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COMMITTED TO RESEARCH, INNOVATION AND EDUCATION 46 years

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PRESENTS
CBIT HACKATHON

SUDHEE 2025 CBIT HACKATHON

PROBLEM STATEMENTS

Domain: AI & ML

A1. Title: Real-Time Sign Language Generation from Spoken Language

Detailed Description:
Individuals who are Deaf or Hard of Hearing often face communication barriers due to reliance on sign language, limiting access to information and opportunities. The challenge is to develop a real-time system that converts spoken language into visually accessible sign language (e.g., ASL, IS). This system must accurately process audio input, accounting for natural language nuances and differing grammatical structures between spoken and sign languages, and generate a dynamic, understandable visual representation of the appropriate sign language. The key is to accurately and dynamically bridge the communication gap in real-time, supporting multiple sign languages.

A2. Title: Ethical Anomaly Detection in Video Surveillance

Detailed Description:
Video surveillance systems generate vast amounts of data, making it difficult for human operators to identify critical events promptly. Automated analysis is needed, but current methods struggle with accuracy and raise significant ethical concerns about privacy and bias. The core challenge is to develop an anomaly detection system for video feeds that accurately identifies unusual or potentially threatening behaviors *while* demonstrably mitigating biases, ensuring transparency, and protecting individual privacy. The system must minimize false alarms and missed events, and prevent disproportionate impact on any demographic group. The solution needs to find a good balance point between improving public safety, and keeping the fundamental human rights.

A3. Title: Automated Application Screening and Ranking

Detailed Description:
Manually screening and scoring applications is a time-consuming process, delaying the identification of top candidates. The challenge is to develop an automated system that performs data verification and eligibility checks against predefined criteria. This system must accurately assess applicant data to determine their suitability and generate a ranked list of the top 10 candidates for each specified region, streamlining the initial stages of the recruitment process. The key is to rapidly and accurately filter a large applicant pool down to a manageable, highly qualified shortlist.

A4. Title: AI-Powered Personalized Student Schedule Optimizer

Detailed Description:
Students often struggle to balance academic requirements, extracurricular activities, and personal commitments. The challenge is to create an AI-powered assistant that generates personalized schedules. This system must consider individual student preferences, existing commitments (work, sports, etc.), and academic course requirements to produce an optimized schedule. The goal is to help students effectively manage their time, reduce scheduling conflicts, and improve overall academic performance by providing a tailored, dynamic scheduling solution.

A5. Title: AI-Powered Satellite Image Analysis and Classification System

Detailed Description:
Satellite imagery provides a vast and valuable source of data for a wide range of applications, but extracting meaningful information from these images requires sophisticated analysis techniques. The challenge is to develop a software application that uses artificial intelligence (AI) to automatically analyze and classify satellite images. The system must be capable of identifying and categorizing different features and land cover types within the imagery, enabling applications such as land use monitoring, environmental change detection, and resource management. The core problem is to transform raw satellite data into actionable insights through automated, intelligent image processing.

Domain: IOT & BLOCKCHAIN

I1. Title: Smart Cold Chain Monitoring for Agricultural Produce

Detailed Description:
Post-harvest food loss due to inadequate storage and transportation is a significant problem, impacting both farmers' incomes and food security. The challenge is to create an IoT-enabled smart cold storage system that continuously monitors environmental conditions (temperature, humidity) and detects early signs of spoilage within storage facilities. The system must go beyond basic monitoring; The aim is to not only to track conditions, but to use this data to actively preserve produce quality, extend shelf life, and minimize waste throughout the cold chain, from storage to transportation.

I2. Title: Intelligent Medication Management System for Enhanced Adherence

Detailed Description:
Medication non-adherence is a critical problem, particularly among elderly and chronically ill patients, leading to adverse health outcomes and increased healthcare costs. The challenge is to create an IoT-powered smart pill dispenser that ensures timely and accurate medication intake. The system must automatically dispense the correct dosage at prescribed times and provide reminders to the user. Crucially, it must also incorporate a mechanism for alerting caregivers or healthcare providers in case of missed doses, enabling timely intervention and improving overall medication adherence.

I3. Title: Automated Waste Sorting System

Detailed Description:
Inefficient waste sorting leads to contamination of recyclables and reduced resource recovery. The challenge is to develop an automated system that accurately identifies and sorts different types of recyclable materials (e.g., plastic, paper, metal) in real-time. The system must employ computer vision and machine learning to classify materials on a moving conveyor belt and use a robotic mechanism to physically separate them into designated bins. The core problem is to achieve high accuracy and speed in material identification and sorting, enabling more efficient and effective recycling processes.

I4. Title: Blockchain-Based Secure Document Verification Platform

Detailed Description:
Ensuring the authenticity and integrity of documents is critical in many contexts, from academic credentials to legal contracts. The challenge is to develop a web-based platform that leverages blockchain technology to provide a secure and tamper-proof system for document verification. The system must utilize smart contracts to manage the verification process, ensuring transparency and immutability of records. The core problem is to provide a reliable and trustworthy method for verifying the authenticity of documents, eliminating the risk of forgery and fraud.

I5. Title: Decentralized Peer-to-Peer Lending Platform

Detailed Description:
Traditional lending systems often involve high interest rates, complex processes, and reliance on intermediaries and credit scores, limiting access to financial services for many individuals. The challenge is to develop a decentralized finance (DeFi) lending platform that enables peer-to-peer lending and borrowing of assets. The system must utilize smart contracts to automate loan agreements, manage collateral, and ensure secure and transparent transactions without relying on traditional financial institutions. The core problem is to create a more accessible, efficient, and equitable lending ecosystem by removing intermediaries and empowering individuals to directly participate in financial transactions.

Domain: Web Development

W1. Title: Collaborative Cyber Threat Intelligence Platform for Businesses

Detailed Description:
Small and medium-sized businesses (SMBs) often lack the resources and expertise to effectively protect themselves against evolving cyber threats. The challenge is to develop a platform that provides real-time threat intelligence, risk assessment, and collaborative incident reporting specifically tailored for SMBs. The system must aggregate and analyze threat data from various sources, provide actionable insights, and facilitate information sharing among businesses to enhance collective defense. The core problem is to empower SMBs with the tools and knowledge they need to proactively mitigate cyber risks and respond effectively to security incidents

W2. Title: Comprehensive Mental Health Support and Well-being Platform

Detailed Description:
Access to timely, personalized, and effective mental health support is often limited, leaving many individuals struggling with conditions like anxiety, depression, and stress without adequate resources. Traditional support systems can be fragmented and lack real-time insights. The challenge is to develop a comprehensive platform that provides a safe and supportive environment for individuals to track their emotional well-being, connect with others, and access professional resources as needed. The core problem is to improve the accessibility, personalization, and effectiveness of mental health support, empowering individuals to proactively manage their mental well-being.

W3. Title: Grievance Redressal Web Portal

Detailed Description:
Efficient and transparent grievance redressal mechanisms are crucial for ensuring accountability and user satisfaction in various services and organizations. The challenge is to develop a user-friendly web portal that streamlines the process of submitting, tracking, and resolving complaints. The system must provide an intuitive interface for users to register their grievances, and incorporate intelligent features to facilitate efficient processing and resolution. The core problem is to improve the accessibility, responsiveness, and overall effectiveness of grievance handling, leading to greater user trust and satisfaction.

W4. Title: Recipe Sharing Web Platform

Detailed Description:
Sharing recipes among friends, family, and cooking enthusiasts often relies on scattered emails, social media posts, or handwritten notes. The challenge is to develop a simple, user-friendly web platform where users can easily share and discover recipes. The system must provide a clean interface for users to input recipe details (ingredients, instructions, preparation time, serving size) and view recipes shared by others. The core problem is to create a centralized, easily accessible, and visually appealing repository for recipes, making it easier to organize, share, and find culinary inspiration, without complex features like user accounts, ratings, or comments

W5. Title: Smart City Public Utility Monitoring and Management Dashboard

Detailed Description:
Efficient management of public utilities (e.g., electricity, water, waste) is crucial for the sustainable operation of smart cities. The challenge is to develop a centralized, web-based dashboard that provides real-time monitoring and management capabilities for these essential services. The system must integrate data from various sources, present it in an intuitive and informative way, and provide tools for city administrators to optimize resource allocation and respond to service disruptions. The core problem is to improve the visibility, control, and efficiency of public utility management in a smart city environment.

Domain: Hardware

H1. Title: Intelligent Automated Hydroponic Nutrient Management System

Detailed Description:
Efficient resource utilization and precise environmental control are crucial for successful hydroponic farming. The challenge is to develop an automated system that manages nutrient delivery and lighting in a hydroponic setup. The system must continuously monitor key parameters (e.g., pH, electrical conductivity (EC)) of the nutrient solution and adjust nutrient dosing accordingly. It should also control grow lights to optimize energy use and promote plant growth. The core problem is maintaining optimal growing conditions automatically, minimizing manual intervention, and maximizing resource efficiency in a hydroponic environment

H2. Title: Real-Time Hydration Monitoring System for Athletes

Detailed Description:
Maintaining optimal hydration is critical for athletic performance and safety. The challenge is to develop a wearable device that non-invasively monitors an athlete's hydration status in real-time. The system, in the form factor of a wristband, must accurately measure key electrolyte levels (e.g., sodium, potassium) in sweat. The device must then process this data to assess hydration levels and provide timely alerts to the athlete, enabling proactive fluid intake and preventing dehydration-related performance decline or health risks.

H3. Title: Affordable and Portable PCR Thermocycler for Resource-Limited Setting

Detailed Description:
Access to molecular diagnostics, such as Polymerase Chain Reaction (PCR), is often limited in resource-constrained settings due to the high cost and complexity of conventional laboratory equipment. The challenge is to design and build a low-cost, portable PCR thermocycler that enables DNA amplification for diagnostic purposes. The system must accurately control temperature cycling within a specified range, be robust and reliable, and ideally incorporate features to address common challenges in resource-limited environments, such as power fluctuations or lack of specialized training. The core problem is making essential molecular diagnostic capabilities accessible and affordable where they are most needed.

H4. Title: Intelligent pH Control and Monitoring System for Industrial Reactors

Detailed Description:
Maintaining precise pH levels is critical for optimal performance and safety in many industrial chemical reactors. The challenge is to create an automated pH control system that continuously monitors and adjusts the pH of a reactor in real-time. The system must accurately measure the current pH, predictively adjust the addition of acid or base to maintain the desired setpoint, and provide remote monitoring capabilities. The core problem is to ensure consistent and optimal reaction conditions while minimizing manual intervention and potential risks associated with pH fluctuations.

H5. Title: Myoelectric Gesture-Controlled Robotic Arm for Assistive Technology

Detailed Description:
Individuals with limited mobility or limb loss face significant challenges in performing everyday tasks. The challenge is to develop a robotic arm that can be intuitively controlled by the user's muscle signals (electromyography or EMG) and gestures. The system must accurately interpret these signals to provide precise and responsive control of a multi-degree-of-freedom robotic arm. The goal is to create an assistive device that restores a degree of independence and empowers users to perform a wide range of manipulation tasks with greater ease and dexterity. A crucial part is ensuring safety for the user.

Domain: Miscellaneous

M1. Title: Privacy-Preserving Authentication System Using Zero-Knowledge Proofs

Detailed Description:
Traditional authentication methods often rely on passwords and centralized databases, creating vulnerabilities to data breaches and privacy violations. The challenge is to develop an authentication system that leverages Zero-Knowledge Proofs (ZKPs), specifically zk-SNARKs, to enable users to prove their identity *without* revealing any sensitive information, such as passwords or personal details. The system must provide strong security and privacy guarantees, ensuring that only authorized users can gain access while protecting user data from unauthorized disclosure. The core problem is to create a more secure and privacy-respecting authentication mechanism that minimizes the risk of data breaches and identity theft.

M2. Title: Intelligent Automated Cell Culture Incubator with Contamination Detection

Detailed Description:
Maintaining a sterile and controlled environment is crucial for successful cell culture, but contamination remains a significant challenge, often leading to experiment failure and wasted resources. The challenge is to create a smart cell culture incubator that not only maintains optimal temperature and humidity but also automatically detects microbial contamination. The system must employ computer vision and machine learning to identify contamination events early, enabling timely intervention and minimizing the impact on cell cultures. The core problem is to improve the reliability and efficiency of cell culture processes by preventing and rapidly responding to contamination.

M3. Title: Smart CO2 Capture and Monitoring System using Metal-Organic Frameworks

Detailed Description:
Reducing atmospheric CO2 concentrations is a critical challenge in mitigating climate change. The challenge is to design and build a small-scale CO2 capture unit utilizing Metal-Organic Frameworks (MOFs) as the adsorbent material. The system must effectively capture CO2 from a gas stream and continuously monitor the efficiency of the capture process. Key requirements include accurate measurement of CO2 concentrations before and after passing through the MOF filter, and real-time monitoring of the filter's saturation level. The core problem is to demonstrate the feasibility and effectiveness of MOFs for CO2 capture in a controlled environment, providing a foundation for potential scale-up and real-world applications.

M4. Title: Quantum-Enhanced Secure Email Client

Detailed Description:
Email communication remains vulnerable to various cyber threats, including interception and unauthorized access. The challenge is to develop a secure email client application that leverages the principles of quantum cryptography to enhance the confidentiality and integrity of email communications. The system must incorporate quantum-resistant cryptographic techniques to protect against both classical and potential future quantum computing-based attacks. The core problem is to provide a significantly higher level of email security compared to traditional encryption methods, ensuring robust protection against evolving cyber threats.

M5. Title: Optimizing Library Book Reshelving Efficiency

Detailed Description:
University libraries, especially large ones, face a constant challenge in efficiently reshelving returned books. Patrons return books to designated drop-off points, and library staff must then sort and return these books to their correct locations throughout the library's extensive shelving system. Inefficient reshelving leads to delays in book availability, misplaced books, and increased staff workload. The challenge is to develop an optimized system for sorting and reshelving returned books that minimizes the total time and distance traveled by library staff. This system must consider the layout of the library, the distribution of book returns across different subject areas (and thus, different locations in the library), and the number of staff available for reshelving. The key is to devise a practical, step-by-step procedure (e.g., sorting strategies, route planning) that can be easily implemented by library staff