the fabrication of an octagonal hole with a smooth cut surface throughout the workpiece thickness. The octagonal hole with a size of 8.28 mm on each side was focused on.

The initial workpiece was prepared by creating a circle hole using a drilling process with diameters of 19, 20, and 21 mm. The material was aluminum alloy grade AA1100-O (JIS) with 3 mm in thickness. After the shaving experiment, the quality of the shaved surface was examined by focusing on the die roll, smooth cut, and crack.

Keywords: Shaving Process, Shaving die, Smooth cut surface, Crack, Octagonal

Study on Cold Welding via Equal Channel Angular Extrusion Process

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Advisor
Prof.Dr.Sutasn Thipprakmas

Tool and Material Engineering

Abstract

Equal Channel Angular Pressing (ECAP) is a metal forming process that refines the initial microstructure of a metal, resulting in ultra-fine grains in the micrometer range. This grain refinement through the ECAP process significantly enhances the hardness of the material. Consequently, a concept has been proposed suggesting the potential application of this process to achieve solid-state welding between two metallic workpieces. The objective of this project is to investigate the parameters involved in the angular pressing of aluminum to understand the factors influencing the welding of two aluminum pieces under the ECAP process at room temperature. The experiment involved the design of three distinct workpiece geometries ypothesized to affect the adhesion of the aluminum components. The die used in the experiment featured a channel size of 10 mm x 10 mm and an angle of 120 degrees. The experimental results revealed certain limitations, including the intrusion of lubricant between the two aluminum pieces and an insufficient stress distribution within the designed workpiece geometries. These factors led to a failure in achieving welding between the two aluminum pieces and resulted in tearing.

Keyword : Equal Channels Angular Pressing/ Cold welding/ Aluminum

Welding Jig for Automotive Body Pulling

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Advisor
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Tool and Material Engineering

Abstract

This engineering project aims to reduce welding time by at least two times compared to welding without a jig, this will increase the accuracy of positioning workpieces and reduce waste in the manufacturing process. The study and design of a welding jig for the Dyno 2000 body puller device focus on designing a jig that meets the high-precision manufacturing requirements and is easy to use. The research project begins with studying the principles and operation of jigs, welding procedures, and the time required for welding. Then, an analysis is conducted to select suitable materials for fabricating the welding jig, using SS400 steel, which is a material that is strong, resistant to the heat generated during welding, and has been phosphate-treated to prevent rust.

In testing the performance of the designed jig to evaluate its effectiveness in reducing time and improving precision in manufacturing, the results show that the designed jig significantly increases the accuracy of workpiece production and helps reduce errors during assembly or production caused by unstable workpiece clamping. Furthermore, it improves production efficiency and reduces working time noticeably, which aligns with the objectives of the research project outlined above.

Keywords: Dyno 2000 body puller device / Phosphate coating / SS400 steel / Welding jig

Design and manufacture a plastic injection mold for producing exterior automotive decorative parts.

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Advisor
Dr. Ratchanee Paisarn

Tool and Material Engineering

Abstract

This engineering project aims to design and manufacture a plastic injection mold for producing exterior automotive decorative parts, which are products of TFP Industrial Co., Ltd. The project team designed a two-cavity mold and performed calculations related to the mold design. The mold drawings were then submitted to TFP Industrial Co., Ltd. for review before proceeding with the mold fabrication. The approved drawings were sent to the mold manufacturer, and the completed mold was tested through trial injection molding using TFP Industrial's injection molding machine. A three-plate injection mold was selected for this project. in addition, the team designed a form for part inspection and collected data on production time and output quantity. This data was used to analyze and compare the performance of the two-cavity mold with a single-cavity mold in terms of production efficiency.

Improving the efficiency of the production process for SN518.4 Case study Line wire, Siam Senator Co., Ltd.

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Advisor
Dr. Ratchanee Paisarn

Tool and Material Engineering

Abstract

In the present era, the automotive industry is undergoing rapid transformation driven by advancements in technology and innovation. These changes have a direct impact on the automotive parts industry, particularly in terms of production costs, efficiency, and manufacturers' competitiveness in the market. Therefore, the objective of this project is to design, improve, and develop a mold for the production process of part SN518.4, a structural component of a car seat, manufactured by Siam Senator Co., Ltd. Currently, this part faces quality issues due to a forming error that occurs during the forging process of a 7-millimeter diameter steel wire. The existing method involves forging from the same side, which differs from the original process that required forging from opposite sides. This deviation results in products that do not meet quality standards. Consequently, the project focuses on improving the production process to reduce errors, save time, and lower production costs through the design of a new mold capable of integrating production steps into a more continuous and efficient process. Engineering principles are applied to analyze and resolve the issues, utilizing tools such as Quality Control (QC) Tools and the ECRS principle (Eliminate, Combine, Rearrange, Simplify) to minimize waste in the manufacturing process. The expected outcomes of this project include a reduction in forming errors, shorter production time, and overall cost savings in terms of materials, time, and labor, thereby enhancing the efficiency of the production process.

Design and Construction of a Low Pressure Die Casting Mold for a 100 mm Ball Valve Cap

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Advisor
Dr. Ratchanee Paisarn

Tool and Material Engineering

Abstract

This project aims to design and fabricate a mold for the Low Pressure Die Casting (LPDC) process to produce 100 mm ball valve caps. Replacing the current forging process with LPDC reduces production steps and suits complex shapes. Final parts meet the design requirements.

Development of a Checking Fixture for the Inspection of Fuel Filter Bracket Components in Automobiles

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Advisor
Asst.Prof. Noppadol Kumanuvong

Tool and Material Engineering

Abstract

The primary objective of this engineering project is to design and develop a checking fixture (CF) for the final inspection of fuel filter bracket components in automobiles prior to delivery to the manufacturer. The research began with an in-depth study of existing issues in the inspection process. Initially, over 1.8% of the inspected parts were found to be non-compliant with quality standards, with an average inspection time of approximately 40 seconds per piece. The process involved the use of various measuring tools across multiple inspection points, which contributed to measurement errors and inconsistencies. To resolve these issues, the project team opted to redesign the CF to enhance the accuracy and reliability of quality control. The design incorporates principles of Geometric Dimensioning and Tolerancing (GD&T), enabling comprehensive inspection of both dimensional and profile features around the component. These principles also guided the development of appropriate part-holding and inspection positioning strategies.

In addition, go/no-go gauges were integrated into the CF to ensure compliance with hardness-related tolerances and to extend the fixture's operational lifespan. S50C material was selected for the fixture, as it provided an acceptable balance between durability and cost-effectiveness, according to the manufacturer's criteria. Upon implementation and testing, the new CF demonstrated that it could completely eliminate non-conforming parts from being delivered to the customer. The average inspection time was also reduced by 66% compared to the previous process. To validate the fixture's performance, a one-by-one inspection method was employed, confirming the fixture's ability to detect all out-of-tolerance parts and achieve the targeted time savings. As a result, the redesigned CF met all project objectives and has since been successfully adapted onto the production line by the manufacturing company, where it remains in use.

Keywords: Checking Fixture (CF), 100% Inspection, Inspection Time Reduction, Cost Reduction, Quality Control

Design to develop and create a semi-automatic jig for bending workpieces processed by austempering.

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Advisor
Assoc. Prof. Dilok Siprapai

Tool and Material Engineering

Abstract

This engineering project aims to design, develop, and produce a semi-automatic jig for bending workpieces, and to test the use of the jig to reduce the bending time of workpieces, which is caused by parts in the assembly of automatic transmissions of automobiles. After the austempering process, the workpieces are warped and not in the specification. The company originally used a manual bending process using a bending comb, which required human strength to bend. The limitation of using the bending comb is that there is only one employee who can estimate the bending distance to bring the workpiece back to the specified specification. In addition, the employee's fatigue from bending for a long time causes the workpieces to have inconsistent accuracy, resulting in a small number of workpieces that pass the specification per bending cycle. The design of the semi-automatic jig for bending workpieces has a sensor system to check the distance of the workpiece placement according to the customer's design. A pneumatic cylinder moves the block to bend the workpiece and adjust the bending distance in detail. In this part, a test will be performed by adding a shim plate with sizes of 0.10-0.90, 1.00-5.00, and 10.00 mm to find the appropriate size of the shim plate to make the workpiece in specification, and analyzing the results of comparing the use of the company's original bending with the designed jig.

Designing a Fixture for Clamping Control Valves in Shell Testing and Using Image Processing for Seat Leakage Testing

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Advisor
Asst.Prof.Dr.Kusol Prommul, Asst.Prof.Jiraporn Sripraserd

Tool and Material Engineering

Abstract

In various industries such as petrochemical plants, oil refineries, and gas processing facilities, control valves are critical devices used to regulate key process parameters including flow rate, pressure, and temperature. For safe and reliable operation, these valves must undergo standardized testing accepted internationally. There are two main testing methods: the Shell Test and the Seat Leakage Test. The Shell Test evaluates leakage around the valve body by increasing internal pressure to a specified level and monitoring the valve's ability to maintain this pressure through the reading on a pressure gauge. The Seat Leakage Test assesses leakage between the valve seat and disc by applying pressure and counting the number of air bubbles escaping from the interface within a set time, ensuring it does not exceed the acceptable limit. Currently, the bubble counting in the Seat Leakage Test is conducted manually, which can lead to inconsistencies and human error.

Moreover, control valves in industrial settings vary widely in size, necessitating the use of a fixture to securely hold the valve in place during testing. Without proper clamping, valve movement may occur, resulting in inaccurate test results.

This research aims to design and develop a fixture system capable of securely accommodating control valves of different sizes to ensure stability throughout the testing process. Furthermore, it seeks to implement image processing technology to automatically detect and count air bubbles during the Seat Leakage Test. This approach is intended to reduce human error and improve the accuracy and efficiency of leakage detection in control valve testing procedures.

Study on Redrawing Process to Reduce Thinning of Cylindrical Cups with Rounded Bottom

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Advisor
Assoc. Prof. Dr. Varunee Premanond, Assoc. Prof. Jiraporn Sriprasird

Tool and Material Engineering

Abstract

The deep drawing process often leads to wall thinning in the corner radius area of cylindrical parts, resulting from metal stretching during forming. This research aims to minimize thinning in cylindrical parts with curved bottom through a redrawing process using 2 different first drawing punch profiles. The study compared cylindrical punches with curved and flat bottom to analyze thickness distribution and investigates the effect of punch curvature ratio on thinning of curved-bottom cups. Testing with Al1100 revealed that deep drawing punch curvature ratios of 1.35, 1.7, and 2 resulted in thinning at the thinnest points of 26%, 10.6%, and 6%, respectively. A punch with a ratio of 1.35 caused the most thinning, and decreased as the curvature ratio increased. The redrawing study, where the first drawing used a flat bottom punch and the second used punches with curvature ratios of 1.35, 1.7, and 2, showed that as the curvature ratio increased, the ability to reduce thinning decreased. This was similar to the first drawing using a punch curvature ratio of 2.5. Selecting an appropriate punch curvature ratio in the redrawing process is crucial, as it helps reduce thinning, especially in parts with curved bottoms.

Development of drill bits that can increase the smoothness of the drill hole surface

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Advisor
Prof.Dr. Sutasn Thipprakmas

Tool and Material Engineering

Abstract

The purpose of this research is to design and fabricate a drill bit that can make the inside surface of the drill hole smoother than the general drill bit. The values were collected by drilling acrylic first, followed by AISI1050 steel with a general M16 drill bit at the lowest machine speed. Then, the three designed drill bits, which are groove type, lubrication welded hole type, and notch type, were tested by drilling through acrylic first. Then, AISI1050 steel was tested with all three drill bits. The values were recorded based on the smoothness of the drill hole every 1 cm around the hole 0-360 degrees. After that, the values of the smoothness of the drill hole that occurred were compared.

The use of artificial neural networks to predict parameters affecting the thickness of the insulation of F.25 KV-CC electrical wires

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Advisor
Asst. Prof. Dr. Kusol Prommul, Asst. Prof. Jiraporn Sripraserd

Tool and Material Engineering

Abstract

The production of electrical wires in the industrial sector is a critical process that must adhere to established electrical wire manufacturing standards. This project aims to study the factors influencing the insulation thickness of F.25 KV-CC electrical wires with a cross-sectional area of 50 square millimeters, manufactured by Thai-Yazaki Electrical Wire Co., Ltd., using the extrusion process. The factors considered in this project include the screw speed in the production of the insulation of all three layers, which consist of conductor shield, insulation, and insulation shield. In this project, Python will be utilized through the Jupyter Notebook platform to develop an artificial neural network for predicting the screw speed. Currently, the company relies on expert judgment to manually adjust the screw speed, which results in material waste and extended production time. The proposed artificial neural network will be trained using actual production data from 2023, with the dataset divided into 80% for training, 10% for testing, and 10% for validation. The model will take a total of 19 input parameters to predict the screw speed. The organizing committee expects the prediction model to achieve an accuracy rate of 85% or higher.

Keywords: Artificial neural network / Screw speed / Conductor shield / Insulation / Insulation shield

The simulation system of a defective workpiece sorting machine on a conveyor belt controlled by an Arduino board

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Advisor
Asst. Prof. Dr. Kusol Prommul, Asst. Prof. Jiraporn Sriprasert

Tool and Material Engineering

Abstract

Abstract
This project aims to study, design, and build a prototype system that simulates the operation of a defect detection and sorting machine for workpieces formed through a deep drawing process on a conveyor belt. The defects are categorized into three types: 1) tearing at the bottom of the cup, 2) wrinkling at the rim, and 3) wrinkling on the wall. The system uses an Arduino board as the main control unit, incorporating an AI vision sensor to detect defects in the moving workpieces. Once a defect is identified, the system triggers a mechanism to push the defective workpiece off the conveyor belt into a separate storage box. The Arduino handles data processing from the sensor and efficiently controls the motor operations. This prototype is capable of accurately and reliably sorting defective workpieces with issues such as wrinkles and tears from the forming process. Moreover, the system can be adapted as a model for research in tooling and materials engineering, as well as a case study in designing automated systems relevant to manufacturing industries.

Study on friction evaluation test using T-shape compression

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Advisor
Assoc. Prof. Dr.Varunee Premanond

Tool and Material Engineering

Abstract

This research evaluates the friction coefficient using the T-shape compression test method compared to the Ring compression test method, focusing on the influence of die surface roughness and lubricants on the friction coefficient. The die set was made from DC53 steel grade with a hardness of 60 HRC, featuring varying surface roughness levels, while the test specimens were made from aluminum grade 1060. The lubricants used included TDN81 oil, grease, polypropylene, and a condition without lubrication. Preliminary test results indicate that the die surface roughness and type of lubricant significantly affect material deformation, as evidenced by the varying friction coefficients obtained from each test condition.

Regression application for PMSM preventive maintenance

Tanig Plaboothong, Kittikan Luangprasit, Punnawit Yaowapan

Advisor
Asst. Prof. Dr. Ekkachai Mujjalinvimut, Dr. Tanapon Kumpao

Electrical Engineering

Abstract

This project aims to develop a preventive maintenance approach for Permanent Magnet Synchronous Motors (PMSMs) used in electric vehicle propulsion systems by utilizing the Simplified Refined Instrumental Variable for Continuous-time (SRIVC) algorithm for parameter estimation. This method enables accurate estimation of dynamic system parameters even in the presence of measurement noise. The process includes the development of a mathematical model for the PMSM and the SRIVC algorithm, which was implemented using MATLAB and Simulink. The system was then embedded on the Texas Instruments F28379D microcontroller board for real-time processing. Experimental results show that the SRIVC algorithm can accurately estimate the changing parameters of the system, with an R-Squared value exceeding 0.9. Additionally, it can detect trends of motor degradation caused by various fault modes before actual failures occur. Examples include stator inter-turn short circuit, demagnetization, and lubricant deterioration in the motor, which results in unique pattern of parameter changes. This project demonstrates the potential of using parameter estimation systems to identify early stages of PMSM fault modes that cause parameter changes in motors, leading to the development of a highly accurate and efficient preventive maintenance system.

Wireless power transfer for golf car

Ms. Nipada Lappoon, Ms. Passachol Tanodkaew, Ms. Sawita Sricharoen

Advisor
Asst. Prof. Dr. Ekkachai Mujjalinvimut, Dr. Nattapong Hatchavanich

Electrical Engineering

Abstract

This project presents a wireless power transfer (WPT) system for golf car applications. The proposed system supports wireless charging for two golf carts using a single power conversion circuit. The system leverages the bifurcation phenomenon, which causes the original zero-phase angle (ZPA) frequency to split into multiple ZPA frequencies. The advantage of operating at ZPA frequencies under bifurcation is the ability to maintain a stable output voltage from the wireless power transmitter despite variations in the coupling coefficient, thereby ensuring reliable power delivery to the on-board battery chargers installed in the electric vehicles. The system employs transmitter-side control, utilizing a PI controller to regulate the transmitter voltage and a phase-locked loop (PLL) to track the ZPA frequency. The system design includes Comsol Multiphysics for modeling the transmitter-receiver coils, MATLAB/Simulink for control system simulation, and LTspice for frequency response analysis. Simulation and experimental results confirm that the proposed system can wirelessly deliver 500 W of power at least 10 cm air gap.

Demonstration of Slot Discharge on Stator Winding of Generator

Ms.Nuntarat Wongsawang, Ms.Sirirat Kaekam, Mr.Thanadon Komolkiat

Advisor
Asst.Prof.Dr. Supakit Chotigo

Electrical Engineering

Abstract

This project aims to investigate the issue of surface discharge on stator coils in the stator slots (slot discharge) of generators, which affects the reliability of rotating machinery, particularly in industrial applications. Statistical data from service providers indicate that daily fluctuations in power generation cause abrasion between the surface of the stator coil and the core, leading to damage to the semiconductive material and eventually resulting slot discharge. In this study, slot discharge was simulated on two 6.6 kV stator coils under laboratory conditions. The results from six standard testing methods—Insulation Resistance (IR), Polarization Index (PI), DC Ramp, Dissipation Factor (DF) and Dissipation Factor Tip-up, Off-line Partial Discharge (PD) Testing and Dielectric Discharge (DD)—were collected and compared against the degree of damage to the semiconductive layer. The results showed that even though IR remained constant and PI and DD values increased, they were not directly correlated with the occurrence of slot discharge; however, these tests remain important for evaluating stator coil quality and preparing for high-voltage testing. In contrast, the DF and PD results showed a clear upward trend corresponding to the extent of semiconductive material damage and were closely related to slot discharge formation. Additionally, the DC ramp test revealed a decreasing trend in coil capacitance, leading to a corresponding decrease in charging current (IC) as the damage increased. It can be concluded that the results of the DF and PD tests are consistent with the database and field test results, while the DC ramp test effectively indicates occurrences of partial discharge. These findings can be applied to help enhance in-field stator insulation condition assessment in the future.

Real-time Voltage and Current Monitoring System for Lithium-ion Batteries Using Feedforward Neural Networks for Battery State Prediction

Mr. Dechawat Munkhiew, Mrs. Waraporn Pongnongpok, Mrs. Phattaranit Suwansoponsiri

Advisor
Asst.Prof.Dr. Supakit Chotigo, Asst.Prof.Dr. Chanchai Techawatcharapaikul

Electrical Engineering

Abstract

This project aims to design and develop a real-time monitoring system for lithium-ion batteries by applying artificial intelligence technology alongside voltage and current measurement systems to evaluate essential battery parameters, including State of Charge (SoC), State of Health (SoH), State of Energy (SoE), and Remaining Useful Life (RUL). The project utilizes a Feedforward Neural Network (FNN) developed using Deep Learning Toolbox of MATLAB, which provides an efficient framework for creating and designing models for battery condition prediction. After completing the model training, it is integrated with a real-time battery voltage and current measurement system consisting of electronic devices controlled through Arduino programming. The key component in the measurement system is the PZEM-017 module, responsible for accurately measuring battery voltage and current values and transmitting the data to the NodeMCU microcontroller, serving as the communication interface to the computer. The measured data are used as dynamic input for the FNN model to predict the battery status, which has been validated with high accuracy in the training process of this algorithm. This high accuracy is also in agreement with manual calculations. The prediction results are subsequently visualized in real time via the Grafana platform, which provides a user-friendly, flexible, and highly accessible environment for continuous data display. This study aims to enhance convenience and safety in monitoring the status of batteries or electrical systems using lithium-ion batteries as the primary energy source, while also supporting users in optimizing energy management efficiency for various practical applications.

Primary side control technique for Wireless E-Bike Charger

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Advisor
Asst. Prof. Dr. Supapong Nutwong

Electrical Engineering

Abstract

Wireless charging technology for electric vehicles has gained widespread popularity due to its convenience, eliminating the need for conductive cables during power transfer. The core principle of wireless charging involves power transmission and reception via magnetic coupling between primary and secondary coils. However, a major limitation of wireless charging systems lies in the control of current and voltage supplied to the battery, which typically requires sensors and measurement devices to be installed on the secondary side. This increases system complexity and cost due to the need for sensing devices and communication interfaces between the primary and secondary sides.

This project aims to study and design a wireless charging system for electric bicycles by employing a series compensation topology and implementing primary-side control. This approach eliminates the need for secondary-side sensing equipment, reducing overall system cost and complexity.

Circuit Breaker Tester

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Advisor
Mr.Thawatchai Chayawanich

Electrical Engineering

Abstract

This study aims to develop and create circuit breaker test equipment capable of simulating abnormal electrical conditions to verify the efficiency and accuracy of circuit breakers in low voltage (220V) electrical systems. The equipment design follows industry standards to study critical scenarios affecting circuit breaker operation, including thermal trip overcurrent conditions, Type AC residual current, and serial arc faults. The research encompasses theoretical data collection, design methodology, and prototype development of test equipment for examining circuit breakers under specific testing parameters: overcurrent conditions (thermal trip according to IEC 60898-1:2015), residual current devices (specifically Type AC according to TIS 2425-2560), and arc fault detection devices (serial arc according to IEC 62606:2013). The equipment can accurately simulate these electrical scenarios while prioritizing operational safety and practical usability.

Preliminary test results demonstrate that the test equipment can accurately verify circuit breaker responses, enhancing confidence in electrical protection devices, reducing risks of fire and electric shock, and providing valuable applications as educational tools for electrical safety training to enhance understanding of electrical hazard prevention in a controlled, safe environment.

Development of an I-V Curve Tracer for Solar Panels

Mr.Panawat Phinyasak, Ms.Jeerawan Majina, Mr.Ratchapumin Sanguankam

Advisor
Mr. Thawatchai Chayawanich

Electrical Engineering

Abstract

Development of I-V Curve Tracer for Solar Panel Characteristics Testing
This study aims to develop an I-V Curve Tracer for measuring current and voltage of solar panels, to be used for examining the characteristics of solar panels, which will lead to the analysis of abnormalities in solar panels. The focus is on applying knowledge in electronics and microcontroller programming.
In this study, relevant research has been studied and compiled, along with comparing the operating principles of four I-V Curve Tracer circuit techniques: Capacitive Load technique, Electronic Load using MOSFET, Electronic Load using IGBT, and DC-DC Converter technique. The goal is to develop a solar panel current and voltage measuring instrument (I-V Curve Tracer) that can store data and display results through an IoT system. Additionally, the developed I-V Curve was compared for accuracy with I-V Curve Tracers actually used in industry.
The developed I-V Curve will help in preliminary testing of solar panel characteristics according to the objectives. It is also accurate and fast, which will make the solar panel inspection process less expensive.

Development of LoRa Board for Remote Control and Sensing

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Advisor
Dr.Jakkrit Kunthong

Electrical Engineering

Abstract

This project aims to study and develop a microcontroller board designed for remote monitoring and control applications using LoRaWAN technology, focusing on low-power communication systems. The RAK811 module serves as the primary communication interface, allowing the board to connect with various sensors and devices via GPIO, I2C, and UART interfaces. Embedded programming is employed to manage system operations, enabling real-time data acquisition, processing, and visualization through cloud-based platforms, including Node-RED, Influx Database, Grafana, and Home Assistant. The system has been implemented in three practical scenarios: air particulate monitoring, asset tracking, and smart lighting control. Performance testing was conducted using a 5000 mAh battery, assessing sensing accuracy, control capabilities, and power optimization. Field deployment took place at King Mongkut's University of Technology Thonburi (Bangmod Campus), covering approximately 210,439 square meters, with results showing signal strength ranging from -30 dBm to -95 dBm and a maximum battery life of 26 days in low-power mode. The outcomes confirm that the system provides stable long-range communication and has strong potential for expansion into Smart City initiatives and various IoT applications.

Inverter drive and Controlling in EV

TAWEESAK THONGKLIANG, TEETAT SITTICHOK, POOWADECH LEKSAKUL

Advisor
Assoc.Prof.Dr. MONGKOL KONGHIRUN, Asst.Prof.Dr. EKKACHAI MUJJALINVIMUT
TIRASAK SAPAKLOM

Electrical Engineering

Abstract

In the present day, electric vehicles (EVs) are widely used on the roads due to their lower fuel costs compared to other types of vehicles. To ensure efficient and cost-effective energy management, the Vehicle Control Unit (VCU) plays a critical role. It is responsible for safety functions, anomaly detection, operational logic, and communication within the EV system via the Controller Area Network (CAN) protocol. This protocol is a highly efficient wired communication method well-suited for components within electric vehicles. The project was carried out by collecting data of the VCU and establishing correlations with various sensor inputs. These correlations were used to design the operational sequence of a small-scale electric vehicle using MATLAB & Simulink, with communication handled via the CAN protocol. The VCU operation was simulated and implemented on a LAUNCHXL-F28379D microcontroller. The results showed that the VCU was able to follow the designed sequence accurately. This was evident in the handling of torque input, which required data to be properly packed before being transmitted to the controller in order to drive the motor using the Space Vector Pulse Width Modulation (SVPWM) method. Additionally, when mechanical load was increased using a dynamometer (Dyno) test setup, the VCU was able to display key electrical parameters in real time. These values, derived from decoding the incoming data, allowed for monitoring of dynamic changes during operation. Overall, the VCU is essential in electric vehicles, not only for handling communication and monitoring electrical parameters but also for managing internal task prioritization to ensure driver safety.

Creating a model for analyzing and predicting the heating of power transformers with harmonics

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Advisor
Dr. Atip Doolgindachbaporn

Electrical Engineering

Abstract

Electric vehicle (EV) technology is a major part of society today. However, it becomes evident that these systems are affected by increased temperatures and power losses, as well as voltage and current instability caused by harmonics. These harmonics arise during the conversion process from alternating current (AC) to direct current (DC) used in EV applications. The purpose of this project is to investigate how harmonics affect two different kinds of power transformers: a 100 kVA transformer and a 12.2 kVA transformer. The transformers will undergo short-circuit tests under three different current harmonic distortion (THDi) levels for the study: 0%, 15%, and 20%, respectively. To find trends in thermal behavior, electrical characteristics and temperature data gathered from different locations on the transformers will be examined. Then, using the techniques of linear regression and artificial neural networks (ANN), these trends will be used to forecast thermal performance. The Comsol program is also used to create models of thermal flow. The usefulness of the forecasting and modeling techniques in predicting transformer temperature behavior is confirmed by the results, which demonstrate a strong correlation between projected and measured values.

Study and Modeling of Floating Solar PV Systems

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Advisor
Assoc. Prof. Nattawut Chayawanish

Electrical Engineering

Abstract

This project aims to study and simulate the installation of an off-grid floating solar power system for use in remote areas or regions without access to electricity. The system is designed to provide power for basic loads such as small water pumps and lighting. The system consists of a 365-watt solar panel, connected to a charge controller and a 12-volt, 55 amp-hour lead-acid battery to store energy for nighttime use. The floating platform structure is made from locally available materials such as PVC pipes, plastic containers, and rust-resistant steel, which allow the platform to float and securely support the weight of the equipment. The platform is also designed to be disassembled and easily moved. A total cost analysis of the system shows it ranges from approximately 6,000 to 8,000 THB, making it suitable for households or small farms with limited budgets. The system's performance has been simulated using PVSyst to evaluate its energy production potential and compare the results with real installation data. This project will enable users to apply the knowledge for planning, designing, and installing floating solar systems in their own areas, whether for household use, agricultural farms, fish ponds, or rural areas without electricity access. Additionally, it supports the use of sustainable renewable energy and helps reduce dependence on fossil fuels.

Direct Current Surge Arrester For Solar Cell (DCSA)

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Advisor
Boonnua Pungsiri

Electrical Engineering

Abstract

In recent years, solar photovoltaic (PV) technology has gained significant attention as a clean and sustainable energy source. Solar power systems offer an environmentally friendly alternative for electricity generation, as they do not produce harmful emissions or pollution. As global demand for renewable energy continues to rise, solar PV systems are increasingly being adopted in residential, commercial, and industrial applications. Despite their benefits, solar PV systems—particularly those operating on direct current (DC)—face certain technical challenges. One of the critical concerns involves vulnerability to overvoltage and overcurrent conditions, which can be triggered by external factors such as lightning strikes. These incidents may cause severe damage to key system components, leading to performance degradation, safety hazards, and costly repairs. Moreover, the protection of DC systems presents greater complexity compared to alternating current (AC) systems, especially regarding arc fault mitigation. Unlike AC systems, where the current naturally passes through a zero-crossing point, aiding in arc extinguishment, solar cells operate as constant current sources. This constant current characteristic makes it significantly more difficult to interrupt arcs once initiated, increasing the risk of prolonged electrical faults and fire hazards. In light of these challenges, this project aims to investigate and develop effective protection strategies for solar PV systems, with a particular focus on mitigating the risks of overvoltage and arc faults in DC circuits. The objective is to enhance the overall safety, reliability, and longevity of solar power installations, thereby supporting the broader adoption of renewable energy technologies.

Development of AIoT Smart Home

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Advisor
Dr. Jakkrit Kunthong, Lecturer Tirasak Sapaklom

Electrical Engineering

Abstract

Abstract

This project aims to enhance the convenience and intelligence of modern living through the development of a Smart Home AIoT (Artificial Intelligence of Things) system. The proposed system is designed with the following key objectives:

1.IoT-Based Appliance Control: Implement a comprehensive IoT Dashboard to monitor real-time status, store historical data, and control home appliances through both a web interface and voice commands.

2.Intelligent Environmental Automation: Design and integrate an automated system for managing lighting and indoor air quality, ensuring optimal comfort and energy efficiency.

3.Behavior-Driven AI Adaptation: Employ artificial intelligence to analyze user behavior patterns and dynamically adjust environmental settings, providing a personalized and responsive living space.

This project leverages the synergy between IoT and AI to create a smart, adaptive, and user-centric home environment.

Emergency Communication System by Iridium Satellites

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Advisor
Dr. Jakkrit Kunthong, Asst. Prof. Dr. Piyasawat Navaratana Na Ayudhya

Electrical Engineering

Abstract

This project was undertaken with the objective of designing and creating a device capable of communication during emergencies. It relies on the Iridium satellite network, which can be used in areas without conventional telephone signals. The project encompasses hardware study and development, such as designing the internal circuitry of the device and designing the device enclosure with consideration for robustness and suitability for portable use. Furthermore, it involves software study and development for background operations of message reception and transmission. The test results demonstrate that the developed device can correctly send and receive messages. However, the device still has usage limitations, as its operation depends on various factors, including the position of the satellites orbit passing overhead, the device's usage location, and the weather conditions at that time.

Instrumentation Control (Oscilloscope and Power Supply) with IoT

Mr. Chayutpol Onbao, Ms. Prim Sukjitsumrarn, Mr. Kanokpol Saelim

Advisor
Dr. Jakkrit Kunthong, Asst.Prof. Nattavut Chayavanich

Electrical Engineering

Abstract

This research aims to develop a control system for laboratory equipment, including an oscilloscope and power supply, utilizing Internet of Things (IoT) technology to enable remote operation and data monitoring. The research involves the development of software using Node-RED to create a control dashboard, and employs the ESP32 microcontroller in conjunction with the MQTT protocol for communication between devices. Additionally, SCPI commands are used via Telnet to control laboratory instruments. The system development encompasses user interface design, control programming, and the implementation of wireless communication over Wi-Fi. Experimental results demonstrate that the developed system can reliably control devices and read measurement data in real time. This study highlights that the application of IoT technology can significantly enhance efficiency and convenience in electrical engineering laboratory operations.

Design and Control of Single - Phase Grid - Connected Photovoltaic Microinverter

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Advisor
Dr. Nattapong Hatchavanich, Dr. Apichai Suyapan

Electrical Engineering

Abstract

This paper presents the design and control of a 210 W photovoltaic microinverter using an Interleaved Flyback Converter topology, coupled with the Perturb and Observe (P&O) Maximum Power Point Tracking (MPPT) algorithm for enhanced DC power conversion. The Flyback converter is controlled using Sinusoidal Pulse Width Modulation (SPWM), which generates a Full-wave Rectified Sine Wave. This signal is then converted into a Pure Sine Wave AC at 220 volts and 50 Hz frequency by an Unfolding Circuit. The system incorporates a Phase Locked Loop (PLL) to synchronize the inverter's phase and frequency with the grid. A Snubber circuit is also used to prevent voltage spikes during switching. The entire system is controlled by the LAUNCHXL-F28379D microcontroller from the Texas Instruments C2000 family. The designed system is simulated in MATLAB software. Preliminary results show that the prototype microinverter operates stably, handling load variations from 10% to 100%. It is expected to meet PEA power quality standards. This project provides a foundation for the development of stable and efficient microinverters for small-scale solar power systems, which could be applied in the future.

A study of Electrosurgical Generator

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Advisor
Dr. Nattapong Hatchavanich, Lect. Tirasak Sapaklom

Electrical Engineering

Abstract

The purpose of this topic is to study the working principle and control of power supply and scalpel for tissue resection and hemostasis, and to develop and design power supply for tissue resection and hemostasis. Electric generator or ESG is an important part of generating high-frequency electric energy for tissue resection and hemostasis. During the surgical process, the electric generator uses electric energy to generate specific heat to accurately control the operation or tissue destruction.

Among them, we mainly studied and designed a power supply that can meet the requirements of electrosurgical generator equipment, concentrate on power stability control, reasonable adjustment of power supply frequency and short-circuit protection. In order to make electrosurgical equipment run efficiently and safely, we also carried out environmental tests on the power supply system, and evaluated the performance and reliability of the equipment with simulation organizations. The test results must show that the system can respond to the assumptions or objectives of the design.

Study and Simulation of DC Fast Charger for Electric Vehicles.

Mr. TECHIN NAMUEANGCHAN, Mr. KANCHAI DECHAKHUN

Advisor
Dr. NATTAPONG HATCHAVANICH, Asst. Prof. DR. SUPAPONG NUTWONG

Electrical Engineering

Abstract

With the growing adoption of electric vehicles (EVs) in Thailand, the demand for associated technologies particularly battery charging systems has significantly increased. This project aims to study, design, and develop a prototype of a 2-kilowatt DC battery charger for electric vehicles. The proposed system employs an LLC resonant converter topology, which enables efficient energy conversion and supports Zero Voltage Switching (ZVS), thereby minimizing power loss and heat generation. The resonant circuit comprises an inductor, capacitor, and high-frequency transformer, enabling voltage transformation and resonance suited to the battery's requirements. The control system is built around a C2000 microcontroller, which precisely manages the charger's operation. Matlab/Simulink is used for simulating both the LLC resonant converter and the feedback control system. The simulation includes a model of a lithium iron phosphate ($LiFePO_4$) battery, allowing accurate representation of voltage and current variations based on the battery's State of Charge (SoC). The control algorithm dynamically adjusts the frequency of the PWM signals driving the inverter switches, achieving soft switching and phase angle control. This ensures the charging process is optimized for battery condition across all SoC levels, enhancing efficiency and safety. The developed prototype demonstrates the potential for practical implementation in real EV charging scenarios. It offers a high-performance, reliable, and safe solution that aligns with the technical requirements of modern EV systems.

High Electric Field Alert with Non-Contact Detection and Signal Amplification

Pattarapoom Chitchainanukul, Thamakorn Somthip, Thanyasiri Promma

Advisor
Dr. Atip Doolgindachbaporn

Electrical Engineering

Abstract

While cranes are working very near high-voltage overhead power lines, major risks of accidents, property damage, and power cuts in the region will arise. Therefore, this project aims to mitigate such hazards by developing a high-voltage electric field alert with non-contact detection, designed and tested under voltage rating of 22 kV at distance of 5 meters according to minimum clearance standard. The design consisted of pre-amplification circuit, instrumentation amplifier, and operational amplifiers to amplify weak electric field signals. Signal processing and triggering were done using Arduino Nano with alerts sent wirelessly using HC-12 module working at 433 MHz and the electric field sensor utilizes a parallel plate conductor. The experiment was limited to the type of conductor and insulating layer, which will bear maximum voltage within the specified distance. Compared with the double-sided copper PCB, it showed that the double-sided copper PCB has more efficiency than the handmade plates. Because it had fewer air gaps and was consistent throughout the plates. Testing the designed equipment with 22 kV power transformers to see whether distances the equipment could detect. The results showed that the equipment alarm at the distance within 5 meters according to the purpose. It also controls both transmitter and receiver side, giving more convenience for field operation. Further, we use an electromagnetic field analyzer to confirm the credibility of the device in detecting fields up to five meters but also beyond detection up to 13 meters. Measurements corroborated the theoretical expectations where electric field strength decreases when distance increased, hence giving an idea of feasible and effective means of improving safety around high-tension installations.

Solar Forecasting For Photovoltaic Systems

Ms.Warissara Wangwong, Ms.Napat Punyaporn, Mr.Natthawirote Maillusagu

Advisor
Dr. Atip Dooljindachabaporn

Electrical Engineering

Abstract

This study explores the application of machine learning (ML) techniques for short-term solar irradiance prediction, a crucial parameter in planning and optimizing photovoltaic (PV) energy systems. The research focuses on acquiring and integrating data from calibrated weather stations and sensors installed within solar power systems. These datasets are used to build and validate forecasting models employing various ML algorithms. The primary objective is to develop and select the most appropriate ML models capable of effectively predicting solar irradiance. The predicted irradiance is then converted into expected power outputs, which are compared with actual in-situ sensor data from PV modules and weather stations. This comparison allows for assessing model accuracy and identifying climate or technical factors that influence irradiance variability. Additionally, a web-based application will be developed to present the forecasting results. This system will feature an alert mechanism to notify users when actual PV system output deviates significantly from forecasted values, which could indicate potential malfunctions or a decline in solar panel performance. This early-warning system is designed to support the timely detection and correction of faults, enhancing the operational reliability of solar energy devices. In conclusion, the project aims to deliver a decision-support tool that improves the efficiency, stability, and long-term performance of PV power systems. The application will highlight the potential of machine learning in advancing predictive maintenance and energy forecasting within the renewable energy sector.

The Maximum Power Point Tracking for Stand-Alone Wind Turbine

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Advisor
Apichai Suyapan, Ph.D.

Electrical Engineering

Abstract

Global warming caused by various forms of air pollution, such as emissions from industrial factories and conventional power plants, has led to the increasing adoption of renewable energy sources for electricity generation to mitigate environmental impacts. Among these alternatives, wind energy has gained significant attention due to its abundance, sustainability, and the fact that it incurs no fuel costs. However, electricity generation from wind energy is highly dependent on wind speed, which varies continuously based on weather conditions. This variability makes it difficult to maintain consistent power output. To improve the efficiency and reliability of power generation from wind turbines, this project aims to study and present the application of a Maximum PowerPoint Tracking (MPPT) technique for a stand-alone wind energy system. MPPT is an effective method for maximizing the usable energy that wind can provide at any given moment. In this project, a prototype of a control and power conversion system was designed and developed to adjust its operating parameters dynamically in response to fluctuating wind speeds. This system allows for more stable electricity generation and improved overall efficiency.

The findings from this study can be applied to real-world wind energy systems in the future, contributing to the development of practical and sustainable power generation solutions

Solar energy storage system for camping

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Advisor
Asst. Prof. Nattavut Chayavanich, Mr.Manoch Sanluang

Electrical Engineering

Abstract

This project developed a solar energy storage system for camping, comprising a solar panel, a charge controller, a battery, an inverter, and a PZEM-003 power quality monitoring module for operating small AC electrical devices. The project involved studying the operation and components of an off-grid solar power system, along with calculating the best orientation and tilt angle of the solar panel for each province to maximize system efficiency. The kit also includes a battery status monitoring system designed to display remaining battery capacity through the Home Assistant application. Voltage and current measurements were collected using both the charge controller and the PZEM-003 module, and the data were calibrated against a multimeter to achieve the highest accuracy. Once the complete kit was assembled, practical usage experiments were conducted to study the battery's operational behavior and to design an effective battery status display system for efficient energy management. The test results showed that the battery level displayed in the Home Assistant application closely matched the actual usage, successfully supporting the connection of electrical devices and accurately displaying the remaining capacity, with an error margin not exceeding 10%

Study and Modelling Emergency Shutdown Device and Solar Panel Efficiency Optimization with Real-Time Display

Mr. Phanuwat boonsomprasong, Ms. Supalak Phairojwithayaporn , Mr. Chanakhan Kitwanawan

Advisor
Asst. Prof. Nattavut Chayavanich, Assoc. Prof. Anawach Sangswang

Electrical Engineering

Abstract

This project focuses on the design of a power optimizer device that integrates Rapid Shutdown (RSD) and Maximum Power Point Tracking (MPPT) functionalities for solar cell systems. The objective is to develop a system that maximizes power output from individual solar panels, especially under partial shading conditions, while ensuring compatibility with inverters and enabling emergency shutdown. The design incorporates a buck-boost converter circuit to efficiently regulate voltage in both directions, along with a microcontroller (MCU) for system control. Communication for the RSD function is implemented using Power Line Communication (PLC). Additionally, the system complies with the EIT-Thailand Engineering Standard to enhance safety and facilitate intervention by emergency responders, such as firefighters, during critical situations.

Data Science & ML Implementation for Energy Optimization in Commercial Buildings

Mr. Sorrawut Klomampa

Advisor
Asst.Prof. Charnchai Techawatcharapaikul

Electrical Engineering

Abstract

This research aims to develop and apply data science and machine learning techniques to optimize energy usage in commercial buildings. The focus is on creating a dashboard to display Peak Demand, Predictive Mean Vote (PMV), a resident feedback system, and a real-time alert system using the Line API. The research was conducted as part of an 11-week cooperative internship at AltoTech Global Co., Ltd., utilizing Alto CERO technology—an AI-based building automation system.

The research methodology includes exploratory data analysis from the Daikin CCC building's VRV and Outdoor Air Unit (OAU) air conditioning systems, dashboard development using Plotly and Streamlit, machine learning model construction with time-series analysis techniques, and development of a real-time Line API alert system to receive and analyze resident feedback.

The results show that applying data science and machine learning techniques can reduce electricity consumption by at least 5% compared to the previous system, with a power consumption forecast error of less than 15%. Moreover, the system can analyze and categorize more than 90% of resident feedback, enhancing resident satisfaction and improving the building's energy management efficiency.

Development of MPPT Solar Charger with Voltage-Current Control

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Advisor
Asst.Prof.Dr. PIYASAWAT NAVARATA NA AYUDHYA

Electrical Engineering

Abstract

This project, titled “Development of a Solar Charger Using MPPT with Voltage-Current Control”, presents the design and implementation of a high-efficiency solar energy conversion system for off-grid applications such as solar street lighting. The system integrates a Maximum Power Point Tracking (MPPT) technique to maximize power extraction from photovoltaic (PV) panels under varying irradiance and temperature conditions. The energy conversion stage is based on a single Buck Converter, controlled in real-time by an Arduino UNO R3 microcontroller. The microcontroller continuously monitors voltage and current from both the PV panel and the battery to dynamically adjust the converter’s duty cycle and ensure operation at the maximum power point. The charging process is used by a Constant Current–Constant Voltage (CC-CV) strategy, which enhances charging efficiency while safe the battery from overcurrent and overvoltage conditions. A Lithium Iron Phosphate ($LiFePO_4$) battery is selected due to its high thermal stability, safety, and extended cycle life. The system effectively regulates the charging voltage and current within specified limits, reducing energy losses and extending the battery lifespan. Overall, The MPPT-based solar charging system proposed in this project demonstrates an effective and practical approach to renewable energy management. It is well-suited for deployment in remote or rural areas without access to the electrical grid and serves as a promising prototype for sustainable, autonomous lighting systems powered by renewable energy.

Low voltage surge arrester

Ms.Dolchanok Sittinontakorn, Mr.Pakin Chanmanit, Mr.Jedsada Yomchan

Advisor
Asst. Prof. Dr. Supakit Chotigo, Asst. Prof. Dr. Ekkachai Mujjalinvimut

Electrical Engineering

Abstract

Currently, low-voltage surge arresters exhibit a high failure rate due to both external factors within the distribution system and internal deficiencies inherent to the devices themselves. This study aims to identify and analyze the root causes of surge arrester failure, emphasizing overvoltage conditions that exceed standard operating thresholds. Significant contributors to this transient overvoltage include open or disconnected neutral conductors in the low-voltage networks, lightning-induced overvoltage in overhead distribution systems, and fault transference from high-voltage networks into the low-voltage side. These phenomena significantly compromise the integrity and reliability of surge protective devices. Furthermore, improper installation practices and unsuitable placement of the devices can further contribute to their malfunction. The ATP-EMTP (Alternative Transients Program / Electromagnetic Transients Program) simulation software investigates these transient events in the power system. This tool facilitates detailed modeling and analysis of electromagnetic transients, offering valuable insights into system behavior under abnormal and fault conditions.

Simulation and making model of Monopole's Step & Touch Voltage

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Advisor
Asst.Prof.Dr. SUPAKIT CHOTIGO

Electrical Engineering

Abstract

Thailand is now replacing concrete poles with steel Monopole structures due to their flexibility, ease of installation, smaller footprint, and reduced risk of mass pole collapse during accidents. However, steel conducts electricity, raising concerns about electrical leakage and the resulting Step & Touch Voltage hazards. This project uses CDEGS software to simulate and assess safety risks by modeling the poles and installation depths based on Metropolitan Electricity Authority (MEA) standards. Soil resistivity was measured at King Mongkut's University of Technology Thonburi (KMUTT) and the Bangplee Electrical Training Center. The study simulated current leakages of 6.22 kA, 25 kA, and 40 kA, with pole depths of 6 m, 9 m, and 12 m, both with and without grounding wires. Human models weighing 50 kg and 70 kg were tested under IEEE Std 80 standards, considering various surface types (dry ground, concrete, wet concrete, and no surface) and footwear conditions (barefoot, dry shoes, wet shoes). Results showed the most hazardous case occurred at KMUTT soil, with a 40 kA leakage, 6 m depth, no grounding, 50 kg person, no footwear, and bare soil—due to high soil resistivity and current level. Surface coverings, especially dry concrete, significantly reduce voltage risks. Heavier weight and wearing shoes (especially dry ones) also increased resistance and improved safety. Increased pole depth and grounding wire installation effectively reduced Step & Touch Voltage as well.

Charging Management System for ev charging station

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Advisor
Asst.Prof.Dr. Supapong Nutwong

Electrical Engineering

Abstract

The rapid growth of electric vehicle (EV) adoption has driven the continuous expansion of the EV charging station business. However, the diversity of EV chargers from multiple brands, each with their own management platforms, has created challenges for operators in efficiently monitoring and controlling their stations. This project aims to develop a Charge Station Management System (CSMS) that can connect to and manage chargers from multiple brands through a single platform, utilizing the OCPP 1.6J protocol over WebSocket communication. The system eliminates the need for additional hardware installation, without requiring the installation of sensors or modifications to the chargers themselves, thereby reducing equipment investment costs and simplifying system deployment. The CSMS enables real-time monitoring of charger status and displays essential operational data, including energy consumption, power output, current, voltage, charging duration, charging fees for each charging session, and historical usage records, through an intuitive administrative dashboard (Admin Monitor). It also features an alert system for abnormal status detection, enhancing the overall efficiency of EV charging station management.

Lithium-ion battery charger with Active Power Factor Correction

Chotiwat Chokdeewatana, Krit Pornbordeemongkol

Advisor
Asst.Prof. Dr.Supapong Nutwong

Electrical Engineering

Abstract

This project presents the design and implementation of a lithium-ion battery charger incorporating Active Power Factor Correction (PFC) to address the lack of PFC in conventional market chargers. With the increasing adoption of lithium-ion batteries and the growing emphasis on energy efficiency, integrating PFC into battery chargers has become essential. The developed charger is tailored for a 48V, 3Ah lithium-ion battery, charging at a 0.5C rate (1.5A), with an input of 220Vac and an output of 54Vdc.

The charger employs a two-stage architecture: an initial PFC stage using a boost converter topology to ensure a near-unity power factor, followed by a DC-DC conversion stage that regulates the charging voltage and current. This configuration not only improves the power factor but also ensure optimal battery longevity and safety. Experimental results demonstrate that the charger achieves a power factor close to unity and maintains high efficiency throughout the charging process. The implementation of Active PFC in this charger design contributes to enhanced energy efficiency, and reduced grid pollution, making it a viable solution for modern battery charging applications.

Study of Parameters Affecting the Efficiency of GaN and Performance Comparison with Si in a QR Flyback Converter

Ms. Sutita Butkhun

Advisor
Asst. Prof. Dr. Supapong Nutwong

Electrical Engineering

Abstract

This project evaluates GaN transistors in a QR Flyback Converter, focusing on the impact of gate drive slew rate on switching behavior and power loss. A comparison with Si devices in terms of efficiency, thermal performance, and EMI is conducted to propose optimal design guidelines.

Study of Automatic Substation using Hardware-in-the-loop Testing

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Advisor
Asst.Prof.Dr. Sumate Naetiladdanon

Electrical Engineering

Abstract

This project aims to study the operation of control and protection systems within an industrial substation using Hardware-in-the-loop (HIL) testing through a Real Time Digital Simulator (RTDS). An automated substation model was developed to simulate abnormal events that may occur in the system, such as overcurrent, overvoltage, and transformer faults. These simulations were designed to test the response of protective relays configured with specific protection functions, which automatically trigger circuit breakers, which are key components in protecting power systems. In the testing setup, the RTDS was connected to ABB protection relays, specifically model RET615 for transformer protection and REM615 for motor protection. An OMICRON CMS 356 was used as a signal amplifier to transmit voltage and current signals from the simulation model to the relays. When an abnormality was detected, the relays sent a response signal back to the RTDS, which then issued a command to trip the circuit breaker in the model. This process of real-time signal exchange between simulation and actual devices is referred to as Hardware-in-the-loop. The test results demonstrated that the relays responded to abnormal events accurately, reliably, and quickly. Furthermore, the MicroSCADA system was integrated for real-time monitoring, parameter display, and event notifications, which enhanced the efficiency of system status tracking and data analysis. In conclusion, the developed system proved to be practically applicable for the control and protection of industrial power systems. It also offers a viable approach for future electrical system design and planning in a sustainable manner.

A Development of Fractional Order Resonant Circuit for Wireless Power Transfer System (Second phase)

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Advisor
Asst.Prof.Dr. Ekkachai Mujjalinvimut, Dr. Nattapong Hatchavanich

Electrical Engineering

Abstract

In wireless power transfer (WPT) systems, variations in circuit impedance or changes in the distance between the transmitting and receiving coils can lead to a bifurcation phenomenon. This condition often results in reduced power transfer efficiency, increased circuit complexity, and difficulties in control. To address this issue, adjusting the total impedance of the circuit can help prevent bifurcation, thereby enhancing the efficiency of wireless power transmission. This project, therefore, aims to develop a fractional-order resonant circuit for wireless power transfer systems to improve the performance of the power transfer model. The enhancement is achieved by tuning the fractional-order capacitor, which enables appropriate impedance matching through current and voltage regulation within the circuit.

Multi pulse rectifier using phase shifting transformer for harmonics reduction in medium voltage drive

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Advisor
Asst.Prof.Dr.Mongkol Konghirun, Prof. Dr. Ekkachai Mujjalinvimut

Electrical Engineering

Abstract

This project aims to mitigate harmonic distortion in power systems, which is a critical issue in maintaining power quality and system stability. Harmonics, particularly low-order harmonics such as the 5th and 7th, are commonly produced by nonlinear loads, including rectifiers and variable frequency drives (VFDs). One of the most effective and widely adopted mitigation techniques is to increase the number of pulses in the rectification process using multi-phase rectifiers in conjunction with phase-shifting transformers.

By strategically shifting the phase angles of multiple transformer outputs, specific harmonic orders can be naturally canceled due to phase cancellation effects. For example, a 12-pulse rectifier system can reduce total harmonic distortion (THD) to below 12%, while 18- or 24-pulse systems can bring THD down to less than 5%, which meets the IEEE 519 harmonic standard for power quality.

Furthermore, phase-shifting transformers contribute to improved power factor and reduce voltage distortion, enhancing overall system efficiency and reliability. Despite the added cost and design complexity, this approach offers a robust and durable solution for high-performance electrical systems where power quality is a priority.

A study on the operation of DC pumps powered by grids and solar cells.

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Advisor
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Electrical Engineering

Abstract

Thailand currently has a Power Development Plan (PDP) aimed at promoting renewable energy and reducing dependence on imported fuels by increasing the country's energy self-sufficiency. Since Thailand is located near the equator, it receives sunlight year-round [1], making solar energy an increasingly attractive option. As a result, the use of solar panels for electricity generation is expected to grow.

In this research, a control structure for a direct current (DC) submersible water pump energized from the power grid and solar system, is considered. The pump used in our experiment is a 12 volt, 300 watt DC submersible pump with a 1 inch outlet which has the ability to pump 100–130 liters of water per minute. This pump was chosen because it is inexpensive, easy to obtain, and widely used by farmers. It typically draws water from ponds, canals, or storage tanks and is used with sprinkler, spray, or drip irrigation systems to effectively water crops across an area.

The study also explores the concept of Maximum Power Point Tracking (MPPT) for solar panels and how it can be applied to maximize the efficiency of the DC submersible water pump

A Study on Solar Panel Power Generation under Various Conditions

Mr. Kongkidakorn Chananithithum, Mr. Naovaf Langwiset, Mr. Wuttichai Suriya

Advisor
Mr. Thawatchai Chayawanich

Electrical Engineering

Abstract

This research project investigates the electricity generation potential of solar cells under various conditions, with economic viability assessments focused exclusively on specific aspects. The study examines performance differences between Monocrystalline and Polycrystalline solar cells, analyzing both technical efficiency and cost-effectiveness to determine optimal investment scenarios for these specific technologies.

A critical component involves analyzing the relationship between solar cell capacity and inverter size ratios (inverter loading ratios), evaluating how these configurations affect electricity generation while conducting targeted cost-benefit analyses. For these particular aspects, the research considers initial investment costs against long-term energy production returns to identify economically viable system designs.

For other research areas—including bifacial solar panel performance, reflector systems, and sun-tracking technologies, the study focuses on examining energy production potential. These investigations aim to evaluate and measure the electricity generation capacity of these specific technologies under Thailand's climate conditions to establish comprehensive performance data for future reference and implementation.

The project implements a comprehensive IoT-based measurement system to monitor electricity production in real-time, utilizing precision sensors to collect voltage, current, and power measurements across all experimental configurations. Data is transmitted via IoT networks to servers and web interfaces for systematic analysis.

Expected outcomes include clear demonstrations of performance variations across different solar configurations when tested in Thailand, with economic returns analysis specifically limited to solar cell type selection and inverter sizing strategies. This targeted approach aims to provide stakeholders with practical guidance for optimizing these particular system components.

A Study of AC Type 2 Charging Station

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Advisor
Lect. Tirasak Sapaklom, Dr. Jakkrit Kanthong

Electrical Engineering

Abstract

This research aims to study the communication protocol known as OCPP (Open Charge Point Protocol) for electric vehicle charging stations, examine the operation of charging stations that utilize communication based on the ISO 15118 standard, and develop an AC Type 2 electric vehicle charging station capable of communicating with a central management system via OCPP in accordance with relevant standards.

The study involves reviewing the OCPP communication standard for the connection between the charging station and the central management system, as well as the ISO 15118 standard for communication between the charging station and electric vehicles. Subsequently, communication and power control circuits were designed and tested on a breadboard before transferring the design to a printed circuit board (PCB). The charging station was assembled in compliance with IEC 61851 and IEC 62196 standards, and a central management system was developed. The completed system was then tested with actual electric vehicles.

The results indicate that the researcher gained a thorough understanding of the OCPP communication protocol and the operation of charging stations according to the ISO 15118 standard. Furthermore, an AC Type 2 electric vehicle charging station was successfully built, capable of proper communication with both electric vehicles and the central management system according to the specified standards.

The developed AC Type 2 charging station features low-cost equipment and a compact size, making it suitable for residential installation. Although it requires a longer charging time, its cost-effectiveness and ease of use meet the needs of general users. Additionally, communication via OCPP enhances flexibility in managing charging stations, allowing a single central management system to efficiently control stations with varying characteristics and functionalities.

Study of Bidirectional 3 Phase PFC

Pitsinee Soisuwan, Siripon Mangmee, Itsariyaphon Khlueankrathok

Advisor
Lect. Tirasak Sapaklom, Asst. Prof. Dr. Ekkachai Mujjalinvimut

Electrical Engineering

Abstract

Abstract
This project presents a study on the operation of a three-phase bidirectional power factor correction (PFC) circuit, focusing on analyzing and designing a system that enhances electrical energy efficiency and reduces power loss. The system is simulated using PSIM and Code Composer Studio (CCS) to compare experimental results and improve analysis accuracy.

The project integrates knowledge of PFC circuits, Buck-Boost Converters, Grid-Tie Inverters, Three-Phase Rectifiers, Bidirectional Converters, and control circuits to ensure proper operation under various modes. Additionally, the Second Order Generalized Integrator technique is employed to further enhance energy utilization efficiency.

The project team hopes this study will be beneficial to those interested in understanding the operation of three-phase bidirectional power factor correction circuits. We apologize for any errors or shortcomings that may be present.

Vertical sprayer for nutrient and chemical application in perennial trees

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Advisor
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Electrical Engineering

Abstract

Thailand, a major agricultural country, cultivates numerous perennial fruit trees such as durians and mangoes. Maintaining these trees, particularly spraying nutrients and pesticides under the leaves high above the ground, presents challenges and risks, including accidents and long-term exposure to chemical mist.

To address these issues, our team developed a " Vertical sprayer for nutrient and chemical application in perennial trees". This low-cost alternative to agricultural equipment enhances safety, and reduces direct chemical exposure. The device is designed to move vertically along a supporting pole using a DC motor with a worm gear reducer, which prevents shaft rotation when power is off, ensuring stable height maintenance. The system features a rotatable spray nozzle controlled by a DC motor, allowing targeted spraying around the pole. Users operate the device remotely via a remote control, with real-time video feedback from a camera mounted at the nozzle tip displayed on a smartphone. This setup enables precise spray positioning. The spray system is controlled by managing the water pump through a relay switch operated remotely. Testing results showed that the prototype successfully achieved all design goals: vertical movement, height stability, nozzle rotation, real-time monitoring, and remote pump control.

Design and Construction of 1.2/50 μs, 20 kVp, 20 J Impulse Voltage Generator

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Advisor
Boonnua Pungsiri, Asst. Prof. Piyasawat Navarat Na Ayutthaya

Electrical Engineering

Abstract

Transient Overvoltage Surge is a voltage that can occur due to external causes in a power distribution system experiencing fault conditions or because of lightning phenomena, which can potentially cause damage to electrical equipment. The project team has therefore designed and constructed an Impulse Voltage Generator (IVG, T1/T2) with specifications of 1.2/50 μs, 20 kVp, and 20 J to study and test the insulation durability of electrical equipment against impulse voltage or electric field stress, by the IEC 60060-1 standard.

This project has designed and constructed the impulse voltage generator with the parameters of 1.2/50 μs, 20 kVp and 20 J, consisting of 10 stages. The parameters are defined as follows: C's = 1 μF, C'b = 5 nF, R's = 41.156 Ω, and R'p = 68.152 Ω. In the winding of R's and R'p, they are wound in a cross pattern on a PVC pipe to minimize parasitic inductance. A simulation of the impulse voltage generator circuit and the voltage divider circuit of type C has been carried out, with Rdamp (a = 194 times) designed as specified in the standard.

The impulse voltage generator has been designed to be compact with dimensions of 50 × 50 × 60 cm. and constructed to meet the specified design ratings. According to the IEC 60060-1 standard, T1is required to be 1.2 ± 30% (0.84 – 1.56 μs), T2 is 50 ± 20% (40 – 60 μs), with a peak voltage (Up) of 20 kV, and the maximum voltage (Um) can vary within a tolerance of ± 3% (19.4 – 20.6 kV)

Design and Construction of an Impulse Current Generator 8/20 μs 2 kA, 10 kJ and 10/350 μs 1kA, 10kJ

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Advisor
Lecturer Boonnua Pungsiri, Dr. Chakrit Kanthong

Electrical Engineering

Abstract

Currently, impulse current generators (ICGs) play a crucial role in testing the current withstand capability of equipment in medium voltage (MV) systems, including lightning arresters (LAs). These generators are used to assess durability against overcurrent caused by lightning, which is essential for protecting electrical systems from damage and improving reliability. However, the ICG 10/350 μs 1 kA, 10 kJ is expensive and must be imported, leading to the effort to develop such equipment domestically. For an ICG 8/20 μs, the design utilizes components: Cs = 2 μF, R = 4.8 Ω, and L = 35.65 μH at 100 kV, following a conventional structure. Meanwhile, the ICG 10/350 μs adopts Cs = 2 μF, R = 0.203 Ω, and L = 113.36 μH at 120 kV. The setup was simulated using OrCAD Capture and features conductors wound around a cylindrical PVC insulator, a C-type voltage divider circuit (a = 128 times). The structure was modified to ignite using an ICG triggering circuit, with TS1 = 0 μs and TS2 = 10 μs. According to the IEC60060-1 standard, the ICG 8/20 μs must meet T1/T2 = 8/20 ± 10% (7.2 – 8.8)/(18 – 22) μs and -îp < 20% îp. The test results indicate T1/T2 = 8.7/19.60 μs, îp = 3 kA, and -îp = 0.1 kA. For the ICG 10/350 μs, the standard specifies T1/T2 = 10/350 ± 20% (8 – 12)/ (280 – 420) μs and -îp < 20% îp. The measured results were T1/T2 = 10/ (402.0 – 417.0) μs and -îp = 0 A.
Thus, both the ICG 8/20 μs and ICG 10/350 μs conform to standard criteria. However, issues were identified in the triggering circuit, necessitating further refinement and development

Tesla coil 200kV 200kHz.

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Advisor
Mr.Boonnuea Phuengsiri

Electrical Engineering

Abstract

This project aims to develop a Tesla transformer by applying power electronics to replace the traditional mechanical switch transformers, reducing size, eliminating noise, and making it portable. Currently, it is widely used in industrial applications, such as testing high-voltage electrical equipment, electrical insulators, and metal hardening processes.

The design and construction of a 200 kV, 200 kHz Tesla coil transformer utilizes the principle of series LC resonance with an air-core transformer to step up the voltage. The input voltage is Vin = 220 V, fin = 200 kHz, and the output voltage is Vout = 200 kHz, fout = 200 kHz. The transformer ratings are as follows: primary side Lp1 = 31.1712 μH, Cp1 = 100 nF, fp1 = 100 kHz, Lp2 = 33.3695 μH, Cp2 = 100 nF, fp2 = 100 kHz, secondary side Ls = 57.1169 μH, Cs = 38.81 pF, fs = 200 kHz. The inverter rating is 600 V, 50 A, f = 0 – 200 kHz, %Duty Cycle = 0 – 100%, using IGBT MBB50BS6 as the switching device, and a spherical gap with a diameter Ø = 12.5 cm is used as the measuring device, with a gap distance ds = 3.4 cm and Ub = 89.09 kV at f = 200 kHz.

Test results on insulators show that for the busbar insulator with a voltage of Ub = 200 kV, arcing occurs, whereas for the perforated busbar insulator, no arcing occurs (Ub > 200 kV). The conclusion is that the Tesla transformer with a rating of 200 kV, 200 kHz ±20% can be used for testing up to its rated specification.

Battery Management System (Cells Balancing)

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Advisor
Asst.Prof.Dr. Piyasawat Navarata Na Ayudhya

Electrical Engineering

Abstract

The development of a Battery Management System (BMS) for Lithium Iron Phosphate (LiFePO4) batteries is a widely adopted battery technology known for its high safety and long lifespan. The main objective of this BMS development is to enhance the charging efficiency and extend the battery's lifespan through precise charging control to prevent damage from improper charging. The system uses Passive Balancing technology to maintain the voltage balance of four battery cells to ensure optimal performance. The development incorporates a microprocessor-based circuit capable of monitoring key parameters such as voltage, current, and transistor temperature. These parameters are then used to analyze the State of Charge (SOC), and the resulting data is displayed on a real-time LCD screen, allowing users to track the battery's status at any time. Additionally, the system includes overvoltage protection to improve operational safety. This development has the potential to be applied in various fields, such as renewable energy systems, energy storage systems, and electric vehicles, which will enhance the efficiency and sustainability of energy usage in the future.

Power system dynamic response model development

Jeerana Manapiyawong

Advisor
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Electrical Engineering

Abstract

The power system is a critical component in supplying electricity to industrial sectors, requiring high stability and reliability to support continuous energy demand in industrial applications. A comprehensive model of the excitation system and governor system for synchronous generators is essential for simulating the dynamic behavior of the generator, which is vital for the design of protection systems and operational planning within power plants. This project aims to develop and create models of the excitation system and governor system of a synchronous generator, based on IEEE 421.5 standards, for use in SKM Power Tools software. The project also evaluates the dynamic response and stability to match the actual behavior of the generator. Models are created in SKM Power Tools for simulation, and the results are compared with test data covering four main scenarios: (1) de-excitation, (2) voltage step test, (3) synchronization, and (4) load rejection. The comparison of results shows that the developed model can accurately simulate voltage, current, active power, and frequency, closely matching the actual response. Therefore, the model is suitable for analyzing critical events, such as designing generator and load shedding systems, and fault occurrences, and serves as a foundation for future design and operational planning. The power system is a critical component in supplying electricity to industrial sectors, requiring high stability and reliability to support continuous energy demand in industrial applications. A comprehensive model of the excitation system and governor system for synchronous generators is essential for simulating the dynamic behavior of the generator, which is vital for the design of protection systems and operational planning within power plants. This project aims to develop and create models of the excitation system and governor system of a synchronous generator, based on IEEE 421.5 standards, for use in SKM Power Tools software. The project also evaluates the dynamic response and stability to match the actual behavior of the generator. Models are created in SKM Power Tools for simulation, and the results are compared with test data covering four main scenarios: (1) de-excitation, (2) voltage step test, (3) synchronization, and (4) load rejection. The comparison of results shows that the developed model can accurately simulate voltage, current, active power, and frequency, closely matching the actual response. Therefore, the model is suitable for analyzing critical events, such as designing generator and load shedding systems, and fault occurrences, and serves as a foundation for future design and operational planning.

Assessment of Potential and Cost-Effectiveness of Solar Power Generation Systems

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Electrical Engineering

Abstract

Thailand's Power Development Plan (PDP) promotes the use of renewable energy to reduce fossil fuel dependence and improve energy security. As a result, solar photovoltaic (PV) systems are gaining interest, especially in residential and industrial sectors. However, there is still limited research on their performance and cost-effectiveness in the Thai context. This study evaluates the efficiency and economic viability of solar PV systems installed in a household and a factory, and verifies compliance with relevant technical standards.

Two systems were analyzed: a 6.78 kWp rooftop system installed at a house in Bangkok, and a 16.5 kWp system at a factory in Prachuap Khiri Khan Province. Both installations were inspected based on standards including EIT 3210-66, IEC 60364-7-712, IEC 61643-31/11, and TIS 1802/101. Key components such as AC/DC circuit breakers, wiring, surge protection devices (SPD), grounding, and PV cables were reviewed. Power generation data were collected through inverter monitoring systems over 12 months for performance and economic analysis.

The results show that both systems reached payback periods in six years. The residential system had a Levelized Cost of Electricity (LCOE) of 1.11 THB/kWh and a Return on Investment (ROI) of 18.27%, while the industrial system showed an LCOE of 0.99 THB/kWh and ROI of 16.84%. These outcomes demonstrate that both systems are financially sound and technically efficient.

This study provides a useful model for standard-compliant solar PV installation in Thailand. It also supports investment in clean energy for both households and industries, in line with the PDP's goals and the broader push for sustainable development.

THE STUDY OF SURFACE WATERLOGGING DETECTION ON ROADS USING UAV

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Advisor
Dr.Thongchai Phothong

Civil Engineering

Abstract

This research investigates factors in using UAV aerial photography to create road surface elevation models for identifying waterlogged areas, which helps assess vehicle deceleration and traffic congestion. The process has two parts: 1. Identifying the best correction parameters and 2. Determining the best aerial factors. First, it starts with finding the best correction parameters. The best method is Agisoft Metashape's automatic correction method, which gives significantly lower RMSE values than the standard plate correction method in all axes. In the second phase of the flight study, aerial photography was conducted using a DJI Phantom 4 RTK drone at various flight ceilings of (30, 45, 60, 75 and 90 meters), at various camera tilt angles of (-45°, -60°, -75° and -90°), with two flight patterns (one-way and round-trip) and a frontal image overlay set to 75%. Use Ground Control Points (GCPs) and automatic correction in the processing software to adjust photo coordinates. The obtained photographic data was processed to create a surface model using the Agisoft Metashape program and analyzed for coordinate error values (RMSEz) from Check Points (CHPs). The results of the study found that the factors that significantly affect the accuracy of altitude values are the flight ceiling and camera tilt angle, with lower flight ceiling and higher camera tilt angles resulting in lower error values, and the round-trip flight pattern yielded better results than the one-way flight pattern. The flight pattern with the most consistency and lowest average error was 30 meters ceiling, -60° tilt, and round-trip, with an RMSEz value of 0.616 centimeters which sits in the 1 cm of vertical accuracy class in ASPRS2024 standard. In addition, this research can also identify the size and location of the waterlogging areas, which will help in planning and maintaining them effectively in the future.

Seismic Performance of Self-centering Column-Foundation connections with Energy-Dissipating Bolts

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Advisor
Asst.Prof.Dr. Ekkachai Yooprasertchai

Civil Engineering

Abstract

This study proposes a new precast column-foundation connection, the Hybrid Column Shoe Connection (HYSC), as a superior seismic alternative to the conventional Monolithic Shoe Connection (MOSC). The MOSC can be damaged in the column due to its design principle of a strong joint and weak column, which promotes plastic hinging to dissipate seismic energy. The proposed connection integrates column shoes for efficient assembly, post-tensioned tendons for self-centering, and energy-dissipating (ED) bolts for controlled energy dissipation, following capacity design principles. Two experimental tests under quasi-static cyclic loading were conducted to evaluate seismic performance, using a 5% axial load ratio and a moment-to-shear ratio at a height of 1(m. Experimental results from crack patterns and failure modes confirm that the proposed connection exhibits less visible damage in the column. In HYSC, cracks are concentrated at the interface, forming a distinct gap, whereas in MOSC, cracking occurs in the column near the joint. The hysteretic graph of HYSC shows a flag shape, indicating good energy dissipation and self-centering behavior. In contrast, hysteretic graph of MOSC shows greater residual deformation, which can be observed by the "pinching" effect, meaning less self-centering behavior. At story drift of 3.50%, secant stiffness exceeds the acceptance requirement by 65%, whereas MOSC exceeds it by only 19%. All indices, including peak forces, secant stiffness, and relative energy dissipation ratio, are satisfactory based on ACI 374.1-05, validating the proposed hybrid connection as a reliable, low-damage design solution.

Keywords: Column-Foundation Connections/ Energy-Dissipating Bolts/ Low-Damage/ Post-Tensioned Tendons/ Seismic Performance/ Self-Centering

Optimizing Sediment Transport in Gutters: Designing for Minimal Settling

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Civil Engineering

Abstract

Efficient sediment transport in urban gutters is crucial to keep the general functionality and capacity of the gutter system intact while minimizing clogging and operational costs. The aim of this work was to optimize sediment transport through novel geometrical designs of gutters that minimize deposition, thus improving the efficiency of the system and preventing flooding risk in urban areas. The investigation of flow dynamics and sediment behavior in gutters through CFD simulations under conditions such as different gutter geometry, flow condition, and sediment transportation furnishes the groundwork for a basic understanding of interactions between hydraulic parameters and sediment transport mechanisms to further understand how various design factors influence the movement of sediment. The CFD models are performed with rigorous calibration and validation using experimental data to make sure of the accuracy and applicability in real situations. The results highlight key design factors such as gutter geometry and flow conditions that significantly affect the optimization of sediment transport. A well-designed gutter system reduces sediment subsidence, clogging, and hence flooding. Moreover, this research shows the added value that CFD modeling can provide when coupled to experimental data for improving the design methodologies of drainage systems in the quest towards more sustainable and resilient urban infrastructures. The results will be very useful for hydraulic engineers and urban planners in emphasizing the importance of creative gutter design in the optimal improvement of urban drainage systems under various environmental and operational conditions, ensuring effective water management with reduced maintenance demands.

Keywords: Computational Fluid Dynamics (CFD)/ Gutter design/ Sediment transport/ Urban drainage

Effect of reservoir operation in flood mitigation in Chao Phraya River Basin

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Advisor
Dr. Wongnarin Khampho

Civil Engineering

Abstract

Thailand is highly susceptible to flood hazards, particularly in the Chao Phraya River basin, where recurrent and increasingly severe floods occur—most notably the catastrophic event of 2011. Climate change–driven increases in precipitation constitute a primary driver of these floods. Previous studies on dam operation have demonstrated that reservoirs play a critical role in regulating river flows and mitigating flood risk.

Accordingly, this study seeks to refine and modify dam management strategies to reduce flood impacts by applying the H08 hydrological model together with the T12 meteorological dataset for the period 1981–2011. Whereas earlier research focused on the Bhumibol and Sirikit dams, our model is enhanced through the addition of the medium sized Pasak Cholasit dam to attenuate downstream flows and lessen flood severity entering Bangkok. Drawing on lessons from the major floods of 1995 and 2011, we implement a monthly release regime—decreasing outflows during the dry season and increasing them in the wet season. Results show that these adjustments reduce runoff volumes by 1.34% at station C.2 and by 1.04% at station S.9, while model accuracy improves to R^2 = 77% at C.2 and R^2 = 67% at S.4B. The revised H08 model thus demonstrates strong potential to support future decision-making in dam operation, and the incorporation of a medium-scale dam further contributes to flood risk reduction.

Hydrological modeling; H08 hydrological model/ T12 meteorological dataset/ Dam operation management

Application of Deep Belief Network for Predicting Groundwater Levels

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Advisor
Dr. Chanchai Petpongpan

Civil Engineering

Abstract

Abstract
The issue of water resource management in Thailand has become increasingly severe due to global warming and changing climatic conditions, making the prediction of groundwater levels particularly challenging. This poses a significant obstacle to efficient water management. Currently, most groundwater simulation models rely on high-accuracy mathematical models, which require expert knowledge for development and analysis. This study proposes the application of artificial intelligence, specifically the Long Short-Term Memory (LSTM) model, which is capable of learning and forecasting time series data. The study focuses on the Yom River Basin and utilizes outputs from the SWAT-MODFLOW model along with monthly observed groundwater level data from 2007 to 2016. These data were used to train and test the LSTM model in conjunction with rainfall, temperature, and physical terrain characteristics. The model's predictive performance was evaluated using two statistical metrics: R-squared (R^2) and Root Mean Square Error (RMSE). The results demonstrate that the LSTM model accurately predicted monthly groundwater levels, with R^2 values exceeding 0.95, indicating strong capability in capturing groundwater variation patterns consistent with real-world conditions. Moreover, the RMSE values remained below 1.00 m, reflecting the model's accuracy, particularly for short-term forecasts (1–2 months). However, prediction errors tended to increase with longer forecast horizons (5–6 months). These findings highlight the potential of artificial intelligence technology in supporting water resource planning and management.
Keywords: Long Short-Term Memory, Neural Networks, Deep Learning, Forecasting, Modeling

APPLICATION OF MICP FOR IMPROVEMENT OF THE ANCIENT MASONRY STRUCTURE: A SMALL-SCALED MODEL TEST

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Advisor
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Civil Engineering

Abstract

This research performs the MICP treatment on a scaled-down models of ancient structures partially embedded in soil by spraying the solutions on the brick above the ground and letting the solution flow into the ground in which the other brick is embedded. The soil sample was natural soil collected from a site near ancient monuments in Lopburi, whereas the bricks were obtained from the deterioration part of ancient structures in Phra Nakhon Si Ayutthaya Province. In the experiment, Lysinibacillus macroide X1 microorganisms were used in combination with local microorganisms for a precipitation period of 10 days. The amount of calcium carbonate formed during and after the treatment was analyzed using energy-dispersive X-ray spectrometry combined with scanning electron microscopy. The depth of pores on the surface of the ancient bricks was assessed using a 3D surface scanner. The results reveal the occurrence of calcium carbonate in the pore and surface of bricks both that is above and embedded in the ground. The calcite content up to 58.775 percent is possible. Moreover, the calcite content up to 68.430 percent can be found in the soil. This indicates the potential of this treatment method for real application. From both engineering and physical property tests indicated that most properties of the local soil samples showed improvement levels comparable to those of the sterilized samples. This suggests that natural microorganisms tend not to affect the efficiency of the MICP process contradicting the findings of Sirisingumpai, (2021), which reported that natural microorganisms inhibit the efficiency of the MICP process.

Development of a Flood Model for Riverbank Erosion in Phetchaburi River Using HEC-RAS Model

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Advisor
Assist. Prof. Dr. Chaiwat Ekkawatpanit

Civil Engineering

Abstract

This research aims to investigate erosion behavior and develop an erosion modeling framework for the Phetchaburi River, in response to flooding issues. The HEC-RAS model was employed to analyze and assess riverbank erosion and to propose suitable mitigation measures. The study area extends from downstream of the Kaeng Krachan Dam to the Phetchaburi River estuary. The research involved an integrated analysis of topographic, hydrologic, and hydraulic data to develop a comprehensive model of water flow and erosion processes.

The study identified key factors influencing riverbank erosion and proposed context-appropriate solutions to mitigate the impact. Riverbank boundary changes were analyzed using satellite imagery and incorporated into flood modeling simulations using HEC-RAS. Model performance was evaluated using R-Square and RMSE values, calibrated with discharge data (Q) from water stations B.9 and B.10.

The results demonstrate that the HEC-RAS model achieved high accuracy in predicting water flow within the Phetchaburi River, with R-Square values of 96% and 91%, and RMSE values of 11.48 m^3/s and 9.22 m^3/s, respectively. The findings contribute to the effective planning and management of riverbank erosion, provide a reliable tool for erosion risk assessment, and support sustainable water resource management in the long term.

Natural Gas Methane Leak Detection Using an Infrared Camera

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Control system and Instrumentation Engineering

Abstract

Infrared imaging is vital for real-time methane leak detection in industrial environments, yet the computational complexity of 3D Convolutional Neural Networks (3D-CNNs) like VideoGasNet limits their deployment on resource-constrained systems. This paper proposes an optimised preprocessing pipeline for VideoGasNet, replacing the computationally intensive moving median background subtraction with a running average approach and incorporating image downscaling. Experiments on the GasVid dataset demonstrate that our method reduces preprocessing time significantly—by up to 66% at reduced resolutions—while maintaining high classification accuracy (above 98% even at quarter resolution). These enhancements enable real-time gas leak classification, offering a practical balance between accuracy and computational cost for industrial applications.

Room Energy Monitoring and Control

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Advisor
Wutthichai Polwisate

Control system and Instrumentation Engineering

Abstract

In common rooms nowadays, users may forget to turn off electrical devices when leaving the room and not return, leading to unintended energy waste. As a result, many devices are left running after use without being turned off, leading to wasted electricity. Typical examples include lights or air conditioners being left on overnight or during holidays when the rooms are not in use.
This project proposes a wireless system for monitoring and controlling electricity usage to help reduce energy waste. The system consists of three main components: an electrical measurement unit that measure voltage, current and power factor to calculate the power consumption of electrical devices, a display and control unit for shows real-time data on screens located inside each room and at a central control point, and a motion detecting system using MMWave Radar to automatically turn off devices when no movement is detected. All three components communicate wirelessly using the ESP-NOW protocol.
The experiments in this project demonstrated that the system successfully achieved electrical energy measurement, motion detection, device power cutoff control and real-time power usage display on the screen.
Overall, the system is intended to decrease unnecessary energy consumption and offers a practical solution for managing electrical devices in student’s common rooms.

Automatic parcel sorting based on size and weight

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Control system and Instrumentation Engineering

Abstract

In response to the growing global demand for goods, the efficiency of parcel transportation and management has become essential for industrial operations. However, the parcels have different size and weight knowing parcel's size and weight can help courier service more efficient. This project presents the development of an automatic parcel sorting system that classifies parcels based on the size and weight automatically. The system integrates computer vision and load cell to evaluate parcel dimensions and weight simultaneously. A microcontroller manages parcel movement along the conveyor, while images captured by two cameras are processed to OpenCV for a dimension analysis. Concurrently, a load cell installed on the conveyer measures the weight of the parcel. After measuring the size and weight parcel will be sorted and transported to five different storage channels according to classification criteria. In addition, collected data, including size, weight, and sorting status, are transmitted through an IoT communication protocol and stored in a MariaDB database. Visualization of sorting results and statistical analysis are performed via a Power BI dashboard. The system can handle parcels with the weight up to 1.5 kilograms and support six standard sizes (00, 0, AA, CD, A, and 2A).

Experimental results of sorting demonstrate the system efficiency while measurement results of size and weight show good accuracy compared to the reference standard. The developed system significantly enhances sorting speed and reliability while reducing human errors. By combining automation, data management, and real-time visualization technologies this system has a potential to apply for logistics, warehousing, and delivery services.

3D Cephalometric Landmark Using Deep Learning Technique (Phase 2)

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Advisor
Dr. Teema Leangarun, Assoc.Prof.Dr. Patcharapit Promoppatum

Control system and Instrumentation Engineering

Abstract

This study aims to improve treatment planning in orthognathic surgery, a procedure that involves repositioning the jawbones in conjunction with orthodontic treatment to correct facial or jaw deformities. The planning process is based on three-dimensional Cone Beam Computed Tomography (CBCT) images, with the Mid-Sagittal Plane (MSP) used as the primary reference. Accurate cephalometric landmark identification along the MSP is crucial to ensure precise and effective surgical planning.

In this research, the Anterior Nasal Spine (ANS), a key landmark located on the MSP, is selected as the reference point. Traditionally, surgical planning has relied on manual methods performed by expert clinicians, which are time-consuming and prone to human error, especially when critical landmarks are misidentified or misaligned, potentially leading to unacceptable surgical outcomes.

To address these limitations, this study proposes a deep learning approach using Convolutional Neural Networks (CNNs) combined with heatmap regression. This method transforms the 3D landmark coordinates (x, y, z) into a probabilistic map using a Gaussian distribution, allowing for more accurate landmark localization and reducing planning time for clinicians. The model is trained on a dataset of 60 CBCT images, each annotated with the 3D coordinates of the ANS landmark.

We employ the U-Net architecture as the backbone of the deep learning model due to its effectiveness in preserving volumetric information during training. By automating the identification of critical anatomical landmarks, this approach enhances the efficiency and reliability of orthognathic surgery planning.

Automated Sunlight Tracking System

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Dr.Tanagorn Jennawasin

Control system and Instrumentation Engineering

Abstract

This research aims to develop a solar tracking system to improve the energy conversion efficiency of solar panels. The system employs a dual-axis tracking mechanism integrated with a PID controller, enabling continuous adjustment of the panel's orientation to maximize solar irradiance throughout the day. Furthermore, a data communication system was designed to transmit operational parameters to a smartphone application via the NETPIE platform, providing real-time monitoring and alert notifications to enhance system management.

Experimental results indicate that the developed system, entitled "Enhancing Solar Cell Efficiency Through a Sun-Tracking System," successfully increases the electrical output of solar panels compared to fixed installations. The proposed system supports the sustainable utilization of renewable energy and contributes to the advancement of clean energy technologies in the long term.

Cloud-based Welding Energy Consumption Monitoring and Production Management System

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Advisor
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Control system and Instrumentation Engineering

Abstract

Welding machines are widely used in various industries and are known for their high electrical energy consumption. Inefficient energy management can lead to increased operational costs and energy waste. This project aims to develop a cloud-based monitoring system for welding energy consumption and production management. A universal energy measurement device was designed to work with all models of DC welding machines, measuring voltage and current in real-time. Data is transmitted wirelessly to a cloud database and visualized through a dashboard on a mobile application, allowing users to monitor and analyze energy usage anytime and anywhere. The system also supports the calculation of carbon credits based on energy consumption, contributing to environmental sustainability. Experimental results show that the developed system is practical, user-friendly, and capable of enhancing production efficiency by identifying energy-saving opportunities and improving process management.

3D Character Control using Gesture Detection System

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Advisor
Asst. Prof. Dr.Santi Nuratch

Control system and Instrumentation Engineering

Abstract

This project presents the development of a real-time 3D character control system using gesture detection technology. In an era where digital interaction and immersive virtual experiences are highly valued, the ability to control a virtual avatar naturally and smoothly is essential. Current motion capture systems often require expensive hardware, limiting access for general users. To address this challenge, our project utilizes cost-effective technologies such as MediaPipe, OpenCV, and Unity to create a low-cost yet highly functional system. The system captures users' body movements and facial expressions via a standard webcam and processes the data using image processing and machine learning techniques. Gesture data is transmitted in real-time to the Unity engine, where it drives a 3D character's movements and expressions, resulting in an interactive and immersive user experience. Communication between the gesture detection module and the Unity engine is handled using socket programming to ensure low latency and high responsiveness. The project's major contributions include developing a real-time motion detection module, creating adaptable 3D character models that reflect various gestures, and designing a stable, low-latency communication framework. Testing results demonstrate that the system achieves an average latency of approximately 0.49 seconds, which is acceptable for general applications. Ultimately, this project offers a practical, accessible solution for enhancing online communication, gaming, and virtual reality applications without relying on expensive motion capture equipment. Future improvements could involve optimizing accuracy, expanding multilingual support for voice recognition, and integrating the system into more immersive VR platforms.

Cyber-Physical System for Moveable Robot-Arm

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Advisor
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Control system and Instrumentation Engineering

Abstract

With the advancement of Cyber-Physical Systems (CPS), the integration of real-time control and Digital Twin visualization has become essential in smart robotic applications. This project presents a real-time web-based monitoring and control system for a mobile robotic platform equipped with a 5-DoF robotic arm and mecanum wheels. The system supports two operation modes: Auto Mode, where the robot performs predefined movement tasks autonomously, and Manual Mode, which allows users to control the robot and its arm through a web interface.

Communication between the physical robot and the web application is achieved via WebSocket, enabling bi-directional data exchange. The robot sends position updates and ultrasonic sensor feedback while receiving movement and arm control commands. The cyber component utilizes a 3D model rendered in Three.js to reflect real-time actions, thereby realizing the concept of a Digital Twin.

This system demonstrates the seamless integration of hardware and software through a CPS approach, making it suitable for robotics education, simulation, and real-world interaction. It also shows the effectiveness of combining real-time control, web-based visualization, and sensor feedback to build an interactive and responsive system that supports the objective of autonomous object transport.

Keywords : Cyber-Physical System, Real-time Control, WebSocket, Robotic Arm, 3D Visualization, Digital Twin

AMR Robot

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Control system and Instrumentation Engineering

Abstract

Abstract
"This project introduces a prototype of an Autonomous Mobile Robot used for the under-chassis wireless charger system. The robot uses LiDAR to locate the charger station initially. There is a camera associated with image processing techniques for navigating and detecting the front and rear, as well as brands of EV cars, to find the precise position of the wireless receiver. The robot uses a Macanum wheels system to move omnidirectional with the required resolution, which is necessary for the precision alignment of the wireless changer system."

Derivatives Manipulation Detection in SET Index Derivative Warrant

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Control system and Instrumentation Engineering

Abstract

This project aims to detect price and volume manipulations of derivative warrant market in the Stock Exchange of Thailand (SET). The project applied unsupervised learning techniques by using a transformer autoencoder model to learn normal trading patterns from the market data. Trading patterns that are largely different from the learned patterns are treated as anomalies. The data used consists of 30 features: 15 from derivative warrants and the same 15 from their corresponding common stocks. Each data instance includes the top bid and ask prices, five levels of bid and ask volumes, canceled bid volume, canceled ask volume, and matched volume, all normalized prior to modeling. The dataset is divided into training, validation, and test sets in a 60:10:30 ratio. Due to the absence of real-world manipulation labels, synthetic anomalies are injected into normal data to simulate price and volume manipulation scenarios. A threshold is then determined from the validation set to distinguish between normal and manipulated data. This approach establishes a foundation for detecting suspicious trading activities in derivative warrants without the need for supervised labels.

Human-Robot Interaction

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Advisor
Pranchalee Samanpiboon

Control system and Instrumentation Engineering

Abstract

This project presents the development of an integrated Human-Robot Interaction (HRI) system, implemented on an Autonomous Guided Vehicle (AGV) platform and validated using a robot car prototype. This system is designed for intuitive, multimodal communication in real-world environments, and integrates several key technologies: facial recognition (utilizing MTCNN/ResNet) for personalized user identification, YOLO object detection for environmental awareness, Whisper ASR for reliable voice command processing, and the OpenWeather API for real-time weather data integration. The Implementation and testing of the prototype confirm the system's robust and effective HRI capabilities. Key features include reliable interpretation of voice command and dynamic context-aware dialogue enhanced by environmental data. This integrated approach demonstrates significant potential for applications in service robotics and assistive technologies.

Path Planning For AGV

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Control system and Instrumentation Engineering

Abstract

This paper presents the development of an AGV (Autonomous Guided Vehicle) robot prototype for path planning and navigation toward target destinations. The system is developed on the Robot Operating System (ROS) platform and utilizes Lidar-based navigation for environmental perception. A key component of the system is the implementation of the A* path-planning algorithm, which enables the robot to accurately calculate efficient routes from a starting point to a designated goal. The robot uses laser data from a SLAM (Simultaneous Localization and Mapping) module to create real-time maps, allowing it to avoid obstacles and adjust its path dynamically during movement.

The main objectives of this project are to study autonomous navigation techniques and to build an AGV prototype capable of operating safely in structured environments. Testing showed that the robot could navigate to designated targets while effectively avoiding both stationary and moving obstacles. The results confirm that combining the A* algorithm with laser-based mapping is well-suited for indoor navigation. This research serves as a foundation for future developments in autonomous delivery systems.

Web Application for Learning and Diagnosing Small Animal Thoracic X-Ray Images

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Advisor
Dr.Kajornvut Ounjai, Dr.Teema Leangarun

Control system and Instrumentation Engineering

Abstract

Many veterinary students struggle to accurately identify abnormalities in X-ray images, while instructors have limited time to provide sufficient individual guidance. To address this educational challenge, our team developed a web application to help students practice analyzing X-ray images and diagnosing diseases in a focused and effective way. The system incorporates three main learning activities: an intro quiz where students review basic knowledge by identifying organs and distinguishing between normal and abnormal radiographs; a photo hunt game where students practice identifying abnormalities through interactive clicking with response tracking and heatmap visualization; and scenario-based analysis where students practice disease diagnosis through simulated consultations by collecting symptom history from pet owners. The prototype system is fully functional, allowing students to complete exercises and monitor their learning progress while enabling instructors to add new cases, track student performance, and use behavioral data to improve teaching methods. This application represents a significant opportunity for veterinary education, potentially reducing the burden on instructors while providing students with consistent, self-paced practice opportunities. In the future, the system could be expanded to include additional imaging modalities, more complex case scenarios, and integration with existing veterinary school curricula, ultimately helping to produce more competent veterinary professionals with strong diagnostic imaging skills.

Data Integration For Sustainability Management, Case Study

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Advisor
ASST.PROF.DR. DIEW KOOLPIRUCK

Control system and Instrumentation Engineering

Abstract

This research aims to enhance data accessibility and elevate data quality for use in energy management and control at King Mongkut's University of Technology Thonburi. The scope of development involves integrating monthly energy consumption data into the system to identify energy usage sources for each building within the university. A platform will be implemented to support data processing and visualization, aiding organizational decision-making in reducing carbon emissions from activities and energy consumption. Additionally, the initiative seeks to minimize the carbon cycle rate

LiDAR and Camera - Based Autonomous Vehicle Control System

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Advisor
Assoc. Prof. Dr. Benjamas Panomruttanarug

Control system and Instrumentation Engineering

Abstract

In the rapidly advancing world of technology, creating accurate navigation and mapping systems is essential in various fields, such as autonomous transportation and geographical surveying. LiDAR (Light Detection and Ranging) technology and the Xsens MTi 680 sensor play a pivotal role in providing precise 3D environmental mapping and accurate localization. LiDAR uses laser beams to measure distances, creating detailed, real-time 3D maps of the environment, while the Xsens MTi 680 sensor provides high-precision position data by measuring angular and motion changes.

This project focuses on the development of an autonomous driving system for a golf cart, integrating LiDAR, the Xsens MTi 680 sensor, cameras, and the YOLOP model for real-time object, lane and drivable area detection. The system processes environmental data in real-time, enabling the vehicle to make intelligent decisions on direction control, obstacle avoidance, and maintaining appropriate speed. By applying the Pure Pursuit control law, the system ensures smooth and responsive path-following, where the vehicle continuously steers towards a lookahead point on the path. The steering angle is dynamically adjusted based on the vehicle's lookahead distance and wheelbase, ensuring precise and efficient navigation even in dynamic environments.

The primary objective of this research is to enhance the efficiency, safety, and reliability of autonomous electric vehicles through the integration of advanced technologies across perception, localization, and control. LiDAR and the Xsens MTi 680 sensor provide accurate environmental mapping and precise vehicle positioning. The camera system, combined with the YOLOP model, enables real-time detection of objects, lanes, and drivable areas for safer navigation. Additionally, the implementation of path-following algorithms and real-time control systems ensure smooth motion and adaptive decision-making in dynamic environments.

Smart Refrigerator

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Control system and Instrumentation Engineering

Abstract

This project presents the design and implementation of a Smart Refrigerator system aimed at improving food management, minimizing waste, and enhancing user convenience through real-time ingredient detection and inventory tracking. The proposed system integrates both software and hardware components to detect and monitor food items using computer vision techniques. Leveraging the YOLOv11 object detection model, Raspberry Pi 4, Raspberry Pi Camera Module V3, and a 7-inch touchscreen interface, the system is capable of identifying and tracking ten predefined ingredients apple, banana, blueberry, cabbage, cucumber, egg, lettuce, meat, salmon, and sausage with high accuracy.

To support intelligent food usage, the system features dynamic freshness tracking, expiration alerts, and personalized recipe recommendations generated through integration with OpenAI. Each detected ingredient is logged with a timestamp, and its freshness is visually indicated using a color-coded user interface. The model was trained using a custom-labeled dataset and evaluated using metrics such as classification loss, precision, recall, and mean average precision (mAP), with class-wise results confirming the model's capability to perform accurate real-time detection.

Further innovations include the incorporation of a magnetic reed switch to control camera activation based on refrigerator door status, dynamic ingredient status updates, and a UI that adjusts in real time based on detection results. Additionally, the system provides user interaction through customizable recipe generation based on dietary preferences and ingredient availability, all while optimizing AI usage through a selective, credit-efficient design.

In conclusion, the Smart Refrigerator prototype delivers an affordable and scalable solution that empowers users to manage their food inventory effectively, reduce spoilage, and adopt sustainable consumption habits. The system’s modular architecture also allows for future enhancements such as expanded ingredient databases, improved hardware ergonomics, and AI-generated visual meal suggestions.

Stock Trading Decision Using Generative-AI Based

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Advisor
Dr.Teema Leangarun, Dr.Kajornvut Ounjai

Control system and Instrumentation Engineering

Abstract

Recently, the Stock Exchange of Thailand (SET) has reported an increase in the number of securities trading accounts, highlighting the growing importance of effective stock trading decision-making. This research proposes an attention-based BiLSTM model integrated with trading strategies to support such decisions. The model predicts stock price movements, while predefined trading strategies translate these predictions into actionable decisions—buy, hold, or sell. Additionally, this study incorporates Generative AI tools to analyze unstructured data sources, including financial news, financial indicators, and fundamental data. Each factor contributes an individual recommendation (buy/hold/sell), and a score-based aggregation mechanism is used to determine the final trading action. The output from the Generative AI component includes not only a recommended action (Buy/Hold/Sell), but also reasoning and references to the data sources used, helping to build trust and transparency in the decision. The final goal of this system is to support users—especially those without financial expertise—in making investment decisions in the SET50 market with reduced risk. The proposed method is expected to achieve a return on investment (ROI) of approximately 8%, highlighting its potential to effectively predict market trends and improve investment outcomes.

Enhancing Scalability of MLOps Infrastructure on Azure for Smart Manufacturing

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Control system and Instrumentation Engineering

Abstract

Manufacturing sectors heavily invest in big data analytics and machine learning (ML) to enhance operational efficiency and support decision-making on business-critical issues. Machine Learning Operations (MLOps) play a crucial role in managing ML models by automatically optimizing deployment, monitoring, and maintenance processes with minimal effort required from human agency. This paper exploits the design of Azure-based MLOps to improve scalability of the system while still automatically operating data ingestion and model deployment. Experimental results demonstrate the impact of resource allocation on overall performance, particularly in CPU workload, latency, and backlog accumulation under high data loads. Our results show that performance bottlenecks in the scaling process can be mitigated by adjusting the number of streaming units in Azure Stream Analytics and deployment instances correlating to the data loads. According to our findings, these adjust-to-scale features of Azure MLOps lead to a significant reduction in resource usage and response time fluctuations, thereby improving the stability and efficiency of the overall system that can be applied to ML-driven manufacturing use cases.

Smart Harvesting System

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DR.Tanagorn Jennawasin

Control system and Instrumentation Engineering

Abstract

This project presents the development of a smart harvesting robotic system based on a six degrees of freedom (6DOF) robotic arm. The robotic arm is controlled using an ESP32 microcontroller and a PCA9685 servo driver for precise actuation. A graphical user interface (GUI) allows manual adjustment and smooth motion control. Ripe and unripe fruits are detected using a YOLOv8 model trained with Label Studio. Detected object coordinates are transformed from camera space to robot space through manual calibration. The system detects an object, moves the arm to the (x, y) position, lowers the end-effector, simulates harvesting, and returns to home position. The integration of machine vision and robotic control shows promising potential for agricultural automation.

Automated Harvesting Machine For Organic Salad

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Advisor
Dr.Tanagorn Jennawasin, Dr. Thavida Maneewarn

Control system and Instrumentation Engineering

Abstract

This project focuses on the development of an Automated Harvesting Machine for Organic Salad, designed to support small-scale farmers by significantly reducing harvesting time, minimizing labor costs, and increasing operational efficiency. The machine consists of four core modules: a puller and cutting mechanism, a soil removal unit, a tray stacking system, and a Human-Machine Interface (HMI) for monitoring and control. A Programmable Logic Controller (PLC) serves as the central control unit, processing input from sensors and coordinating motor actions to ensure seamless operation. The machine can be operated from two stations: an automation control panel and the HMI. Through the HMI, users can select either automatic mode or manual mode, which enables independent control of each module. The system was tested using real harvesting scenarios to evaluate its performance. Results showed that the machine can reliably harvest vegetables of varying sizes, confirming its effectiveness and adaptability for practical agricultural use.

INC EV Car Dashboard Version1.0

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Advisor
Wuttichai Polwisate

Control system and Instrumentation Engineering

Abstract

This project aims to develop a comprehensive measurement and display system for electric vehicles, building upon the department's existing electric golf cart project. The developed system focuses on enhancing the vehicle's ability to monitor key operational parameters that contribute to driving safety and efficiency, including speed, travel distance, steering angle, brake and accelerator status, as well as the detection of obstacles at both the front and rear of the vehicle.

All sensor data is processed and visualized through an integrated dashboard consisting of two main components: a real-time variable monitoring screen and an obstacle detection interface utilizing LiDAR sensors. These components collectively support real-time driving decisions and enhance overall operational safety.

The system is designed to operate autonomously and is powered primarily by solar panels, promoting environmental sustainability and energy efficiency. Key components include a rotary encoder for precise steering angle measurement, an ACS712 current sensor for electrical current monitoring, a TFmini Plus LiDAR sensor for accurate distance measurement, and a CAN Bus communication network to ensure reliable real-time data exchange between subsystems.

Preliminary testing indicates that the system performs with high accuracy and meets core design requirements. However, certain limitations were identified, particularly concerning long-term stability and environmental robustness under dynamic driving conditions. Future work will focus on improving sensor calibration, enhancing communication reliability via the CAN Bus, and optimizing data processing algorithms to further improve accuracy, responsiveness, and system durability. Ultimately, this project lays the foundation for the development of a more intelligent, efficient, and safer electric vehicle platform.

Real-Time Welding Quality Monitoring and Prediction System

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Advisor
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Control system and Instrumentation Engineering

Abstract

Gas Metal Arc Welding (GMAW) is a critical process in various industrial applications, necessitating real-time monitoring to ensure weld quality and integrity. This study addresses the challenges of limited real-world data and the deployment of monitoring algorithms on resource-limited devices. We propose a method to generate realistic simulated weld signals with defects, including porosity and burn-through, using good weld data samples. Additionally, we present an optimization technique for XGBoost settings, focusing on model complexity, feature selection, and temporal resolution. The XGBoost algorithm is trained on simulated data and tested on unseen datasets, both synthetic and actual ones. Results on test simulated data demonstrate that a 100 Hz sampling rate, using a single feature (mode), can achieve high accuracy, indicating strong generalization. However, when tested on real-world samples obtained from another welding machine, adding skewness as the second feature improves prediction accuracy. Dynamic Time Warping (DTW) analysis further confirms that our simulated defect signals closely match their reference counterparts, with the smallest DTW distances observed for synthetic burn-through and porosity. Feature-selection experiments show that mode alone suffices at 100 Hz, while combining skewness and mode sustains perfect classification at higher sampling rates. Comparative benchmarking against decision tree and random forest classifiers demonstrates that the optimized XGBoost model achieves high accuracy, precision, recall, and F1-score on both synthetic and real-world test sets. To further validate our approach, we will collect real welding voltage signals under controlled laboratory conditions and apply the optimized XGBoost model to classify weld types on these real-world datasets. This step will assess the model's ability to generalize from simulation to practice and demonstrate its robustness for on-site weld quality monitoring. The proposed approach therefore demonstrates the ability to achieve high classification accuracy with minimal features and reduced data sampling rates.

Fish Counting and Water Managements System

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Advisor
Assoc. Prof. Dr.Santi Nuratch

Control system and Instrumentation Engineering

Abstract

This project integrates a YOLOv11-based detection model and Kalman Filter tracking into a real-time aquatic monitoring system to classify Mad Carp and Thai Carp. Conducted as a case study at a fish ladder site, the system architecture consists of an IP camera capturing live video, which is processed using YOLOv11 for object detection, while the Kalman Filter ensures smooth and accurate tracking across frames. A Flask server handles backend processing and data storage, and a web-based dashboard—built using Flet—displays live detection results along with environmental metrics such as temperature, rainfall probability, and water flow. These metrics are obtained via external APIs and sensors, and stored in a centralized database to support predictive analytics for water level trends. Model training was performed on annotated video datasets using landmark-based labeling to improve species differentiation. Simulation data involving water levels, rainfall, and gate flow were analyzed to develop preliminary guidelines for dam control—such as when to increase or reduce flow to avoid temperature shocks or preserve fish migration patterns. Testing revealed high detection accuracy for Thai Carp, with some limitations in identifying Mad Carp due to similar morphology and movement patterns. By combining real-time fish monitoring with environmental data and simulation-based dam control recommendations, the system supports biodiversity preservation, optimized gate operations, and adaptive water resource management.

Low-Cost Reaction Wheel for CubeSat Attitude Control System

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Advisor
Asst. Prof. Dr.Sudchai Boonto

Control system and Instrumentation Engineering

Abstract

This thesis presents the design and implementation of a low-cost reaction wheel system for CubeSat attitude control. With the growing demand for small satellite technologies, CubeSats have emerged as a cost-effective solution for various space missions. However, maintaining precise attitude control in these small satellites remains challenging due to their size and power limitations. This project aims to develop a budget-friendly control system capable of stabilizing and orienting CubeSats in low Earth orbit.

The system uses reaction wheels as the primary actuator to achieve fine-tuned control including system modeling, attitude dynamics, and the configuration of reaction wheels, to validate the system's performance under Earth-based testing conditions. This research demonstrates that a low-cost solution can still provide effective control capabilities, potentially lowering the entry barriers for educational institutions and smaller organizations in the space sector.

Keyword: Altitude control system / Attitude control / CubeSat / Low-cost reaction wheel / Small satellite

Feature Engineering of Unsupervised Stock Manipulation Detection Model

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Control system and Instrumentation Engineering

Abstract

Price manipulation of securities negatively impacts all investors by distorting stock prices and undermining confidence in financial markets. Detecting these practices is essential to ensure fair trading and uphold market integrity. This research focuses on developing a model using a transformer autoencoder combined with unsupervised learning techniques. Unlike traditional methods, this approach identifies abnormal trading patterns without requiring labeled examples of manipulated stocks, making it more adaptable to real-world conditions where such labels are often unavailable. The model is trained using normal trading data from the Stock Exchange of Thailand (SET), specifically in the form of order books, which provide detailed insights into the dynamics of market supply and demand. Our work emphasizes on using feature engineering to improve model performance. We added additional 19 features to the previous year's 15-feature model and trained both models with the same data for comparison. Six samples from manipulated securities were used as a dataset. The results showed a mix of improvement/impairment of performance on different securities. Lastly, we used SHAP to analyze the importance of features on each security.

Stock Prediction using a Transfomer model and Portfolio Optimization with Mean-Variance model

Mr. Boonyarit Kerdsuwan, Mr. Siraphop Noiamphaeng

Advisor
Dr. Kajornvut Ounjai, Dr. Teema Leangarun

Control system and Instrumentation Engineering

Abstract

This project presents a framework that integrates a Transformer model for stock price prediction with mean-variance portfolio optimization. Using SET50 data (2004–2024), the approach enhances investment strategies by improving returns and reducing risk.

Generative AI For Industrial Asset Management

Mr. Narch Srirom, Mr. Setthawut Songpan, Mr. Thanayot Wongmasa

Advisor
Asst.Prof.Dr.Diew Koolpiruck

Control system and Instrumentation Engineering

Abstract

This project aims to develop a Generative AI system to support industrial asset management by enhancing how technical information is retrieved, analyzed, and utilized. Users can upload PDF or Excel files containing equipment data, maintenance records, or technical manuals. The system extracts and stores the information in a vector database (Weaviate) to enable efficient semantic search and question answering. When users pose questions, the AI retrieves relevant content and generates accurate responses based on the stored documents.

Moreover, the system allows users to submit descriptions of specific problems or issues encountered with assets. Based on the provided information and existing knowledge, the AI generates detailed action plans (Work Orders) outlining suggested solutions. These orders are automatically exported as downloadable PDF files, providing users with a practical and professional output that can be directly applied in operational settings. To ensure continuous improvement, the platform incorporates a feedback mechanism where users can rate the usefulness and accuracy of the generated orders.

By combining document retrieval, natural language understanding, and generative capabilities, this project offers a powerful tool for streamlining asset management processes, reducing response times, and supporting more informed decision-making in industrial environments.

Development of a local exhaust ventilation system to minimize welding fume exposure

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Asst. Prof. Prapat Pongkiatkul

Advisor
Asst. Prof. Prapat Pongkiatkul, Ph.D., Asst. Prof. Pichet Chaiwiwatworakul, Ph.D.
Trairat Muangthong-on, Ph.D.

Environmental Engineering

Abstract

This study presents the development and optimization of a novel portable Local Exhaust Ventilation (LEV) system designed to efficiently capture welding fumes containing ultrafine particulate matter and toxic metal vapors. The system was tested through three development phases—before modification, after preliminary modification, and final optimization. Key airflow parameters were measured at three blower levels. The final design achieved average hood velocities of 7.04 m/s, 8.98 m/s, and 11.61 m/s, with corresponding flow rates of 0.124, 0.159, and 0.205 m³/s. These values confirm substantial improvement in fume capture efficiency, particularly suitable for small- and medium-sized enterprises.

The innovation lies in the aerodynamic design of a cone-shaped hood, optimized to maintain a face velocity near the ACGIH-recommended 7.62 m/s. A three-speed blower enables real-time adjustment of suction power to suit varying welding conditions, enhancing flexibility and energy efficiency. Duct and blower configurations were refined to reduce pressure loss and maintain steady airflow.

A modular filtration unit, combining conventional filters and activated carbon, supports simultaneous removal of particles and gases. Although HEPA filters are not yet included, the system's design allows easy upgrades. Weighing only 50 kg, the unit is highly portable and practical for field use or small workshops, addressing key limitations of conventional LEV systems in cost-sensitive settings. The final prototype demonstrates strong potential for improving occupational air quality and welding safety.

Innovative Infrared-Based Detection System for Identifying Volatile Organic Compound Leaks in Industrial Settings

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Advisor
Asst.Prof. Dr.Prapat Pongkiatkul

Environmental Engineering

Abstract

This project presents the development of a non-contact detection tool for volatile organic compounds (VOCs) leakage using an infrared (IR) camera. The primary challenge in detecting VOCs lies in their low contrast against the background in IR imaging. To address this, we investigated the effect of different background materials and thermal properties on detection performance. Experiments were conducted to compare surface finishes (matte vs glossy), background colors (white, gray, black), and temperature conditions (heated, cooled, and ambient). The results showed that a matte black background with active heating significantly enhanced the visibility of VOC plumes in the IR spectrum by increasing the thermal contrast. This improvement enables more reliable and precise leak detection. The proposed setup is low-cost, adaptable, and suitable for industrial applications, particularly in preventive maintenance and environmental monitoring.

Development of natural hydrogel for phosphorus recovery and fertilizer

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Advisor
Assoc.Prof.Dr. Songkeart Phattarapattamawong

Environmental Engineering

Abstract

This research aims to synthesize hydrogel from chitosan (CS), a byproduct of the seafood industry, and lactic acid (LA), a naturally biodegradable substance. The study investigates the effect of the ratio of CS to LA on the hydrogel efficiency, indicated by swelling capacity, phosphorus-adsorption capacity, and leaching ability. Used hydrogel after phosphorus adsorption can be used as fertilizer in agriculture. The result indicated that the swelling capacity increased with higher LA contents. Adsorption capacities of hydrogel were 0.41, 0.30, 0.32, and 0.22 mgP/g at CS:LA ratios of 5, 15, 25, and 35, respectively. Leaching abilities were 0.28, 0.43, 0.74, and 1.30 mgP/g, respectively. Therefore, higher LA enhanced the swelling capacity and leaching ability, while the adsorption capacity decreased. In addition, LA induced flexibility and solubility.

Keywords: Lactic acid; Chitosan; Phosphorus; Nutrients; Hydrogel

Implementation of UV/EO in veggie washing process

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Advisor
Assoc. Prof. Dr. Songkeart Phattarapattamawong

Environmental Engineering

Abstract

Procymidone is a fungicide in the dicarboximide group, known for its high efficacy in inhibiting fungal growth. However, its major drawback lies in its high environmental stability and persistence in agricultural products for extended periods. Consumption of produce containing residues exceeding the permissible limit can pose health risks to consumers. This study aims to develop a method for removing procymidone from fruits and vegetables using a combined electrooxidation and ultraviolet irradiation (UV/EO) process. This advanced oxidation technique generates reactive species such as hydroxyl radicals (•OH) and reactive chlorine species (RCS) to degrade contaminants effectively. The study investigates the effects of key variables, including electrode type, and current density (CD), on the efficiency of procymidone removal. Experimental results indicated that the optimal conditions were pH 7, a current density of 20 mA/cm^2, NaCl concentration of 50 g/L, using boron-doped diamond (BDD) as the anode and titanium (Ti) as the cathode. Under these conditions, the UV/EO process efficiently produced both reactive chlorine species and hydroxyl radicals. Moreover, this method offers the advantage of operating under safe conditions without leaving harmful residues, ensuring both health and environmental safety. The findings demonstrate the potential of the UV/EO process as an innovative approach to enhance the safety of fruits and vegetables at the household level.

Air Drying Machine Of RDF

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Advisor
Dr.Trairat Muangthong-on

Environmental Engineering

Abstract

This research aims to design and develop an air-drying machine specifically for reducing the moisture content of refuse-derived fuel (RDF) derived from food waste. As Bangkok produces nearly 8,979 tons of waste per day, a significant portion remains underutilized or improperly managed, often ending up in landfills or incinerated, both of which contribute to environmental problems such as air pollution, leachate, and unpleasant odours. RDF has become a promising alternative fuel that transforms municipal waste into a usable energy source. However, a major challenge in RDF production, particularly RDF-3, is the high residual moisture content which negatively affects combustion efficiency and heating value. This is especially true for RDF composed of materials such as fabric or wood chips, which readily absorb moisture from the air. To address this, the study proposes a custom-designed air-drying machine that can effectively reduce RDF moisture content to below 25% by weight, in compliance with the standard requirements of industrial users like Siam City Cement. The project includes a detailed review of waste management issues in Bangkok, RDF characteristics, and drying requirements. The machine is designed to use a hot air system to dry shredded RDF (<50 mm) efficiently. The expected result is a functional prototype capable of producing consistent low-moisture RDF, thus improving its value and usability as an alternative fuel.

MEMO-RO-DERLY (Memory-Robot-Elderly)

Ms. Pornthip Tiraoram, Ms. Alinya Merwin, Ms. Alicha Towatthanakit

Advisor
Assoc. Prof. Raungrong Suleesathira, Ph.D.

Electronics and Telecommunication Engineering

Abstract

It is well known that nowadays the number of sick people and the elderly is increasing each year. To relieve symptoms and stabilize the patient's condition. Therefore having this project To dispense medicines to patients to take on time To reduce stress and conflicts on caregivers(family members) of patients who do not take medicine as prescribed. To continuously monitor the patient's medication adherence. In addition, there will be reminders of the patient's medication Real-Time notification to caregivers(family members). So that caregivers or family members are aware of the patient's medication intake and whether they are taking medication or not.

Unsupervised Crack Detection System using GNN Clustering

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Advisor
Assoc. Prof. Dr. Wuttipong Kumwilaisak

Electronics and Telecommunication Engineering

Abstract

This project presents an innovative and scalable approach to unsupervised crack segmentation by integrating classical image processing techniques with graph neural network (GNN) clustering, further extended into a standalone hardware-software system. Traditional crack detection methods heavily rely on manual inspection, which is time-consuming, labor-intensive, and susceptible to human error. To address this limitation, our system automates the process through a hybrid methodology and deploys it on a portable device suitable for field use.

Our pipeline begins with image acquisition via a standalone Raspberry Pi 5 unit equipped with a camera module. Captured images are first preprocessed using classical image processing techniques, including Canny edge detection and morphological operations, to emphasize potential crack regions and suppress noise. The preprocessed images are then passed through a pre-trained ViT (Vision Transformer) model to extract rich feature representations. These features are used to construct graphs that capture spatial and contextual relationships within the image. A graph neural network (GNN) clustering algorithm is then applied to these graphs to perform unsupervised crack segmentation. The resulting segmented images are transmitted in real-time from the Raspberry Pi to a host machine using Python socket communication over a local network.

By integrating the model into a hardware setup, this project not only advances the segmentation performance through GNN-based learning but also demonstrates the feasibility of an edge-device-based crack monitoring system. The proposed system contributes to infrastructure assessment by offering a cost-effective, portable, and automated solution for detecting and categorizing cracks. Ultimately, this approach enhances inspection efficiency, promotes timely maintenance, and supports the long-term safety and durability of critical infrastructure assets.

Keywords: Crack segmentation, Graph neural networks, Unsupervised learning, Raspberry Pi, Image processing, Python socket, Infrastructure monitoring

Alaryngeal Voice Conversion

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Electronics and Telecommunication Engineering

Abstract

This project introduces a real-time mobile application designed to enhance alaryngeal speech to sound more like natural speech. Building upon the kNN-VC (k-Nearest Neighbor Voice Conversion) framework, we propose a novel enhancement by replacing the conventional neighbor-matching strategy with an Attention-based Fuzzy C-Means (AFCM) matching method. This allows for more adaptive and context-aware feature alignment between alaryngeal and normal speech using attention-weighted fuzzy clustering. Our system is built using FAST API for backend processing and FlutterFlow for cross-platform mobile development. The app enables users to upload or record speech, choose gender-specific voice targets, and select between Thai and English languages for speech conversion. The final output is synthesized into natural-sounding speech, providing an accessible tool for individuals with alaryngeal conditions. This work aims to improve both communication ability and social confidence in multilingual real-world contexts.

Data modeling for machine vibration data analysis

Mr.Thanakrit Somsri, Mr.Wisarut Saenkla, Mr.Peerapat Meesangket

Advisor
Asst. Prof. Apichai Bhatranand, Ph.D, Asst. Prof. Yuttapong Jiraraksopakun, Ph.D

Electronics and Telecommunication Engineering

Abstract

In the present, delayed access to machinery data leads to significant challenges in optimizing machine performance according to desired production standards. As a result, products may fail to meet expected quality levels, leading to increased production inefficiencies and waste. Furthermore, machinery that is improperly maintained often deteriorates faster, contributing to the growing issue of electronic waste. Improper disposal methods such as landfilling and incineration release harmful chemicals into soil, water, and air, adversely affecting human health and ecosystems.

To address these challenges, this project proposes the development of a real-time monitoring and predictive maintenance (PDM) system utilizing Industrial Internet of Things (IIoT) technologies and artificial intelligence (AI) techniques. The system will gather operational data, particularly vibration signals, from machinery via sensors, and use machine learning algorithms to detect anomalies and predict potential failures. An interactive interface and dashboard will be developed to display real-time performance trends, alert users to abnormal conditions, and assist in maintenance planning. By predicting failures before they occur, the system enables timely interventions, prolonging the machinery's lifespan and maintaining consistent production quality.

Ultimately, the project aims to enhance operational efficiency, reduce unplanned downtime, and minimize the environmental impacts associated with electronic waste. By extending the service life of machines and reducing the need for frequent replacements, the project supports sustainable manufacturing practices and contributes to the broader goals of Industry 4.0 initiatives. The integration of IIoT and AI not only improves maintenance strategies but also paves the way for smarter, more environmentally responsible industrial operations.

Development of Web-Based Application for Curriculum Evaluation

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Advisor
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Electronics and Telecommunication Engineering

Abstract

The application for course assessment in the form of a website that can be accessed via a browser focuses on computer use. The website has various functions that facilitate and make it easy to use for professor in the department. There is a login page to enter the system, an options bar, and a sub-option bar for viewing each professor's courses. Each professor can upload a Microsoft Excel file that stores course assessment data or PI values (Performance Indicator: performance indicators that show whether the performance of a particular task or responsibility meets the organization's expectations). Upon uploading the file, the website automatically determines the PI value for each subject and stores the data in the database. Finally, there is a function to export a file of a total score table calculated as a weighted percentage (Total Weighted Outcome), which is a combination of the PI score file obtained from professors and the score file obtained from the student survey. In addition, there is a file reporting the progress of the assessment to reduce delays in course assessment for professors in the department.

Data b ase we bsite of Institute for Scientific and Tec to promote sear c h and mat c hing hnological Resear c b etween resear c h and academic h and Services (ISTRS) personnel.

Ms. Saowalak Suejing, Mr. Kitsadarat Waivicha, Ms. Surirat Chobchai

Advisor
Dr. Paisarn Sonthikorn

Electronics and Telecommunication Engineering

Abstract

The Institute for Science and Technology Research and Services (ISTRS) at King Mongkut's University of Technology Thonburi (KMUTT) has traditionally faced challenges with an inefficient system for matching researchers with relevant research projects. To address these issues, this project developed a comprehensive web-based platform and researcher database using PHP for backend development, MySQL for database management, and XAMPP as the local server environment. The system, which is now fully operational, is capable of storing profiles of over 500 researchers and academics and their associated research projects. By utilizing a keyword-based matching engine, the system enhances the accuracy and efficiency of matching researchers with suitable projects, ultimately streamlining the process of collaboration between researchers and external organizations.

Prototype System Producing water from Air

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Advisor
Dr.Paisarn Sonthikorn

Electronics and Telecommunication Engineering

Abstract

Drought continues to impact many regions worldwide, particularly in northeastern Thailand where water shortages persist during the dry season. This project presents the development of a prototype atmospheric water generator (AWG) using condensation principles. The system cools ambient air via Peltier modules controlled by an Arduino Leonardo board, causing moisture to condense into water. After improvements to the heat dissipation system, the prototype was able to generate water, producing approximately 14.4 mL per day. While this output is modest, the system demonstrates potential for further development and efficiency improvements. The prototype is compact, low-cost, and user-friendly, making it potentially suitable for use in rural or drought-prone areas. Future developments may scale the system for broader community or emergency use. This project represents an early-stage step toward sustainable solutions for water scarcity.

Class A transimpedance power amplifier using SiC JFET

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Advisor
Asst.Prof.Dr.Kamon Jirasereeamornkul

Electronics and Telecommunication Engineering

Abstract

The project aims to design a Class-A power amplifier using a Transimpedance Amplifier circuit combined with JFET transistors to amplify audio signals. The circuit will first be simulated using LTspice, then built and tested Based on harmonic distortion and efficiency.

A Preventive Tracking System for Personal Belongings

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Advisor
Prof. Dr. Pinit Kumhom

Electronics and Telecommunication Engineering

Abstract

The frequent misplacement of personal belongings—such as wallets, keys, and bags—poses a persistent challenge, particularly in public spaces where retrieval is unlikely. While commercial tracking solutions like Tile and AirTag have gained popularity, they exhibit critical limitations: high cost, short effective range, and a reactive approach that requires users to manually initiate searches. These shortcomings underscore the need for a more proactive, responsive, and affordable alternative.

This study proposes a dual-function tracking system explicitly designed to prevent item loss before it occurs. The first function continuously evaluates the signal strength between the user's device and the tagged item to monitor their proximity. When the measured distance exceeds a user-defined threshold, the system autonomously sends a real-time alert to a web interface, enabling immediate user response before the item is lost. The second function enhances recovery by activating an audible buzzer attached to the object. This buzzer can be triggered automatically when separation is detected or manually via the web interface, helping users accurately locate misplaced belongings in dynamic environments.

The system architecture separates sensing from control logic, improving modularity, responsiveness, and energy efficiency. By eliminating dependence on manual location queries and offering real-time alerts and physical cues, the system directly addresses the key limitations of existing trackers.

Experimental validation confirms the system's effectiveness in enhancing user awareness, preventing item loss, and reducing retrieval time. Its design balances technological performance and usability, making it a scalable, cost-effective, and reliable solution to a common but impactful problem. The approach represents a step forward in personal item security, bridging the gap between everyday convenience and intelligent prevention.

A CUSTOMIZABLE PLAYBACK CONTROLLER SYSTEM FOR LIVE MUSIC PERFORMANCE

Mr.Natchapol Kiriwanna, Mr.Poomiphat Thongdeenitiphat, Mr.Phusit Pornpacharapoka

Advisor
Asst.Prof.Dr. Pinit Kumhom, Ph.D

Electronics and Telecommunication Engineering

Abstract

Digital Audio Workstations (DAWs) constitute essential tools for track management in contemporary live music performances. While direct DAW control by engineers and/or musicians simplifies setup, this approach compromises setlist flexibility and visual feedback, diminishing on-stage control efficiency. The user needs a simplified setup and flexible setlist management system, although existing solutions often introduce unnecessary complexity without adequately addressing these necessities. This project presents the development of a Playback Controller System designed to streamline track management and enable wireless configuration for faster setup processes.
The system architecture relies on embedded systems implementing MIDI technology for DAW communication. Setlist management functionality operates through a user-based swapping algorithm controlled via GPIO interfaces, while WebSocket implementation enables wireless connectivity. The hardware design includes circuit design, component selection, and user interface development centered on user requirements. Prototype evaluation was conducted with professional participants from Thailand's music industry in multiple scenarios using the Guidance of Usability framework outlined in ISO 9241-11 standards.
The results show an average satisfaction score of 72.75 and demonstrate the ability to maintain wireless connectivity for five or more users with a maximum latency of 39 ms. While the system effectively addressed core functionality requirements, minor refinements could enhance performance metrics and expand feature capabilities to facilitate live musical performances. This research establishes a foundation for hardware-based setlist management solutions that balance technical functionality with user-centered usability in professional concert environments.

Development of a Digital Granular Synthesizer

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Advisor
Asst. Prof. Kamon Jirasereeamornkul, Ph.D., Asst. Prof. Pinit Kumhom, Ph.D.

Electronics and Telecommunication Engineering

Abstract

The objective of this project is to design and implement a Granular Synthesis sound synthesizer using digital signal processing (DSP). Granular Synthesis is the creation of sound by manipulating a small portion of an audio sample, which is called a Grain, while software-based Granular Synthesis or VST (Virtual Studio Technology), there are many to choose from, but this project focuses on developing a hardware synthesizer that is easily portable. Can synthesize new sounds and quickly adjust parameters The hardware design consists of several key components, including an analog-to-digital converter (ADC) to sample the sound, a Digital Signal Processing (DSP) system to process the granular, and a digital-to-analog converter (DAC) to synthesize the sound. The system architecture uses microcontroller technology. This project emphasizes low latency and efficient use of resources. Power consumption, device size and portability are also considered to ensure that the synthesizer is suitable for live performance and studio use.

Road Detection without Lane Markings for Autonomous Vehicles

Mr.Sittiporn sangatit, Mr.Nattapong Wattanasit, Mr.Patcharapol Ratchatapaiboon

Advisor
Asst. Prof. Dr.Werapon Chiracharit

Electronics and Telecommunication Engineering

Abstract

Currently, AI technology plays a vital role in autonomous driving systems; however, challenges remain when operating on rural roads or environments without clear lane markings, as most technologies are primarily designed for urban roads. This research presents an improvement of the YOLOP model by retraining it with a newly developed dataset consisting of 4,000 images, featuring various challenging conditions such as potholes, waterlogged surfaces, blurred boundaries between road and roadside, and heavy shadow interference. Experimental results demonstrate that the enhanced model outperforms the original, with Recall form object detection increasing from 84.9% to 91.3% and mIoU form drivable area segmentation improving from 80.04% to 92.6%. The developed dataset and model significantly improve detection accuracy and safety in complex autonomous driving environments.

Development of web application for student check in

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Advisor
Asst. Prof. Werapon Chiracharit, Ph.D.

Electronics and Telecommunication Engineering

Abstract

The Online Attendance System was developed to enhance the efficiency and convenience of managing student attendance records. The system comprises two primary user groups: "Users" (students) and "Administrators" (instructors or administrative staff). For students, the system provides functionalities such as logging in via LINE, recording attendance for scheduled classes, and submitting advance leave requests for personal or medical reasons, thereby facilitating streamlined communication and management. For administrators, the system offers tools to monitor attendance records, including check-in status, instances of tardiness, absences, and approved leave, as well as the ability to create and manage class sessions and courses for attendance tracking purposes. This system was implemented as a web application integrated with the LINE API to support secure login and authentication processes. The database architecture was designed to efficiently store student information, course details, attendance records, and leave applications. Overall, the Online Attendance System serves as a vital tool to support instructors and administrative personnel in accurately tracking and evaluating student attendance with enhanced precision and operational efficiency.

Smart Qualified Quality of Fruits Detection Device

Vitchaya Tatiyamongkolchai, Paponwat Suchotikapan, Wit Angsuwotai

Advisor
Dr. Ravivudh Khun-in, Asst.Prof. Watcharapan Suwansantisuk
Asst.Prof.Dr. Werapon Chiracharit

Electronics and Telecommunication Engineering

Abstract

Fruits are highly beneficial foods and they are primary food items in human consumption. However, there are some issues with the standard originating from the same source but varying in quality, and to access is difficult for small-scale operators or the general public. To address this problem, the proposed a device is functioned to detect moisture, temperature, and ethylene, in which they are the main factors contributing to fruit spoilage, then display the results through a real-time display via an LED screen. The goal of this method is to observe food deterioration before clear visible signs appear and to let the system be accessible to small-scale operators or the general public as the proposed device is affordable.

Temperature and Humidity Control for Suitable Mushroom Cultivation

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Advisor
Dr.Ravivudh Khun-in

Electronics and Telecommunication Engineering

Abstract

Thailand is a country with hot weather throughout the year and is not suitable for growing some types of mushrooms. And the hot weather often causes the mushrooms that are cultivated to spoil. The creator proposes a project that helps solve the problem of inappropriate temperature and humidity. This book discusses the working principles of the Ganoderma lucidum greenhouse. Experimental-sized Lingzhi shiitake and Bhutanese mushrooms equipped with tools to control temperature and relative humidity in a closed system through an Arduino board that is controlled by a C+ language computer program so that the experimental-sized mushroom cultivation house can operate automatically without the need for users. The temperature and humidity must be controlled manually. This is because the equipment in the greenhouse will work in conjunction with a computer program that has been written and will have sensors that can measure temperature and relative humidity. Let the greenhouse have a temperature and relative humidity that meets the needs of the Ganoderma lucidum. Lingzhi mushrooms Shiitake mushrooms and Bhutanese fairy mushrooms are used for growing.

Garbage trap net with marvellous sensor

Mr.Tanapongsakot kitcharoenkha, Mr.Promporn choochote, Ms. Piyada Panyasai

Advisor
Asst. Prof. dr. Watcharapan Suwansantisuk, Asst. Prof. dr. Werapon Chiracharit
Dr. Ravivudh Khun-In

Electronics and Telecommunication Engineering

Abstract

The disposal of plastic waste into the ocean has severe environmental and human health impacts. Microplastics, which form as plastic waste breaks down, can accumulate toxic substances and pose health risks to both marine animals and humans. Addressing plastic pollution requires multi-sectoral cooperation, including policy reforms, public awareness campaigns, and an engineering solution to reduce plastic wastes already existed in riverways. This project developed a waste-trapping net equipped with sensors to monitor the accumulation of debris in real-time. The system allows for remote monitoring of the net's status through built-in sensors that measure the volume of collected waste. The data is processed to provide users with up-to-date information about the equipment’s condition on whether the net is full, enabling efficient waste management. By integrating this technology with local waste management systems, communities can respond more effectively to pollution hotspots.

Water barrier for plastic waste removal

Tanatach Janthapun, Pragon Sanggoh, Chanathip Khanthaseema

Advisor
Asst. Prof. Watcharapan Suwansantisuk, Ph.D., Assoc.Prof.Dr.Weerapong Chewpraditkul
Assoc. Dr. Ravivudh Khun-in

Electronics and Telecommunication Engineering

Abstract

Plastic waste in water is critical global problem. Threatening marine life and food chain. This project is a water barrier system to trap and collect plastic waste from canals before it reaches rivers and the sea. The solution is cost-effective and friendly for environment. Device using reusable materials and complies with regulations, aligning with the UN SDG.

Pretreatment of fish tank water

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Advisor
Asst. Prof. Thorin Theeradejvanichkul

Electronics and Telecommunication Engineering

Abstract

Global warming increasingly affects all living organisms each year, disrupting ecosystems through rising temperatures, pH changes, and shifting environments. These changes make it hard for many species to adapt, potentially leading to extinction. Fish are among the affected, as global warming contributes to their deaths in both home aquariums and fish farms.In addition to temperature changes, fish tanks face challenges such as bacterial growth from leftover food, which harms fish health and alters water quality, including pH levels. These issues can make fishkeeping more difficult and threaten fish survival.To address these problems, the project team developed a smart prototype fish tank system. It features three main automated functions: temperature control, automatic feeding, and pH level adjustment. The goal is to help home fishkeepers maintain healthier environments for their fish.In the future, this system could be expanded for use in large-scale fish farms that need efficient, intelligent solutions to support higher fish populations.

Face Airborne Filtration System (FAFS)

Mr. Euri Genesis Capiz, Mr. Siriwut Sangaunwong, Mr. Piyawat Lochingchairit

Advisor
Asst. Prof. Thorin Theeradejvanichkul, Ph.D.

Electronics and Telecommunication Engineering

Abstract

Millions of people worldwide are impacted by air pollution and the issue has only been growing. The World Health Organisation estimates that the health effects of air pollution cause 2.4 million deaths annually. While IQAir has the following statistic: Of 62 million people who die per year (as of 2021) 8.1 million deaths have air pollution as the main risk factor ranking it 2nd overall among all major risk factors of death worldwide. Due to its effects on climate change as well as on public and individual health with rising rates of sickness and mortality due to air pollution, it is one of the biggest issues of the modern day.

There are many different contaminants that are significant contributors to human illness. One big constituent of the issue is Particulate Matter (PM), which are particles with varying but extremely small diameters that enter the respiratory system through inhalation and can lead to severe health complications. This includes cancer, reproductive and cardiovascular disorders, and malfunctions of the central nervous system and reproductive system. PM2.5 refers to fine dust particles up to 2.5 micrometers in diameter.

To combat this growing issue, we have developed an electronic device that can both filter out and detect PM2.5 levels to help protect users as well as raise awareness of the dangers of air pollution. The device is wearable and comes in the form of a mask to aid with portability and ease of use. This project addresses the detrimental effects of air pollution on people’s health and benefits both the environment and society as the device will be created using recycled materials.

Through a few revisions to our initial mask design, filter testing, fit testing and battery testing we have completed a prototype that we believe meets our main objective of establishing a product that can help people breathe cleaner air in areas with excess levels of PM2.5.

Evaluation of the Effectiveness of Digital Technology Adoption in an Organization: Case Study of Document Management

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Advisor
Asst. Prof. Chirasil Chayawan

Electronics and Telecommunication Engineering

Abstract

This project investigates the application of digital tools in online document management, with a focus on implementing Robotic Process Automation (RPA) to streamline processes, reduce processing time, and minimize resource consumption. Traditional workflows often involve manual tasks, leading to inefficiencies and delays. By utilizing RPA for repetitive activities, such as data entry, file organization, and document routing, workflows become more structured, reducing human error and increasing efficiency.

The effectiveness of the RPA approach is assessed using the Digital Transformation Index (DTI), which allows a comparison between digital and traditional document management systems. The DTI evaluates key factors such as operational efficiency, user accessibility, and overall system performance.

The results demonstrate the potential of digital tools in improving organizational efficiency and adaptability. By integrating these technologies into routine operations, organizations can not only enhance productivity and responsiveness but also ensure better preparedness for future technological advancements.

The organization currently lacks precise tools to evaluate the cost-effectiveness of replacing traditional processes with digital solutions. Image processing is being explored as a supporting

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Advisor
Asst. Prof. Chirasil Chayawan

Electronics and Telecommunication Engineering

Abstract

Nowadays, Entrepreneur is looking to use technology to replace the traditional work processes. Using technology to change old processes for business to make them more fit for business in the constantly changing digital world.
However, using technology to replace the traditional process may not be worth the cost. Furthermore, an organization lacks the instruments to appropriately assess the worth of using technology devices to replace the previous work method. As a result, we explored and researched solutions to this problem, including applying the DTI (Digital Transformation Index) to determine the value of technology in the organization and building a product quality inspection system based on image processing technology. This system will automatically analyze the product's qualities in order to classify them as either quality or non-quality. The data will then be collected for value evaluation by comparing the results of the previous method to those of the organization's use of image processing technology.

Air pollution reduction device at bus stop

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Advisor
Asst.Prof.Dr. Suwat Pattaramalai

Electronics and Telecommunication Engineering

Abstract

Air pollution is one of the most pressing environmental issues directly affecting public health and quality of life, particularly around bus stops. To address this issues, an air pollution reduction device has been designed specifically for installation at bus stops. This device is designed to capture airborne particulate matter and improve overall air quality. Its structure is made from galvanized steel, providing high durability against weather conditions and excellent resistance to rust. The device features a real-time air quality monitoring system, primarily using sensors to detect fine particulate matter (PM2.5), while also supporting measurements of PM1, PM10, relative humidity, carbon dioxide (CO_2), and ambient temperature. For filtration, it incorporates HEPA filters and carbon dioxide filters to reduce PM2.5 and CO_2 levels. A built-in fan system assists in air intake and exhaust. Additionally, the device can be connected to the Telegram application for remote control and real-time data display, enhancing the convenience of monitoring air quality and managing system performance. Preliminary testing shows that the device can reduce airborne particulates and toxic gases by approximately 30%.

Class A transimpedance power amplifier using SiC JFET

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Advisor
Asst.Prof.Dr.Kamon Jirasereeamornkul

Electronics and Telecommunication Engineering

Abstract

The project aims to design a Class-A power amplifier using a Transimpedance Amplifier circuit combined with JFET transistors to amplify audio signals. The circuit will first be simulated using LTspice, then built and tested Based on harmonic distortion and efficiency

Monitoring The Health Condition of Dairy Cows (KomilO Project)

Ms. Htoo Wint Htal , Ms. Mya Thinn Thinn Kyu, Ms. Phyo Pyae Pyae Zaw

Advisor
Assoc. Prof. Rardchawadee Silapunt, Ph.D., Salinee Choowitsakunlert, Ph.D.

Electronics and Telecommunication Engineering

Abstract

The KomilO Project aims to develop an affordable health monitoring system for dairy cows, addressing the gap in traditional farming practices that lack timely health detection. This system uses a neck tag developed with IoT sensors and deep learning algorithm to monitor cows' health, which offers a cost-effective solution for farmers, particularly in rural areas. The neck tag records body temperature and movement data every second. Designed for rural farmers, the system is easy to use, non-invasive, and supports data-driven herd management. Integration of modern technology in this project aims to increase farm efficiency, productivity, and overall animal welfare, contributing to the broader social and economic sustainability of rural communities. By utilizing this system, farmers can reduce veterinary visits while also promoting sustainable farming practices that align with the United Nations' Sustainable Development Goal No. 12 on responsible consumption and production.

Current methods for checking the quality of cow's milk are inconvenient for veterinarians

Nay Chi, Nang Yein Mo Hsai

Advisor
รศ.ดร. ราชวดี ศิลาพันธ์, ดร. สาลินี ชุวิทย์สกุลเลิศ
อ.เอื้อพงศ์ ใยเจริญ

Electronics and Telecommunication Engineering

Abstract

Mastitis, a common and harmful udder infection in dairy cows, affects animal health, milk quality, and farm profitability. Early detection is essential to prevent these adverse effects, but traditional diagnostic methods often lack real-time monitoring capabilities. This project addresses this challenge by developing a system that continuously monitors milk's electrical conductivity and pH levels—two critical indicators of mastitis. Data from these sensors are first collected by an Arduino Uno and then transmitted to an ESP32 microcontroller. The system uses Wi-Fi to upload real-time data to a Thingsboard server, allowing farmers to monitor their cows' health from mobile devices conveniently. Additionally, the project includes an LCD screen for local data visualization, ensuring continued usability even in the absence of an internet connection. This cost-effective solution prioritizes accessibility to support early mastitis detection and improve dairy farm productivity, making it particularly valuable for rural farmers.

Application of Radio Frequency Signals in Milk Quality Assessment Combined with CMT Testing

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Electronics and Telecommunication Engineering

Abstract

This project aims to address the challenges faced by the dairy industry in maintaining milk quality and protecting dairy cow health, particularly concerning mastitis, a major issue that affects milk production efficiency and consumer safety. The California Mastitis Test (CMT) is currently a widely used preliminary screening method for mastitis, relying on visual assessment to classify changes in milk samples. However, this method has limitations in accuracy due to external factors such as variations in human evaluation and environmental conditions.

To overcome these limitations, this project applies high-frequency radio frequency (RF) technology and antenna-based sensing to detect mastitis in dairy cows. The developed device analyzes the reflection coefficient of RF signals in milk samples to determine whether the milk is affected by mastitis. This approach reduces reliance on subjective visual assessments and improves the accuracy of milk screening.

This project is expected to enhance the efficiency and reliability of mastitis detection, ensuring more accurate separation of affected milk, reducing the risk of contamination in the production process, and improving dairy cow health management. Ultimately, this innovation will contribute to the long-term sustainability of the dairy industry.

SMART COLLAR FOR DAILY COW HEALTH

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Advisor
Assoc. Prof. Dr. Rardchawadee Silapunt, Dr. Salinee Choowitsakunlert

Electronics and Telecommunication Engineering

Abstract

This project aims to develop and apply sensor technology to monitor the health conditions of dairy cows using temperature and accelerometer sensors. The MLX90614 sensor measures body temperature, while the MPU6050 sensor monitors movement and behavior. An ESP32 microcontroller processes and compares the data collected from these sensors with predefined standard values. If abnormalities are detected, the system sends an alert to notify farmers to check the health of their dairy cows.

The development of this project will help farmers monitor their cows' health accurately and promptly, reducing the risk of severe illness and the death of dairy cows. It will also help increase milk yield and enhance the overall quality of life of the cows. Applying IoT technology to monitor dairy cow health can improve the efficiency and sustainability of dairy farming.

Equipment readiness check in the lab

64070502480 Thiraphong Phunsawat, 64070502488 Puchits Sooksumran, 64070502498 Sukit Tohyee

Advisor
Auapong yaicharoen

Electronics and Telecommunication Engineering

Abstract

This project report focuses on the development of a device designed to inspect the operational status of Integrated Circuits (ICs), specifically to ensure their readiness for use in laboratory environments. The inspection device is capable of testing ICs of the 7400 series. If any faults or damage are detected, the system will promptly notify the supervising instructor, allowing for immediate repair or replacement of the IC. This process significantly enhances the efficiency and safety of IC usage in laboratory settings.

Additionally, this project includes the development of a Flutter-based application aimed at improving lab management and equipment readiness verification. The application allows instructors and lab technicians to log and monitor lab activities and equipment usage. Students can view the status of lab equipment and submit requests to add or remove items as needed. The system also provides real-time notifications to users, including instructors and technicians, about important updates or changes within the laboratory.

By offering convenience and resource efficiency, this application contributes to more effective laboratory management. It streamlines the access to and administration of lab resources, ultimately supporting both instructors and students in maintaining a high standard of operational efficiency and safety in the laboratory.

Equipment readiness inspection system in the laboratory

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Advisor
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Electronics and Telecommunication Engineering

Abstract

Currently, laboratories are equipped with a large amount of equipment used in research and study. As a result, the process of preparing and verifying the readiness of this equipment is time-consuming and prone to errors during lab preparation or equipment return after use. To address this issue, this project proposes the development of an IoT system for equipment readiness inspection using RFID technology integrated with an ESP32 microcontroller board. This system helps improve laboratory management by allowing users to start the inspection process via the ESP32 board, after which the RFID module reads data from RFID tags attached to each piece of equipment. The collected data is then transmitted back to the ESP32 and forwarded to a database via Wi-Fi communication to record the equipment status and display the information through a website. This system supports two types of users in which students can access the website without logging in to check and borrow equipment on their own, while laboratory technicians can log in to check equipment status, add or remove equipment items in the system, and review students' borrowing and return records. This system effectively reduces inspection time, improves accuracy, and minimizes the risk of using malfunctioning or unprepared equipment.

Dew Point Control by Building Automation System

Ms. Kingkamon Yuyod, Mr. Phongsathorn Gridanont

Advisor
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(Salinee Choowitsakunlert, Ph.D.

Electronics and Telecommunication Engineering

Abstract

Condensation caused by high humidity levels is a prevalent issue in many building environments, leading to various problems such as mold growth, structural damage, and discomfort for occupants. These issues are particularly challenging for companies operating in regions with fluctuating humidity levels or in industries where precise humidity control is critical. Traditional methods of humidity control often fall short, leading to the need for a more reliable and automated solution.
The objective of this project is to develop a Dew Point Control System that can efficiently manage and control humidity levels within a building. The system is designed on a smaller scale to replicate real-world scenarios and utilizes a Nuvoton LB NUC140 board for its core functions. The Nuvoton LB NUC140 is chosen for its robust communication and control capabilities, which are essential for the seamless operation of the system.
This research project aims to demonstrate the feasibility and effectiveness of a building automation system in controlling dew point and humidity levels. By leveraging the capabilities of the Nuvoton LB NUC140 board and integrating advanced control mechanisms, the proposed system offers a scalable, efficient, and reliable solution to humidity-related problems in building environments. The successful implementation of this system can significantly improve indoor air quality, prevent condensation, and enhance the overall comfort and safety of building occupants.

Road Detection without Lane Markings for Autonomous Vehicles

Mr.Sittiporn sangtit, Mr.Nattapong Wattanasit, Mr.Patcharapol Ratchatapaiboon

Advisor
Asst. Prof. Werapon Chiracharit

Electronics and Telecommunication Engineering

Abstract

Currently, AI technology plays a vital role in autonomous driving systems; however, challenges remain when operating on rural roads or environments without clear lane markings, as most technologies are primarily designed for urban roads. This research presents an improvement of the YOLOP model by retraining it with a newly developed dataset consisting of 4,000 images, featuring various challenging conditions such as potholes, waterlogged surfaces, blurred boundaries between road and roadside, and heavy shadow interference. Experimental results demonstrate that the enhanced model outperforms the original, with Recall form object detection increasing from 84.9% to 91.3% and mIoU form drivable area segmentation improving from 80.04% to 92.6%. The developed dataset and model significantly improve detection accuracy and safety in complex autonomous driving environments.

Design of a control system for calibrating and checking the performance of the tester board.

Mr. Patiphol Phumam, Mr. Parunchai Sritarasanguan, Ms. Kanyarat Bamrungkwaen

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Dr. Ravivudh Khun-in, Ph.D.

Electronics and Telecommunication Engineering

Abstract

This project presents the design of a control system for calibrating and checking the performance of the tester board used at Silicon Craft Technology Public Company Limited. The company developed its own tester boards to reduce costs and enhance testing flexibility. However, using a newly developed tester board without calibration may affect the accuracy of test results. The proposed system was developed for verifying and calibrating tester boards, along with a control board compliant with IPC-2221 standards and ISO 225140-7 verification procedures. This system includes calibration using ISO/IEC 17025-certified equipment and a GUI control program for operation. Users can initiate the verification process by pressing a button in the program, which then verifies, processes, and displays any errors. Calibration data is stored in a computer for further analysis. The results show that the system accurately and effectively verifies the performance of tester boards. Additionally, the program helps reduce errors and improve usability. The system can be expanded to support a broader range of tests and automatic error analysis, such as detecting incorrect connections or voltage issues, to reduce manual inspection and enhance production and testing standards for electronic devices.

IoT-Driven Environmental Monitoring for Server Room Security

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Electronics and Telecommunication Engineering

Abstract

Modern-day data centers and server room environments require robust monitoring systems to ensure operational stability and security. This project presents the development of an IoT-based monitoring system utilizing ESP32 NodeMCU DevKit V1 board, a compact powerful microcontroller designed for IoT applications. The system integrates the BME280 sensor, which measures temperature, humidity, and atmospheric pressure, and the MQ2 sensor, which detects various gases, including LPG, , and smoke.

The project aims to monitor environmental conditions in server rooms, sending immediate alerts when readings fall outside predefined thresholds for temperature, humidity, or gases levels. These alerts are communicated through a LINE application, ensuring real-time responses to potential hazards. Data collected from the sensors is stored in an InfluxDB database and visualized using Grafana, providing a comprehensive GUI that allows users to continuously monitor and review environmental conditions. This system conforms to the ISO/IEC 27001 standard for information security management and the IEEE Std 7002™-2022 standard concerning system privacy needs identification and privacy impact assessment, which are standards used by UCS (Universal Communication Systems Co., Ltd.). Experimental results confirm that the proposed system effectively monitors and alerts on critical environmental parameters, thereby enhancing the safety and security of server rooms.

Design of a Process Flow Diagram to Check the Access Control

Mr. Kiattipoom Boonsriudomsuk , Mr. Chaowanon Jarusmatusorn

Advisor
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Electronics and Telecommunication Engineering

Abstract

TCC Technology has been assigned to manage the Access Control system within residential rooms, bathrooms, and offices, which includes checking the condition of Access Control devices such as Buzzer alarm, Emergency Break Glass, Exit push button, Magnetic lock, and door contact within the One Bangkok project. Given the large number of rooms in the project, the traditional inspection method is slow and prone to errors, which may affect the community in terms of time, safety for people entering the One Bangkok project, and unnecessary equipment replacement. This project aims to design a process map for inspecting the Access Control system and evaluate the proposed process map based on the criteria desired and accepted by stakeholders. The project begins with data collection through surveys with team members, followed by analyzing the gathered data to design a process map. The designed process map is then tested in real usage scenarios using engineering design methods, including designing and considering the process map until it meets the most accurate requirements. Environmental and social needs are incorporated into the design while operating under imposed conditions, with a timeline of 6 months. This project is beneficial in reducing inspection time, improving the efficiency of the inspection process, and enhancing the safety of individuals entering the buildings within the One Bangkok project. TCC Technology and interested parties can study and apply it in practice.

Study and Design Hardware Checker Manual for HS92

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Advisor
Assoc.Prof.Dr. Kamon Jirasereeamornkul, Assoc.Prof.Dr. Thorin Theeradejvanichkul

Electronics and Telecommunication Engineering

Abstract

This project was undertaken in collaboration with Analog Devices (Thailand) Co., Ltd., a company specializing in the design, manufacturing, and testing of integrated circuits (ICs) for analog, digital, and mixed-signal applications. These circuits are used in computers, peripherals, and electronic devices. Analog Devices is a global leader in high-performance semiconductors for signal processing.

The objective of this project is to study the TPE (Test Product Engineer) department's processes, specifically focusing on the development of a testing manual for the HS92 hardware. Currently, HS92 hardware is tested on the production line, where boards frequently fail, often several times a week. The repair process for each board is time-consuming, and engineers are required to fix them due to the complexity and difficulty of understanding the schematic. Additionally, the schematic must be used alongside software, which further increases the difficulty for technicians. Therefore, we aim to create a comprehensive manual for testing various components of the HS92 hardware, organizing it to make the hardware circuitry easier to understand.

The components we will cover in the testing manual include the 25LC256 (256-K SPI Bus Serial EEPROM), SHT35 Humidity and Temperature Sensor, MAX4638 Single 8:1 Low-Voltage Analog Multiplexers, and Capacitors at DUT. The testing procedures will be based on the datasheets of these components. The goal is to ensure that the tests are conducted with the utmost accuracy and efficiency, minimizing errors. Once the testing has been thoroughly validated, it will be considered complete and ready for practical application.

Design and Development of Experimentation of a Communication System for the Engineering Model of the TSC-1 Satellite

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Electronics and Telecommunication Engineering

Abstract

As part of a cooperative education internship at the National Astronomical Research Institute of Thailand (Public Organization), a study was conducted to develop a communication subsystem for the TSC-1 satellite's engineering model. The project focused on three key components essential to the satellite's development: (1) Orbital Path Loss Simulator for TSC-1 Satellite. This simulation tested the communication system's performance under various attenuation factors, such as ionospheric loss, atmospheric loss, rain attenuation, cloud attenuation, and free space path loss. The results be more specific that the system-maintained signal strength within the required specifications; (2) Design of UHF Bandpass Filter for Ground Station. A UHF bandpass filter was redesigned to improve satellite signal reception. Using ANSYS Electronics Desktop software, the circuit was optimized, and testing across a wide temperature range (-40°C to 85°C) showed that the filter met design specifications; and (3) SDR-Based Satellite Ground Station Transceiver. This system was designed to encode and decode the AX.25 protocol and support Frequency-Shift Keying (FSK) modulation. Integrated with the SatNOGS network,
it successfully decoded satellite signals at buad rate 9600 bps. Testing demonstrated accurate data transmission and reception, with precise alignment to transmitted commands. These interconnected components collectively contributed to the successful development of the communication subsystem for the TSC-1 satellite's engineering model, which is still under development at the National Astronomical Research Institute of Thailand (Public Organization).

Keywords: TSC-1 satellite, Path loss, Attenuation, UHF, Bandpass Filter, Temperature Chamber, AX.25, FSK Transmitter and Software defined radio.

Web Application for Daily Tracking of Building Progress

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Electronics and Telecommunication Engineering

Abstract

This project arises from the need to solve the check-in and check-out tracking issue for the mobile team, which plays a crucial role in installing and distributing telephone and internet signals within the construction site. The project has designed a web application to monitor work attendance and provide weekly progress updates. The "Web Application for Daily Tracking of Building Progress" project is supervised by T.C.C. Technology Co., Ltd. and the mobile team staff from Huawei Technologies (Thailand) Co., Ltd. The objectives of this project are as follows: (1) to design a system for managing check-in and check-out data, (2) to create a website that collects, summarizes, and displays data according to specified formats, such as graphs and tables, and (3) to develop an automatic notification system to alert users via email in case of missed check-outs. The Web Application is built using Google App Script, a scripting platform developed by Google, in conjunction with HTML, CSS, and JavaScript. This Web Application development helps the organization efficiently manage the team's check-in and check-out data, systematically track weekly progress, and enhance the safety of workers on the construction site.

Designing systems and tools for customizing and securing networks in organizations

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Advisor
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Electronics and Telecommunication Engineering

Abstract

In the current era, communication networks play a crucial role in driving the operations of various organizations and agencies. The stability and continuity of the network are essential factors for the rapid transmission of data and service delivery. If the primary communication path encounters problems, it can significantly impact operations

This project aims to develop tools and solutions that facilitate efficient network management, covering design, analysis, monitoring, and improvement in four main areas: 1. Designing the device system and testing the performance of backup routes; 2. Developing tools that can analyze and monitor various network settings; 3. Designing and testing approaches for data center networks; and 4. Designing tools for analyzing and monitoring the network environment before implementing switches

The expected results of this project include comprehensive tools and solutions that aid in network management, from problem prevention to system improvement, helping to reduce complexity and increase confidence in network administration.

Statistical Comparisons and Percent Yield Analysis for Semiconductor Test Qualification Evaluation

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Advisor
Asst.Prof.Dr. Thorin Theeradejvanichkul, Dr.Salinee Choowitsakunlert
Asst.Prof.Dr. Kamon Jirasereeamornkul

Electronics and Telecommunication Engineering

Abstract

This research focuses on testing the quality of NOR Serial Flash Memory and Automotive Microcontrollers for the automotive industry. It begins with the functional testing of devices to measure performance and operational effectiveness. Subsequently, the study compares the test results between pre-electrical test (QA pre-electrical test) and post-electrical test (QA post-electrical test) after simulating the products in real-world usage. The aim is to identify factors affecting production and to compare the quality of testing between machinery and products from Singapore and Thailand to evaluate manufacturing efficiency and standards. The findings highlight differences in quality and performance that impact the overall production process, which can be utilized to improve future quality and efficiency in manufacturing effectively.

Development and Design of Automated Network-as-a-Service (NaaS) Using Open-source Network Operating Systems on Public Cloud

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Advisor
Dr.Salinee Choowitsakunlert, Dr.Ravivudh Khun-in

Electronics and Telecommunication Engineering

Abstract

The concept of Network as a Service (NaaS) allows organizations to efficiently manage their networks by using cloud-based networking services. Currently, NIPA Technology Co., Ltd. employs an open-source network operating system in conjunction with NaaS. Due to the need for manual configuration on the open-source network operating system every time, it causes difficulties and complexity in the workflow.

This project focuses on integrating NaaS with a flexible and customizable open-source network operating system (NOS) according to the organization's needs. The goal of the project is to compare various open-source NOS platforms to evaluate how well they can incorporate automation technology and how effectively they can work with the company's NaaS, ultimately simplifying network management for both service providers and customers.

Rack Diagram Design and Network Design Planning Applied for SME Solution

Chanatha Saanan, Phanakan Khamphake

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Asst. Prof. Watcharapan Suwansantisuk

Electronics and Telecommunication Engineering

Abstract

In today's landscape, having a single, localized data center can pose limitations in terms of efficiency and operational flexibility. Establishing multiple data centers interconnected via the internet and cloud-based systems enhances agility in data management and enables quicker responses to customer demands. To address this, we have designed an automated rack-building program using VBA (Visual Basics for Application) to reduce time and improve accuracy in data management. This program works by extracting information from Bill of Quantities (BOQ) files to allocate various equipment into racks and generate 2D visualizations in Excel, significantly speeding up the workflow and ensuring higher accuracy.

Additionally, the concept of urban automated vertical farming is gaining popularity, as it significantly enhances production efficiency while conserving resources. Designing the network infrastructure for these farms is critical to ensuring stable and secure connections for IoT devices. Huawei Technologies (Thailand) Co., Ltd. has selected network equipment capable of supporting IoT device connections and providing comprehensive signal coverage across the entire farm, enabling real-time control and monitoring of the farm's systems. This solution enhances the stability and security of urban automated vertical farms, supporting future scalability. It represents a technological advancement that improves resource management and production efficiency in farming operations.

Design of an Optimization Solution for a 5G-NSA Network on 700-Megahertz

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Advisor
Prof. Dr. Wuttipong Kumwilaisak

Electronics and Telecommunication Engineering

Abstract

In recent years, the demand for high-quality mobile network experiences has grown significantly, particularly with the widespread adoption of 5G technology. Users and customers increasingly expect consistent signal coverage and high-quality network performance, even as new technologies are deployed. In the Ladkrabang area, where this project is focused, network users have expressed concerns about poor signal strength and inconsistent service quality, affecting daily communication and access to digital services.

At the same time, customers emphasize that ongoing 5G network optimization efforts must not compromise the performance of the existing LTE network. Maintaining seamless operations during this transition is essential to ensure user satisfaction and avoid disruptions to service. Additionally, local residents are strongly concerned about environmental impact, particularly the preservation of green spaces. Any infrastructure deployment must, therefore, be carefully planned to avoid reducing green areas, which are vital for the community's well-being and urban ecology.

Addressing these concerns is critical not only for improving the technical performance of mobile networks but also for ensuring community support, environmental responsibility, and alignment with customer expectations. Optimizing the 5G NSA (Non-Standalone) network in a way that balances technical improvements with ecological and user needs will ultimately contribute to a more sustainable and customer-centric mobile communication infrastructure.

Enhancing the Efficiency of Integrated Circuit Testing Tools and Building Knowledge, Including the Development of Personnel within the Organization

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Advisor
Assoc. Prof. Rardchawadee Silapun

Electronics and Telecommunication Engineering

Abstract

Analog Devices (Thailand) Co., Ltd. has long been involved in the design, manufacturing, and testing of integrated circuit (IC) devices, continuously improving operational efficiency. Enhancing productivity within IC manufacturing is a key strategy that enables the organization to adapt and remain competitive in the rapidly evolving electronics industry. The company has focused on process and personnel development to meet increasing demands for speed and accuracy.

This initiative comprises two main aspects. The first involves enhancing IC testing processes, particularly the migration from LTX-TS88 testers to ASL1K testers. This transition includes the development of a new function for automatically retrieving .csv files from the server, aimed at improving testing speed and accuracy while minimizing errors from manual data handling.

The second aspect emphasizes skill development for Test Development Engineering (TDE) and Failure Analysis (FA) personnel. By equipping employees with the ability to adapt and learn effectively, the organization ensures efficiency and responsiveness to industry demands.

Design of a Demonstration Kit to Illustrate a Fiber-to-the-Room Solution

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Advisor
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Electronics and Telecommunication Engineering

Abstract

Fiber-to-the-room (FTTR) technology is a new in-building network technology based on fiber optic communication that enables fast and reliable data transmission. Generally, most building technicians lack the knowledge to manage the fiber cables used in FTTR technology on their own. Therefore, fiber service providers, such as Interlink, along with their installation technicians and customers, need to understand and visualize the process before proceeding with the actual installation.

This project aims to design, install, and test the parameters of a solution model to demonstrate FTTR technology. The project's methodology includes gathering user requirements, converting these requirements into engineering specifications, identifying design objectives, defining acceptable parameter values, designing a demonstration kit by selecting the best options, planning the FTTR system installation, preparing installation equipment, carrying out the installation, measuring and verifying the parameters, and recording the results.

The outcome of this project is a solution model that meets user requirements and addresses social and environmental needs. This project is beneficial in preventing and reducing installation errors on-site, increasing convenience for installation technicians, and improving overall performance assessment, including parameter measurements from the receiver to the transmitter.

Design of methods to optimize a 4G antenna system operating at 1800 MHz to enhance signal quality for Huawei Technologies (Thailand) Co., Ltd.

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Advisor
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Assoc. Prof. Dr. Raungrong Suleesathira, Ph.D.

Electronics and Telecommunication Engineering

Abstract

Currently, Huawei Technologies (Thailand) Co., Ltd. is consolidating signal towers to reduce signal overlap at each base station, lower investment assets, and minimize resource usage related to base station equipment. After the consolidation, some areas experienced insufficient signal coverage, requiring further improvements. This Design of methods to optimize a 4G antenna system operating at 1800 MHz to enhance signal quality for Huawei Technologies (Thailand) Co., Ltd. project aims to enhance signal quality in the area from Ratchadaphisek 3 Alley to the Chan Mueang Alley. The assignment involves addressing coverage issues in 3 specific areas: Chan Mueang 2 Alley, Chan Mueang 4 Alley, and Ratchadaphisek 3 Alley, Section 4-12. Various methods exist for improving signal coverage, such as modifying antenna physical characteristics, increasing transmission power, or constructing new base stations. The project team chose the Electronic Tilt (E-Tilt) method for its resource efficiency and effectiveness in enhancing coverage. The E-Tilt was adjusted for 5 cells: A_01, B_01, B_02, C_03, and E_01. Post-adjustment, measurements in the specified areas showed that RSRP and SINR values met the PAT Work Control standards, with RSRP exceeding -103 dBm in 90% of the area. SINR values below or equal to 0 dB were under 10%, while those equal to or above 10 dB were at least 30% of the area. Additionally, comparisons of LTE user usage, including DL PRB Utilization and DL Throughput per User before and after the adjustments, confirmed compliance with Huawei's LTE Criteria. The criteria set a threshold of less than 70% PRB Utilization and at least 2.5 Mbps DL Throughput per User. The results indicated that both metrics passed the standards, demonstrating that adjusting the E-Tilt alone effectively resolved signal coverage issues in the Ratchadaphisek 3 Alley to Chan Mueang area.

Welding Turntable

Punn Kampa, Kantaphong Panya, Wuttichai Charoenrat

Advisor
Dr. Somporn Peansukmanee, Asst. Prof. Dr. Chettapong Janya-anurak

Production Engineering

Abstract

This project aims to design and develop a welding turntable and tilt adjustment device to work in conjunction with a welding robot in the production process of Pipe on Plate workpieces. The project focuses on controlling the temperature at the welding area to remain within an appropriate range throughout the operation, as heat accumulation during welding can cause problems such as cracking of the workpiece structure, which impacts the overall quality of the weld.

The developed system can record the welding position and measure the temperature in real time. When the temperature at the welding point exceeds the specified limit, the system automatically pauses the operation and adjusts the welding position to an area with a lower temperature, helping to reduce heat buildup and maintain the quality of the workpiece throughout the process.

This development enhances the accuracy of welding process control, reduces the risk of defects caused by excessive heat, and improves production efficiency in automated welding, especially for Pipe on Plate workpieces that require continuous and consistent weld quality.

High-speed inspection Technique of Surface railway Defects Based on Motion Induced Eddy Current Testing

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Advisor
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Production Engineering

Abstract

Thailand's rail system has transitioned from a minor role in transportation to becoming a primary mode of travel and freight transport, driven by government investments in double-track rail development. High-speed rail projects, such as the Thai-Chinese railway, are set to enhance capacity and efficiency. However, increased rail usage has led to higher risks of surface defects like rolling contact fatigue, head checks, and squats, with 5% of rail-related accidents in early 2022 linked to track issues.

Current non-destructive testing (NDT) methods, including Visual Testing, Magnetic Particle Testing, Ultrasonic Testing, and Eddy Current Testing, face challenges in accuracy, speed, and sensitivity during high-speed inspections. To overcome these limitations, this study proposes an advanced induced-motion eddy current testing technique using self-induced electromagnetic principles and Magneto-Resistive (MR) sensors. This approach aims to enable high-speed, precise rail inspections, improving safety and aligning with international standards.

Study on a processing methods of survey and inspection signal for sub-surface structures with Electromagnetic Methods

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Production Engineering

Abstract

The exploration and assessment of underground structures and objects are critical for effective infrastructure management. However, since these objects are not visible to the naked eye, specialized surveying equipment is required. Due to the complexity and relatively low accuracy of current signal interpretation methods for these devices, this project presents the development of a software system for processing signals by applying machine learning techniques and statistical analysis to enhance the accuracy of material classification, underground structure localization, and stray current leakage detection.

The project focuses on three types of devices: Pipe and Cable Locator, Ground Penetrating Radar (GPR), and Stray Current Mapper, all of which primarily rely on electromagnetic principles for underground surveying. The system is designed to achieve a target accuracy of no less than 80%. In addition, the Stray Current Mapper has been upgraded to perform semi-autonomous movement based on GPS coordinates, with an average positional error not exceeding 5 meters.

The developed system can classify three types of underground materials—metal, plastic, and concrete—and can accurately detect stray current leakage areas. Testing results demonstrate that the system's signal interpretation and navigation performance meet the specified accuracy criteria. This project provides a foundation for further applications, such as the development of underground infrastructure mapping and effective maintenance planning

Keywords: underground structure inspection, signal processing, material classification, stray current detection.

Design and development of acoustic emission system for long term structural health monitoring

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Production Engineering

Abstract

This thesis presents the design and development of an acoustic emission (AE) system for long-term structural health monitoring. The primary objective is to create a compact, robust, and field-deployable system that can effectively operate in real-world worksite environments. The hardware system is based on a microcontroller platform, capable of collecting AE signals and extracting essential AE parameters to enable efficient and scalable data acquisition while minimizing system complexity and size. To complement the hardware development, a dedicated software platform was developed to perform post-acquisition data analysis. The software facilitates the classification of acoustic events, effectively distinguishing between background noise and genuine crack signals. Furthermore, it provides an assessment of damage severity, offering users critical insights into the structural health condition. This innovation supports preventive maintenance, enhances data management, and enables the early detection of structural damage, contributing to improve operational safety.
Keywords : Portable Acoustics Emission / AE parameters / AE Signal Analysis / Structural health monitoring system / Nondestructive Testing

Ball Balancing Robot

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Advisor
Dr. Pinet Sriyotha

Production Engineering

Abstract

At present, robotics technology has been continuously developed to meet the demands of daily life, particularly in the design of robots capable of mobility and balance in complex environments. Ball-balancing robots, which utilize a spherical wheel as a base, represent a significant engineering challenge due to the need to maintain stability in all directions simultaneously. This system offers several advantages, including high maneuverability, the ability to change direction instantly without tilting or rotating wheels, reduced contact with the ground, and enhanced stability in crowded environments.

This project focuses specifically on the study and development of the balancing system for a ball-based robot, employing control strategies based on the "Inverted Pendulum" model. The objective is to enable the robot to maintain balance with high precision, laying the groundwork for future applications such as autonomous services, transportation in confined spaces, and safe, efficient operation in complex environments.

Self Balancing Bike

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Production Engineering

Abstract

This project aims to develop a prototype of an automatic two-wheel balancing bicycle based on the principle of reaction wheels to create torque for controlling the system’s stability. The main controller is designed using a PD (Proportional-Derivative) controller to respond appropriately to balance and motion conditions. The control data is obtained from an Inertial Measurement Unit (IMU) sensor, which consists of an Accelerometer and a Gyroscope. The sensor data is processed through a Complementary Filter and Low-pass Filter to reduce noise and improve the accuracy in controlling the reaction wheel motor.

Design results show that the bicycle maintain balance when starting from an angle of 10 degrees and can continuously reach a state of equilibrium. In a stationary condition, the bicycle can maintain balance for more than 5 minutes. When moving back and forth on a flat surface, the bicycle maintains stability, with the tilt angle not exceeding 10 degrees. Even with external disturbances, the bicycle can still maintain balance and respond effectively according to the project’s objectives. It is also able to maintain balance while turning, with the tilt angle averaging around 10 degrees. However, the balance control system still has room for improvement to enhance the overall accuracy and stability of the bicycle.

Iron dome

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Mr. Thamnithi Vijitthumapanee

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Production Engineering

Abstract

This project aims to design, construct, and test a prototype system for detecting and intercepting airborne objects, inspired by Israel's Iron Dome air defense system. The prototype is designed to detect an orange spherical object with a diameter of 6 centimeters, moving horizontally at a speed not exceeding 1 meter per second and at an altitude not exceeding 2 meters. When the object enters the detection zone, a stereo camera processes 3D images to detect its position and predict its trajectory within a limited time frame. The system employs color detection, image processing, and a Kalman filter to enhance the accuracy of target position prediction.

The "Defender" system includes a firing mechanism driven by two parallel brushless DC electric motors (BLDC), utilizing a slider-crank mechanism to propel projectiles through the BLDC motors at a velocity of 25.60 meters per second. The projectiles are blue spheres with a diameter of 2.2 centimeters. The system aims to intercept the target object at a calculated time without requiring a direct hit; instead, the interception is considered successful if the projectile reaches within a predefined error radius (6–10 cm) in the range of 0–3 meters. The firing base is designed to rotate along both vertical and horizontal axes, each controlled by separate AC motors.

Improvement of Magnetic Particle Testing Machine Bench Unit Type

Thitipol oris, Thanawat klanskul, Panaphat saranarat

Advisor
Assoc.Prof.Dr. Bovornchok Poopat, Assist.Prof. Dr. Chettapong Janya-anurak

Production Engineering

Abstract

This project aims to develop a non-destructive testing machine using magnetic particles, focusing on enhancing the electrical and mechanical systems to improve efficiency and meet the ASTM E 709-21 standard. The testing machine is capable of supplying currents in the range of 300-3000 amperes and supports three functions: magnetization, demagnetization, and pulse current supply. The design also includes a mechanical system that facilitates user convenience. Testing is conducted using Ketos Ring and both dry and wet magnetic powders. The results are evaluated for accuracy and consistency in accordance with the standard's requirements.

The test results indicate that the non-destructive magnetic particle inspection device is capable of delivering a maximum electric current of 2,800 amperes, with a deviation not exceeding ±10%. The device successfully performs all three key functions magnetization, demagnetization, and pulse current delivery. Furthermore, the mechanical system operates in full accordance with the design specifications.

Self-Balancing Robot

Tasnim Waeuseng, Theetawat Yordsakpaiboon, Anatta Somlok

Advisor
Dr. Pinet Sriyotha

Production Engineering

Abstract

This project focuses on the design and development of a two-wheeled robot capable of self-balancing. The Inverted Pendulum model, a dynamically unstable system, provides a framework for the design and control concepts. The robot's balancing control is built by modeling the system as Full-State Feedback Control, which uses Optimal control in the form of a linear quadratic regulator (LQR) to compute the optimal control gain value from different system states. A Torque Control system is used to drive the motor and deliver the precise amount of torque input. A gyroscope sensor measures the robot's tilt angle to provide feedback to the controller. The robot's performance is tested under various rough conditions, including maintaining balance when driving up a bump at low speeds and traversing across uneven terrain like a grassy field. These experiments demonstrate that the robot can stay balanced under difficult working environments. This study can be used to improve robot propulsion systems, allowing for more adaptable and reliable mobility over different terrains. This work lays the groundwork for building complex propulsion techniques for future mobile robotic applications.

Ball On Plate System

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Mr. Phattanarat Jeedjeen

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Production Engineering

Abstract

This project aims to develop and study the Ball On Plate System, a control system designed to balance and control the movement of a ball on a flat plate using various actuators. It combines knowledge from multiple fields and employs a control system to adjust the angle of the plate, allowing the ball to move or stop precisely at a desired position. In this project, image processing is utilized to detect the position along with real-time processing to monitor the control system, ensuring stability and efficiency. The test results show that the system can control the ball's movement within a designated area and respond quickly and accurately within 5 seconds. This system can be applied in the study of physics, control systems engineering, and autonomous robotics development.

Development of Heterogeneous AMR collaboration : Integrating Active Caster and Differential Drive for Collaborative Transportation

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Production Engineering

Abstract

This project aims to study the collaboration between autonomous mobile robots equipped with different drive systems, with a particular focus on the application of the swerve drive system (also known as active caster) in a Leader-Follower configuration. A host PC acts as the central processing unit, sending movement commands to the robots. The leader robot perceives its surroundings and navigates the environment, while the follower robot is equipped only with a drive system and receives motion commands directly from the leader. The entire system is developed using the Robot Operating System 2 (ROS 2) framework, and a laser scanner is used to create a real-world map for navigation.

The experiment involved guiding robots through a doorway, with the leader robot always positioned ahead of the follower. In the first test, a robot with a 4-wheel swerve drive system was used. Results showed that the robot could follow the leader effectively, with an average deviation of around 5% from the intended path due to sensor and drive system inaccuracies.

In the second test, a robot with a 2-wheel swerve drive system and two free casters (which lack actuation and directional control) was used. This configuration also allowed the robot to follow the leader, with a similar level of path deviation as the first test. However, it required higher torque for movement compared to the fully actuated 4-wheel swerve drive system.

From these experiments, it can be concluded that both swerve drive configurations are capable of working effectively in a Leader-Follower system. Furthermore, there is potential for future improvement in drive accuracy and self-localization to enhance system performance.

Collaborative Transportation Using Multi-Agent UAVs

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Production Engineering

Abstract

Collaborative transportation of cable suspended rigid-body payloads using multiple unmanned aerial vehicles (UAVs) poses significant challenges in coordinated trajectory planning and formation control. For payloads with non-nominal geometry or uneven mass distributions, robust compensation methods are required to handle model uncertainties and external disturbances. This thesis presents a novel Flatness-Based Adaptive Control (FBAC) framework for multi-agent UAV payload transport. First, differential flatness of the coupled UAV–payload system is exploited to generate open-loop feed-forward trajectories for both vehicle positions and cable-force directions. Second, cable tensions are computed via a Moore–Penrose pseudoinverse to satisfy static wrench equilibrium. Third, to reject bounded disturbances and compensate parameter uncertainties, time-varying proportional-derivative gains are adapted online using a σ-modification law, guaranteeing uniform ultimate boundedness of both tracking errors and gain deviations. The complete FBAC scheme is validated through numerical simulations and real-world experiments under a variety of payload configurations.

Development of an Imaging System for Material Deformation at the Microstructural Level

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Production Engineering

Abstract

This project aims to develop an imaging system capable of detecting and recording microstructural changes in materials under various external forces, such as tension, compression, and temperature fluctuations. These microstructural observations are essential, as they directly influence critical material properties, including strength, toughness, and durability.

The core of the system is a Microscope Image Stitching System designed specifically for in-situ observation. It incorporates a motorized 3-axis stage (XYZ): the Z-axis enables automatic focusing, while the XY axes facilitate image stitching across a larger area of the sample surface. This setup allows for the creation of wide-field, high-resolution images of material microstructures during mechanical testing.

To address the common issue of uneven sharpness in microscopic images, the system also implements focus stacking by capturing images at multiple focal depths along the Z-axis and combining them using image processing techniques. This ensures that the final stitched images are sharp and clear across the entire field of view.

Furthermore, the system integrates image processing algorithms to monitor specific regions of interest in real time during tensile testing. As the material deforms, the controller dynamically adjusts the position of the stage to track the selected observation point, maintaining continuous and focused imaging throughout the experiment.

The high-resolution images acquired through this setup can be further analyzed using Digital Image Correlation (DIC) to evaluate strain distribution and other mechanical responses. Overall, the developed system enhances the capability for real-time observation and analysis of microstructural evolution, contributing valuable insights to materials science and supporting the development of stronger, more resilient materials for industrial applications.

Development of an automatic line marking system in construction areas

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Production Engineering

Abstract

This project focuses on the development of an automatic construction layout system designed to improve efficiency and accuracy in site marking tasks. The system comprises two autonomous robots that work together to mark straight lines on the ground.

The first robot acts as the Leader, responsible for navigation and localization. After reaching a predefined target point, the Leader emits a laser beam to guide the second robot. The second robot, functioning as the Follower, is equipped with a laser sensor to detect the laser line. It follows this line while simultaneously marking a straight line on the ground at the construction site. Localization is achieved using Super iBeacon technology, enabling the robots to determine their positions in real-world environments with high accuracy. Both robots operate under the ROS2 framework, with a Host PC acting as the central controller. The Host PC communicates with both robots via Wi-Fi to coordinate their tasks.

This system was tested in a 5×5 meter area, where the robots successfully demonstrated collaborative line marking. The results indicate the effectiveness of the proposed system, though improvements in localization precision and line-marking quality remain areas for future work.

Fire Buster Robot

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Advisor
Dr.Pinet Sriyotha

Production Engineering

Abstract

This firefighting robot aims to develop a robot capable of quickly suppressing fires in their early stages within buildings before the fire spreads uncontrollably. In recent years, the frequency of fire incidents in buildings has increased, making it difficult for firefighters to access certain areas in some situations due to thick smoke and intense fire spread. Although firefighting robots have been increasingly developed, most of them are designed to extinguish fires only after they have already escalated, resulting in significant damage to properties and buildings. The research team recognizes the importance of continuous fire monitoring to ensure that fires can be extinguished before they become severe. This research has developed a robot with functions capable of automatically detecting and extinguishing fires, as well as autonomously navigating obstacles.

Procedure Development of Ultrasonic Phased Array for Weld Inspection by Using Full Matrix Capture and Total Focusing Method

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Ms. Prasita Maneesuk

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Asst. Prof. Chalermkiat Jirarungsatian

Production Engineering

Abstract

This project aims to study and develop a weld inspection process using Full Matrix Capture (FMC) and Total Focusing Method (TFM) techniques, which employ phased-array ultrasonic waves to detect and analyze defects in welds. The Olympus OmniScan X3 was used as the primary inspection device. The process began with an analysis of A-Scan signals for 5 types of weld defects: Incomplete Fusion, Incomplete Penetration, Crack, Porosity, and Slag Inclusion. These defect signals were simulated using BeamTool 10 to create models for weld defects. Additionally, the Ultrasonic Pulser/Receiver was used to study the fundamental principles of Full Matrix Capture (FMC). The collected data was then analyzed and interpreted using Origin Pro.

To enhance inspection accuracy, 3 test blocks were designed and fabricated: TCG Block KMUTT, Calibration Block KMUTT and Beam Steering Assessment Block. These blocks were utilized to evaluate the effectiveness of the developed inspection technique for welds with thicknesses ranging from 10 to 25 mm. The experimental results demonstrated that the proposed method accurately identified the position, depth, and length of weld defects. Furthermore, the developed technique effectively classified the 5 defect types, making it a valuable tool for weld quality control applications.

Keywords : Full Matrix Capture and Total Focusing Method techniques / Internal Defects in Welds / Non-Destructive Testing / Phased Array Ultrasonic waves / Ultrasonic Waves

Facility Location Decision for High Voltage Battery Factory

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Production Engineering

Abstract

This project aims to develop a system based decision-making model for selecting the most suitable location for establishing a High Voltage Battery (HVB) manufacturing facility in Southeast Asia. The study focuses on six countries— Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnamall of which possess the potential to become production hubs for the electric vehicle (EV) industry. The proposed model employs a Multi-Criteria Decision Making (MCDM) approach, integrating the Analytic Hierarchy Process (AHP) to determine the weights of key factors and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) to rank the suitability of each country. The research considers both quantitative and qualitative factors across nine dimensions: labor cost, land cost, transportation cost, energy cost, inflation rate, construction cost, level of automation, tax regulations, and logistics infrastructure. Furthermore, three scenarios are simulated to reflect varying degrees of uncertainty: the Normal Scenario, an Economic Downturn Scenario, and a Government Support Scenario, wherein strong investment incentives are provided by individual countries. The analysis reveals that Vietnam ranks highest under all scenarios, highlighting its competitive cost structure, economic resilience, and comprehensive government incentives. Thailand consistently ranks second, owing to its structural advantages and established automotive supply chain. The Philippines demonstrates high sensitivity to government policy changes, with its ranking improving significantly when strong support measures are introduced. In contrast, Singapore consistently ranks relatively low across scenarios, primarily due to cost and infrastructure limitations. This project illustrates that the application of system analysis tools in combination with scenario analysis can significantly enhance strategic decision-making—particularly in highly uncertain environments—and can be effectively applied to cross-border investment planning.

Keywords: Location selection / Multi-criteria decision-making / High voltage battery plant / AHP / TOPSIS / Scenario analysis

The development of the electropolishing process for stainless steel Tube

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Production Engineering

Abstract

This thesis aims to design an electrochemical polishing process for the inner surface of tracheostomy tubes, identify optimal process parameters, and develop a method to improve surface smoothness and reduce internal corrosion. The motivation for this research stems from case studies reporting corrosion within tracheostomy tubes, which in some instances led to fractures during use. Such incidents pose serious safety concerns for patients and highlight the need for process improvements that can reduce corrosion and enhance the quality of the inner tube surface. The study and experiments revealed that the position and method of electrochemical polishing significantly influence the characteristics and direction of current flow, thereby affecting the polishing rate. Other key factors include polishing duration, type of electrolyte, and the applied voltage. The results indicate that under suitable conditions and techniques, electrochemical polishing can produce a more uniform surface with improved roughness and significantly enhanced corrosion resistance compared to untreated surfaces. Furthermore, the polished surface exhibits a higher water contact angle, indicating reduced hydrophilicity. This reduction in surface wettability helps lower the risk of contaminant and bacterial accumulation.

Incomplete Fusion Reduction in Welding process for Excavator Boom

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Dr. Ittirit Mohamad

Production Engineering

Abstract

This research project conducted a study of the welding of the boom process with the objective of reducing the incomplete fusion by optimizing the welding process. A 2^k factorial design with a single replicate and center point, along with Response Surface Methodology (RSM), was used to determine the optimal parameters and the significant three variables affecting the response. According to the study, a welding current of 394 amperes, welding speed of 50 centimeters per minute and a travel angle of 65 degrees are the optimal welding parameters to satisfy the company's welding quality standards. The welding results under these circumstances meet the required welding specifications, which include a penetration depth of more than 4 millimeters, a vertical weld size of at least 12 millimeters, and a horizontal weld size of at least 8 millimeters.

Improving the drug return process of a medical warehouse

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Advisor
Assoc. Prof. Dr. Charoenchai Khompatraporn

Production Engineering

Abstract

This research aims to develop a software to support the drug exchange process of the drugs close to their expiration dates at the medicine warehouse, Ramathibodi hospital. The software is to assist warehouse operators in summarizing all the drugs needed to be exchanged for monetary credit reimbursement from the suppliers. The process is normally executed manually with over 250 drug items per month. The summary must aggregate all expiring drugs according to their production lots and packages, and separates by individual suppliers. Drugs that are not exchanged in time not only need to be destroyed with incurred cost to the hospital, but also cannot reimburse any credit from the suppliers. The summary of expiring drugs used to take over a day to complete, yet with frequent mistakes. The software developed in this project requires merely approximately 5 minutes to execute from inputting data to generating the final report with 100% correction. This research improves the efficiency and accuracy of the drug exchange process through a development of a software tool.

Keywords : Medicine warehouse / Drug exchange process / Software / Efficiency and accuracy

Prototyping a decision support system for flood forecasting

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Advisor
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Production Engineering

Abstract

The objective of this project is to prototyping a decision support system for flood risk assessment in Lopburi Province using statistical and machine learning techniques: Decision Tree, Random Forest, and Logistic Regression. These methods are combined with spatial data from GIS and environmental factors such as rainfall, slope, land use, and historical flood data from 2018–2023. The study examined the use of a computer-based decision support system for flood risk assessment in specific areas by comparing the three developed models using accuracy as the performance evaluation metric. The models were compared based on accuracy, precision, recall, and F1-score. The Decision Tree model showed the best performance with 2023 data, achieving an accuracy of 0.87, precision of 0.43, recall of 0.23, and F1-score of 0.30. The system developed in this project can be used effectively as a tool to support spatial planning and decision-making by government agencies and local communities.

Feasibility study of agricultural product value-added projects a case study of the Thai Areca nut industry.

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Advisor
Dr. Suriyaphong Nilsang

Production Engineering

Abstract

Areca nut is an agricultural product that is in demand in the dyeing, tanning, and pharmaceutical industries, particularly in its processed forms. Thailand is the third-largest producer and exporter of areca nuts in the world. However, domestic consumption and exports are primarily in the form of raw materials (fresh and dried areca nuts), which limits the competitiveness of the agricultural and business sectors on the global stage, leading to lost revenue and missed export opportunities for the country. This research focuses on studying and analyzing the value chain of Thailand’s areca nut industry, covering aspects such as products, pricing, production processes, and end-users. Data was gathered through interviews with farmers and agricultural officers to explore opportunities for improving areca nut products to better meet market demands and to increase their value through processing. In addition, the researcher proposes suitable production process designs and incorporates economic considerations to enhance the overall value and competitiveness of the industry. The research findings, based on the value chain analysis, identifies three key approaches to adding value to areca nut products: the production of dried areca nut, areca nut powder, and tannin extract. Among these, tannin extract from areca nut is found to be the most economically viable option. With a production cost of 2,039.4 THB per kilogram and a potential selling price of up to 3,000 THB per kilogram, it significantly increases the value compared to fresh areca nuts by 2900%. This approach not only enhances income for farmers and small-scale producers but also reduces dependency on the fresh and dried areca nut markets and creates greater export opportunities for Thailand.

Feasibility study of the project to improve the production process of electrical control cabinets

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Ms. Narisara Purachako

Advisor
Dr. Suriyaphong Nilsang

Production Engineering

Abstract

Due to the increasing demand for electricity in Thailand, the case study company, which manufactures electrical control cabinets (AC Boards), is currently unable to meet the rising demand with its existing production capacity. This research aims to explore the feasibility of increasing the production capacity from 0.7 units per day to 2 units per day by improving the production process using Lean Manufacturing principles and computer simulation. The evaluation criteria are based on the increased production capacity and economic cost analysis. The study found eight feasible approaches that could meet the targeted production capacity. These approaches involve the addition of automated machinery, adjustments in the number of temporary workers, outsourcing, and rescheduling tasks in the following workstations: Powder Painting, Assembly Process, Busbar Process, Mounting Process, Wiring Process, and Nameplate Installation. After evaluating each approach using economic indicators — Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index (PI), and Payback Period — only four out of the eight approaches were found to be economically viable. These selected approaches could increase average production capacity by 194.3% compared to the current level, requiring an average investment of 6.65 million baht. However, each approach still requires further consideration in terms of labor management, machine maintenance, and product quality control to ensure alignment with the company's long-term goals.

Development of a decision support system for triage of symptoms and severity of emergency patients using a random decision tree method

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Advisor
Dr. Suriyaphong Nilsang

Production Engineering

Abstract

Emergency medical service units play a vital role in the rapid and accurate triage and assessment of emergency patients. This process is complex and consists of multiple steps, typically carried out by a single Emergency Medical Dispatcher under time pressure. The assessment often depends on the EMD's individual experience and ability, which can affect the patient's chances of receiving timely treatment and survival. Although the Erawan Emergency Medical Dispatcher currently uses support tools, several limitations still exist. Therefore, this research focuses on developing a decision support system for assessing and classifying emergency symptoms based on the Criteria Based Dispatch protocol. It applies data science and machine learning techniques to improve the efficiency of EMD operations. The study evaluated symptom classification performance by comparing model outputs with the correct CBD classifications. The Decision Tree model achieved an accuracy of 60.89%, while the Random Forest model reached 72.77%. In comparison, the average accuracy of human EMDs was 55.16%. This indicates that a computer-based decision support model can improve human triage accuracy by approximately 20%, accounting for variations in work experience. Additionally, such a system can help reduce EMD fatigue and decision-making time, enhancing overall emergency service efficiency.

Development and evaluation of Pulsed Laser Welding of Cast iron without Preheat – Post weld heat treatment

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Advisor
Dr. Titinan Methong

Production Engineering

Abstract

FCD500 grade cast iron is widely used in industries due to its good mechanical properties, such as the automotive industry, petrochemical industry, and many other industries. After long-term use, cast iron may experience various types of damage, such as wear, crack, creep, or erosion failure. Therefore, repair welding is considered the most cost-effective method. In general, repair welding is Shield metal arc welding (SMAW) process, which is very popular for repairing FCD500 cast iron. However, this welding process requires preheat and post weld heat treatment to prevent cracking. This study therefore investigates the feasibility of using the Pulsed laser welding (PLW) process for repair welding on cast iron. This research has performed the Pulsed laser welding (PLW) process and the Shield metal arc welding (SMAW) process, using nickel group materials as the primer and high carbon steel group materials as the filler metal, under different heating conditions. The results of the study show that the Pulsed laser welding (PLW) process with primer and top filler metal This results in a reduced Martensite microstructure and a reduced hardness of the heat affected zone (HAZ) of the workpiece, which is due to the heat from the second layer of welding. When compared to the Shielded metal arc welding (SMAW) process, which has a large amount of Martensite microstructure and high hardness, this research can conclude that the Pulse laser welding (PLW) process with two or more layers of welding results in significantly reduced hardness and crack-prone microstructure.

Reducing delivery costs through the application of the Vehicle Routing Problem

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Advisor
Nopnarong Sirisatien, Dr. Ittirit Mohamad

Production Engineering

Abstract

This project focuses on reducing the transportation costs of case study company by utilizing various technologies and tools to enhance delivery efficiency. One of the key approaches is the analysis of the Vehicle Routing Problem (VRP) to determine the most efficient delivery routes, considering factors such as the number and locations of delivery points, the volume, size, and weight of goods, as well as transportation time. This project employs the Geocoding and Search API and the Routing API to accurately determine the coordinates and distances of each destination. Subsequently, OR-Tools, a tool developed by Google, is applied to optimize routing by considering constraints such as vehicle capacity and route restrictions. This approach ensures efficient route planning, minimizes overall travel distance, and reduces transportation costs. The project results enabled a reduction in the total distance traveled and the company's overall transportation costs by approximately 11%.

Carbon Footprint Assessment of Anchor Guide 5BS13 Production: A Case Study on the Production Process of Cast Iron Products Using Green Sand at a Foundry in Samut Sakhon

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Production Engineering

Abstract

This research aims to assess the carbon footprint of products from a foundry located in Samut Sakhon Province, following ISO 14067 standards. These standards provide guidelines for measuring and reporting the greenhouse gas emissions of products (Carbon Footprint Product). The focus is on the Anchor Guide 5BS13 cast iron product, produced through the green sand casting method, with a weight of 3.6 kilograms per piece. The assessment is conducted in a B2B (Business-to-Business) format by calculating the carbon footprint in terms of kilograms of carbon dioxide equivalent per piece (kgCO2eq/piece), covering the process from raw material acquisition to the production process. In this study, the carbon footprint evaluation is divided into three main categories: 1. Emissions from the transportation of raw materials 2. Emissions from the raw materials used in the production process 3. Emissions from energy use in the production process.

The evaluation results show that the carbon footprint of the Anchor Guide 5BS13 cast iron product is a total of 484.08 kgCO2eq. The activity with the highest greenhouse gas emissions is the transportation of raw materials, which accounts for 476.01 kgCO2eq, or 98.33% of the total emissions. This is due to the transportation of raw materials from multiple sources in large quantities. Meanwhile, the emissions from the raw materials used in the production process are 6.18 kgCO2eq (1.28%), and the emissions from energy use in the production process are 1.89 kgCO2eq (0.39%). However, this research has limitations in terms of scope, as it only considers the B2B format. Therefore, it does not reflect the overall environmental impact, especially during the usage phase and post-use product management. Therefore, the researcher recommends expanding the scope of the assessment in the future to cover the entire product life cycle in a B2C format. This would provide more comprehensive data that can be utilized for the development of other types of cast iron products, as well as for the creation of environmental labels and carbon reduction labels in the future.

Carbon Footprint Assessment of Shaft Disc Production : A Case Study on the Production Process of Alloy Steel (25CrMo4) Products Using CO2 Sand at a Foundry in Samut Sakorn

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Production Engineering

Abstract

This research aims to assess the carbon footprint of a Shaft Disc product with a diameter of 151 mm and a weight of 2.7 kilograms per piece, which is manufactured through the CO_2 sand casting process at a foundry in Samut Sakhon province, Thailand. The study follows the ISO 14067 standard and employs a Cradle-to-Gate (Business-to-Business: B2B) life cycle assessment approach to evaluate greenhouse gas emissions at each stage, from raw material acquisition, production processes, to the pre-export phase. The research process involves collecting data on energy usage, raw materials, waste, and transportation within the production system, and calculating the greenhouse gas emissions in kilograms of carbon dioxide equivalent (kgCO2eq), based on standardized Emission Factors. The results show that the average carbon footprint per Shaft Disc is 516.24 kgCO2eq per unit, with the highest emissions found in the transportation stage at 502.5335 kgCO2eq, followed by the metal melting process. These findings provide a foundation for improving production efficiency, reducing energy and resource consumption, and raising awareness to support sustainable environmental practices within the metal casting industry.

Investigation of Heat Transfer Coefficient Influencing Cooling Behavior of Permanent Molds in Gravity Casting Process Using Casting Simulation Program

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Production Engineering

Abstract

This research investigates the effect of coating type and thickness on the heat transfer coefficient (HTC) between a permanent mold and aluminum alloy A356 during casting. The HTC is a critical parameter influencing the solidification behavior and shrinkage porosity in castings. Two types of coatings were studied: DAG395 with thicknesses of 100, 200, and 300 microns, and DAG633 with thicknesses of 30, 60, and 90 microns. Casting experiments using FCD500 permanent molds were conducted alongside simulations using MAGMASOFT software. Cooling curves obtained from experiments were compared with simulation results, and HTC values were adjusted to achieve a correlation coefficient (R^2) greater than 0.9. The results show that DAG633 provides significantly higher HTC values—3,020, 2,620, and 2,620 W/m²K—compared to DAG395, which shows 1,070, 1,020, and 760 W/m²K at the liquidus temperature. As a result, castings with DAG633 coating exhibit lower shrinkage porosity volumes of 29.93, 29.76, and 30.38 cm³, whereas DAG395 results in higher porosity volumes of 34.99, 35.06, and 36.65 cm³. These findings indicate that increasing the coating thickness tends to decrease the HTC, which in turn influences the resulting shrinkage porosity volume in the casting. Overall, the results highlight the importance of selecting appropriate coating parameters to improve heat transfer and reduce casting defects, and demonstrate how accurate HTC values can improve simulation reliability in casting process design.

Logistics Process Improvement of a Case Study Company

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Production Engineering

Abstract

This research aims to improve the packaging process. The case study is about the contact lens packaging process at WICE Supply Chain Solutions Company Limited. The study focuses on reducing Non-Value Added Activities (NVA) and increasing the productivity of the contact lens packaging process. The ECRS (Eliminate, Combine, Rearrange, Simplify) principles and Systematic Layout Planning (SLP) were applied to reduce Non-Value Added Activities, which include line balancing to achieve balance in the production line. The study was started by studying the behavior of each process then their packaging time was measured. It was found that 13 activities are Non-Value Added Activities. Of these, 9 were caused by delays and 4 were due to unnecessary transportation. Additionally, it was observed that the production line times were not balanced. The ECRS principle (Eliminate, Combine, Rearrange, Simplify) was applied to reduce Non-Value Added Activities from delays, while Systematic Layout Planning (SLP) was applied to reduce Non-Value Added Activities from transportation in the packaging process. Finally, the line balancing technique was implemented to improve the balance of the production line. The result of the research met the objectives by reducing Non-Value Added Activities from 13 Activities to 0 Activities and increasing the efficiency of the production line from 57.27 % to 89.34 %, in addition to increasing the production rate by 41.69% (from 1,300 units to 1,842 units) in the contact lens packaging process.

Assembly Line Balancing for Power Tillers to Improve Production Efficiency: A Case Study of a Tractor Manufacturing and Export Company

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Production Engineering

Abstract

This research aims to improve the production process of a power tiller assembly line, with the objective of increasing production efficiency by 10%. An analysis of the current working conditions revealed that the main causes of inefficiency were excessive operator movement, unnecessary transportation of materials and products, and delays that disrupted workflow continuity. To approach these issues, two improvement plans were developed. Plan A focuses on the existing workstation arrangement with partial adjustments, along with the implementation of Karakuri Kaizen principles to enhance the continuity of material flow. Plan B proposes a relocation of large-scale workstation structures, leading to a clearer, more consistent, and less complex material movement path. Furthermore, Plan B helps reduce intersections between AGV routes and pedestrian walkways, thereby lowering the risk of accidents and delays in transportation. Karakuri Kaizen principles are also applied in Plan B. Production efficiency was evaluated using data from the original FPC and Predetermined Motion Time Systems (PMTS). The results indicate that Plan A offers the advantage of lower capital investment, making it suitable for short-term implementation. Plan B, despite requiring a higher initial cost, enables a reduction in the number of AGVs from six units to four or five, enhances the material flow, and improves workplace safety. Both improvement plans yielded increasing production efficiency from 81.85% to 89.41%. Although the outcome does not completely reach the 10% goal, the results demonstrate that the proposed solutions effectively enhance line balancing, reduce unnecessary movements, and offer strong potential for sustainable long-term development of the production system.

Keywords: Production Process Improvement, Work Study, Karakuri Kaizen, Facility Layout

The application of fly ash in concrete production for use in the construction industry.

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Production Engineering

Abstract

This research aimed to study the potential of fly ash, a byproduct of coal combustion, as a partial replacement for cement in concrete. The objective was to reduce production costs without compromising mechanical properties below standard levels. Experiments were conducted by replacing cement with fly ash at proportions of 10%, 20%, and 30% by weight. Compressive strength was measured according to BS EN 12390 Part 3 standards. The test results showed that the compressive strength of each concrete mix ranged from 281.1 to 315.8 kg/cm², which significantly exceeded the Thai Industrial Standard TIS 1002/2565 requirements for concrete for flooring (180–240 ksc). Slump tests conducted according to ASTM C143 indicated that concrete mixtures with fly ash remained within the standard range (5–10 cm), although they did not significantly improve workability. Regarding production costs, the mix using 10% fly ash was able to reduce the cost from 44.27 baht to 39.35 baht per set of 6 cube specimens of 15×15×15 cm. Compressive strength tests were performed at 7 and 28 days of curing, with 3 specimens tested at each time point to compare strength performance over different periods. The study's findings suggest that fly ash can effectively reduce costs without affecting quality. Furthermore, it provides a waste management solution and supports sustainable development in the construction industry.

Development of the Gas Cylinder Leak Test Inspection Process

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Production Engineering

Abstract

Abstract
This project aims to enhance the gas cylinder leak testing process to reduce customer complaints, especially those involving recurring leaks at the valve and spout areas. Root cause analysis was conducted using the Why-Why Analysis method, and testing alternatives were evaluated through the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). Complaint data from 2023 revealed that the traditional water flush method, despite testing every cylinder, often failed to detect small leaks.An experiment was conducted using two groups of 300 cylinders: one tested with the standard water flush, and the other with added soapy water inspection at the cylinder head before flushing. The enhanced method improved leak detection, reduced missed leaks by approximately 65.63%, and shortened inspection time. (Closeness Coefficient : C_i^* = 0.8667) indicating strong alignment with the ideal solution.New inspection procedures were developed and adopted with high employee acceptance and no added workload. Risk analysis suggests that applying this method could reduce valve and spout-related complaints from 58 to about 20 cases per year. This improvement would enhance product quality, reduce compensation costs, and build long-term customer trust. Continued monitoring is recommended to maintain effectiveness in real production environments.

Keywords : Leak testing / Gas cylinder / Why Whys Analysis / TOPSIS / Soap solution screening

Development of a system for inspection, classification, and distribution of defect data for the residential unit inspection process before handover to the construction project owner

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Production Engineering

Abstract

This research aims to develop a system that enhances the efficiency of the inspection, classification, and distribution processes of defect data. The case study revealed several critical issues, including employee fatigue due to overtime work, non-value-added activities within the process, and errors in defect data distribution. To address these issues, a software system in the form of a Web application was designed to support and streamline the workflow. The development was based on Lean Thinking principles, particularly the 8 Types of Waste, along with Voice of Customer (VoC) and Design Thinking methodologies to ensure alignment with the actual needs of field users. The results of the study demonstrate that the developed system significantly reduced the average time required for defect inspection, classification, and distribution from 22 minutes per unit to just 6 minutes. Additionally, the number of process steps was reduced from 10 to 6, contributing to decreased employee fatigue and enabling faster and more efficient defect resolution.

Improving Availability Rate in the Header Process of Bolt Manufacturing

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Production Engineering

Abstract

This research aims to improve the availability rate in the header process of bolt manufacturing, which is a critical component of overall equipment effectiveness (OEE). The study focuses on reducing machine downtime by analyzing operator tasks using a flow process chart and applying the 5W1H method in conjunction with the ECRS principle to identify practical process improvement strategies. Data collection revealed that operators are responsible for a wide range of tasks, including the preparation of raw materials, documentation, equipment, machine setup, and machine operation. These overlapping responsibilities contribute to prolonged machine downtime. Further analysis indicated that over 87% of total working time was spent on activities that do not add value to the production process. The proposed improvement approaches include reassigning specific tasks to offline staff, relocating non-machine-dependent activities, using measuring tools as setup references, and adopting digital tools such as tablets to replace paper-based forms. All approaches were evaluated for economic feasibility and payback period. Following implementation, the improved process successfully reduced production-related time losses by an average of 2,597 minutes per month, resulting in a 14.57% increase in machine availability.

Keywords: Cold Forging / Availability Rate / Overall Equipment Effectiveness / Loss Time

Improving Bakery Oven Production Capacity by Sequencing and Reducing Material Flow in the Manufacturing Process

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Production Engineering

Abstract

This research aims to increase the production capacity of the Pro-Range oven model at Fisher & Paykel Appliances (Thailand) Co., Ltd. Currently, the company is operating more overtime than expected, resulting in additional labor costs of 42,240 baht. A root cause analysis using a fishbone diagram revealed that time loss from finding materials and waiting for materials was the main issue. To solve this, the team implemented an Electronic Kanban system to signal material needs and used trolleys for transportation. As a result, material find time at the bottleneck workstation was reduced by 712 seconds/ unit, lowering the cycle time to 5,014 seconds/ unit—a 12.4% reduction. Production capacity increased to 5.74 units/ day. Data collected over the following three months showed no material shortages, confirming that the warehouse could deliver materials as needed and eliminated waiting time on the line.

Keywords : Finding materials / Waiting for materials / Electronic Kanban / Trolley

Feasibility study of Sn addition on Fe removal in Al-Si alloys

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Production Engineering

Abstract

Aluminum is a recyclable material; however, iron contamination is commonly encountered during both production and recycling processes. The presence of iron significantly reduces the mechanical properties of aluminum alloys. Therefore, this study investigates the potential use of tin (Sn) as an additive to promote the sedimentation of iron intermetallic phases in Al-Si alloys. Tin has a higher density than aluminum and adheres well to the surfaces of iron intermetallic phases. In this experiment, tin was added at concentrations of 2, 4, and 6 wt.% to an Al-Si alloy containing iron impurities (Al-10Si-2Fe). The molten alloy was held at 650 °C, 700 °C, and 750 °C for 1 hour. The experimental results revealed that iron contamination in the Al-Si alloy led to the formation of iron intermetallic phases (β-AlFeSi). At a holding temperature of 650 °C for 1 hour, a significant amount of needle-like iron intermetallic phases was observed to precipitate and settle at the bottom of the sample. It was found that the amount of iron intermetallic phases was reduced by 45% in terms of area compared to the sample before thermal holding. Thermodynamic modeling indicated that these iron intermetallic phases form at around 650 °C and, due to their higher density compared to molten aluminum, tend to precipitate and settle at the bottom of the sample. At higher holding temperatures of 700 °C and 750 °C, a decrease in the sedimentation of iron intermetallic phases was observed. Furthermore, the experimental results showed that the addition of tin did not significantly enhance the sedimentation of iron intermetallic phases.

Increasing Machine Operating Time in the Wooden Furniture Component Manufacturing Process

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Production Engineering

Abstract

This project aims to increase the machine utilization rate in the wooden furniture production process at Modernform Group Public Company Limited by focusing on reducing time losses and increasing the operating time of three main machine types: cutting, edge banding, and drilling machines—within the standard working time frame of 480 minutes per day. The implementation involved examining production procedures, analyzing actual machine working time, and identifying root causes of time losses using Time Study and Why-Why Analysis tools.

The cutting machine, which is the most critical stage as it serves as the upstream process of the entire production line, was selected for immediate improvement. Process enhancements were carried out through the repair of the OptiPlanning system, development of operation manuals, and training of staff to improve their ability to operate the system effectively. As a result, the machine's operating time increased from 235.54 minutes to 264 minutes per day, representing a 12.08% improvement and demonstrating the effectiveness of the corrective measures implemented. For the edge banding and drilling machines, development strategies were proposed. Initial solutions include grouping production jobs by edge banding material type to allow continuous processing of similar materials, thereby reducing material change frequency and setup time. For the drilling machine, it was suggested to improve the quality of files received from the CAM Center to align with the capabilities of each machine model, and to establish a file verification system before releasing jobs to the shop floor in order to minimize delays and reduce correction time.

Preliminary results indicate that the proposed process improvements, centered on root cause analysis of time losses, can significantly enhance operating time. This approach can serve as an effective model for optimizing machine performance in similar industrial production environments.

Improving Production Rate in Pipe Manufacturing Process

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Production Engineering

Abstract

This thesis studies and analyzes the production in the pipe production process. The objective is to increase the production rate of carbon pipes of the elbow type in the bending process of the PU-20 machine by 20 percent. According to the study, delayed product manufacture resulted in delivery delays and a decline in customer trust. Therefore, there was a need to improve the production process. In the bending process, the PU-20 machine was the process that produced the most delayed carbon pipes of the elbow type. Work study was used to study the work steps and record them in the form of a flow process chart. We then used the 5W1H questioning technique to analyze non-value added activities and the ECRS technique to enhance the process. Equipment was designed to assist in the work, such as lane arrangement equipment, air gun stands, and gravity rollers, which were used to help transport workpieces. In addition, the work methods were adjusted to reduce work time. After recording the time after the process improvement and integrating the time estimated from the MTM-2 technique, the time could be reduced from 97.71 seconds per piece to 78.93 seconds per piece, which increased the production rate per hour by 19.21 percent. As compared to previous production delays, the quantity of pieces of the elbow type could be reduced from 18,030 pieces to 16,150 pieces.

Welding waveform for energy reducTION

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Production Engineering

Abstract

Energy usage in industries is a crucial factor influencing production processes, cost reduction, and operational efficiency, particularly in sectors employing welding technologies, such as the automotive industry. The Gas Metal Arc Welding (GMAW) process, commonly used in this field, relies on Constant Voltage (CV) energy delivery. While CV provides high-quality results, it is associated with significant energy consumption. To address this issue, this research focuses on the application of Pulsed Current Welding. The study compares energy consumption between Standard Current and Pulsed Current methods by calculating unit workpieces or cycle times based on standard time to assess the potential for energy reduction in welding processes. The research begins with planning an experimental flow chart, reviewing related studies, and conducting pre-Welding Procedure Specification (Pre-WPS) before actual experimentation. The study explains steps to calculate energy usage, determine standard time, and evaluate greenhouse gas emissions resulting from electricity used in welding processes to ensure reliable and precise data collection. The expected outcomes of this research include improved welding processes in industrial applications, reduced production costs, and minimized environmental impacts, contributing to sustainable industrial development in the future.
Keywords: Pulsed Current, Constant Voltage, Energy Consumption, Standard Time, Welding Process, Standard Current