St. JOSEPH'S COLLEGE OF ENGINEERING

(An Autonomous Instituion)
OMR, CHENNAI - 119

PROBLEM STATEMENTS

DEFENCE & AEROSPACE

PSD101 - Microphone array-based direction of arrival for gunshot detection

Develop a real-time gunshot detection and direction-finding system using FPGA. The system will take inputs from multiple microphones, filter and identify gunshot sounds, and calculate the direction they came from. The final direction should be shown on a simple graphical display.

PSD102 - AI Powered Early Warning & Prediction System

The Disaster Prediction Platform uses AI to analyze satellite data, predicting natural disasters like floods and wildfires. By processing weather patterns, terrain data, and historical events, it provides early warnings and disaster severity forecasts, helping emergency teams respond faster and minimize damage.

DEFENCE & AEROSPACE

PSD103 - Environmental Monitoring and Conservation

Develop a drone system that can monitor and track environmental changes in real-time. The drone should be equipped with sensors to detect pollution levels, track wildlife movements, and assess the health of forests and natural habitats. Your solution should provide valuable data to environmentalists and conservationists to help protect ecosystems and biodiversity.

PSD104 - Smart City Surveillance and Security

Design a drone-based surveillance system to enhance the safety and security of smart cities. The system should include features like real-time video streaming, facial recognition, and anomaly detection to identify potential threats and ensure public safety. Consider the ethical and privacy implications of using drones for surveillance and propose solutions to address these concerns.

DEFENCE & AEROSPACE

PSD105 - Affordable Satellite Module for Forest Monitoring & Protection

Design a Low-Cost Satellite Module that uses satellite images to monitor deforestation and illegal logging. The module should be affordable and capture clear images to track changes in forests. It should send real-time data to authorities, helping to protect forests and prevent illegal activities.

IoT & WIRELESS NETWORKS

Candela TECHNOLOGIES

PSI201- Offline Smart Home Assistant with Voice Control and UI Monitoring using Raspberry Pi

Problem Statement

The challenge is to develop an offline smart home solution that enables users to control and monitor home appliances using a Raspberry Pi. The system should function without an internet connection, relying solely on a local hotspot. Users should be able to control appliances via voice commands and monitor their status through a user-friendly UI.

Purpose:

The primary objective of this project is to design and implement a fully offline smart home system that provides seamless control over home appliances. The solution aims to enhance convenience, security, and efficiency by integrating voice control and an interactive UI for real-time monitoring. By eliminating the need for internet access, the system ensures reliability in all conditions, making it ideal for smart home applications in remote or privacy-sensitive environments.

Requirements

Offline Functionality:
The system must operate without internet access, using a local hotspot created by the Raspberry Pi. All connected devices should communicate through this local network.

Appliance Control:
The Raspberry Pi should connect and control various home appliances (e.g., lights, fans, thermostats) using wired or wireless protocols. Users should be able to turn appliances on/off and adjust settings as needed.

Voice Control:

- The system should integrate voice recognition to process natural language commands such as:
- "Turn on the lights."
- "Set the thermostat to 22°C."
- "Turn off the fan."

UI Monitoring & Control:
The system must provide a web-based or mobile UI that allows users to:

- View all connected appliances and their real-time status.
- Control devices manually via toggles and adjustment options.
- Receive notifications for status changes.

Device Connection Monitoring:
The UI should display the list of connected devices and alert users if any device is disconnected or malfunctioning.

Automation Features:
Users should be able to create automation rules, such as:

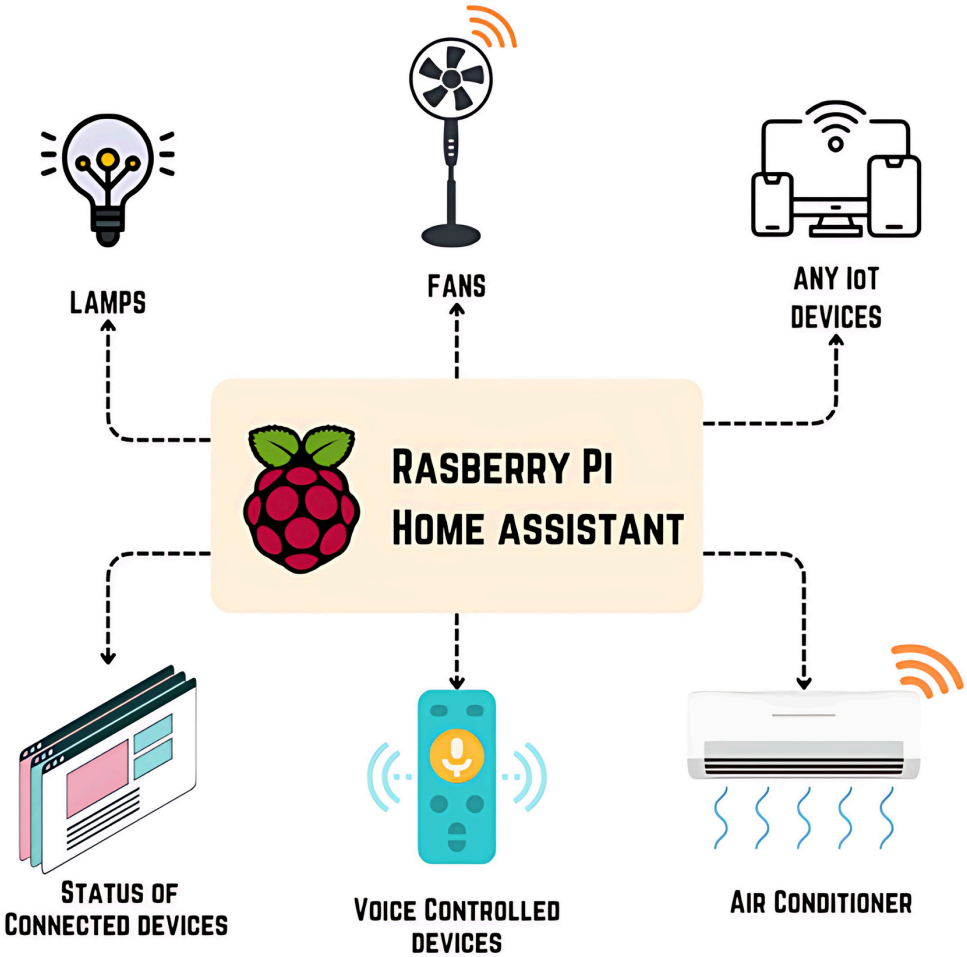
- "Turn on lights at sunset."
- "Adjust thermostat when room temperature reaches 25°C."
- "Turn off all appliances at midnight.”

Security:

The system should ensure secured communication between the Raspberry Pi and connected appliances. Voice commands must be processed securely, and authentication may be required for UI access and device control.

For Reference:

https://www.home-assistant.io/



PSI202 - Advanced Line Follower Bot for Wi-Fi/IoT Test Facility

Problem Statement:

The objective is to build a fully autonomous robotic system that can:

· Autonomous navigation along a designated trajectory.

· Stop upon detecting designated NFC tag points and wait for 20-seconds.

·Integrated dual-battery management system to power the robot and provide auxiliary power for charging external devices positioned on the top rack.

· Remote monitoring and control capabilities via a web-based user interface.

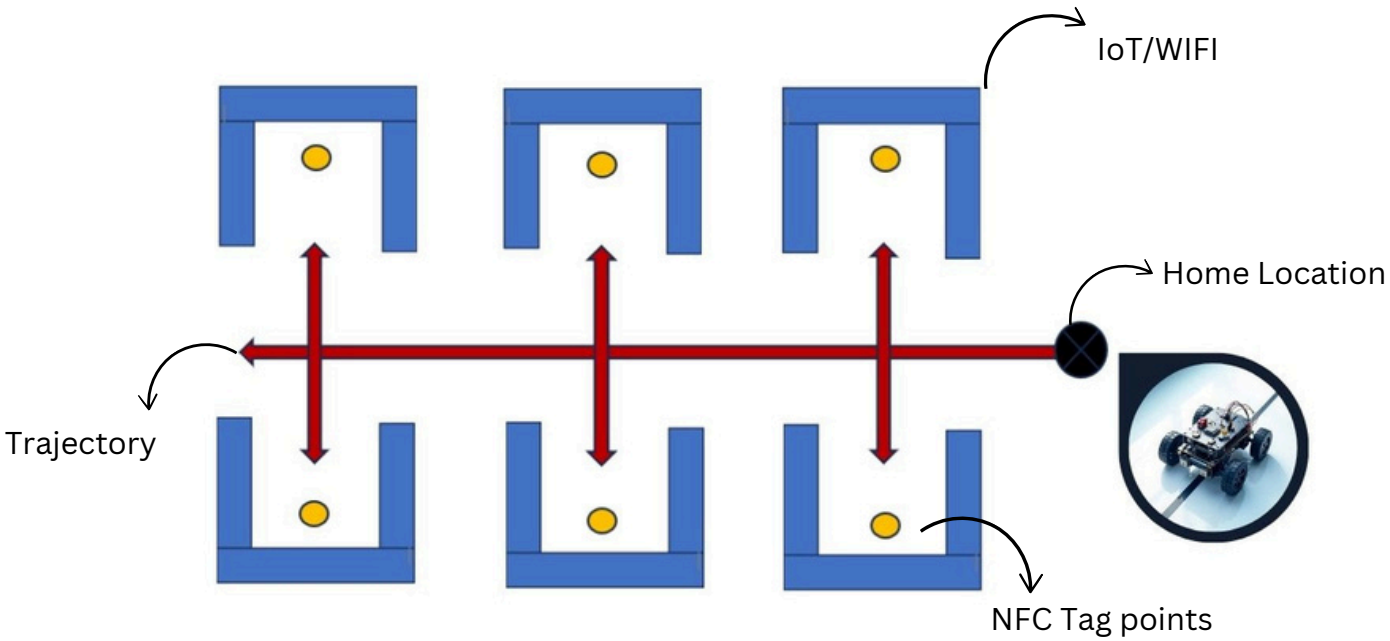
Requirements

- Autonomous Navigation: The robot must follow a predefined trajectory without manual intervention, ensuring smooth movement along the assigned path.
- NFC Tag Reading: Upon encountering a designated NFC tag, the robot maintains a stationary position for a duration of 20 seconds.
- Battery Management: The robot shall incorporate a dual-battery system, housed within the bottom rack, with one battery dedicated to powering the robot's operational systems and a secondary battery allocated for charging external devices, such as laptops or mobile devices, positioned on the top rack.
- Remote Monitoring:
  - Real-time tracking and logging of the robot's trajectory.
  - Live status updates and performance monitoring
  - A digital twin representation for visualizing the robot's movement and task execution.
- Seamless Task Execution: The system should ensure uninterrupted transitions between waypoints while maintaining accurate data collection and power efficiency.

For Reference:

https://youtu.be/Snu3In-Zesc?feature=shared

https://drive.google.com/file/d/1Lc1LQtRJvUei7mNlOaskSAlTBF48a-c_/view?usp=sharing



HEALTH CARE

PSH301 – Accessible Mental Health Support

Design an AI-driven mental health companion that offers real-time emotional support, tracks mood patterns, and recommends personalized interventions, while ensuring privacy and promoting well-being.

PSH302 – Personalized Fitness and Wellness Management

Create an AI-powered virtual personal trainer that offers dynamic workout plans, real-time feedback, and personalized nutrition guidance by using data from wearables and analytics.

PSH303 – AI-Powered Healthcare Diagnostics

Build an AI-powered healthcare diagnostic system that analyzes medical data in real-time, predicts conditions, and provides early diagnosis using medical imaging, electronic health records, and patient monitoring data.

HEALTH CARE

PSH304 – Fall Detection Wearable for Seniors

Develop a wearable device using motion sensors to detect falls in elderly individuals and instantly send alerts to caregivers or emergency contacts.
It must be lightweight, comfortable to wear, and capable of operating independently without needing constant internet access.

PSH305 – Contactless Temperature & Heart Rate Monitor

Build a non-contact system using infrared and pulse sensors to continuously monitor a person's body temperature and heart rate, displaying real-time data on a screen or mobile device.
The system should alert users when abnormal readings are detected and store data for periodic health review.

PSH306 – Smart Navigation Glasses for the Visually Impaired

Design a wearable smart glasses system that uses ultrasonic sensors and voice feedback to detect nearby obstacles and guide visually impaired users safely.
The device should provide directional cues through vibration or audio, enabling indoor and outdoor navigation without internet.

PSE401 - AI-Based Education and Learning Personalization

Build an AI-powered personalized learning platform that adapts to individual student needs, offering customized learning paths, dynamic content recommendations, and real-time feedback. This platform aims to address the limitations of traditional education systems by enhancing engagement, improving performance, and fostering a more personalized and effective learning experience for each student

PSE402 - Gamified Learning Platform

Build a gamified smart education platform designed to enhance learning through interactive challenges, adaptive learning pathways, and personalized experiences

PSE403 - AI Powered Translation for Regional Accessibility

Develop an AI-driven translation system to convert educational resources from English to regional languages with high accuracy. It should preserve context, handle educational terms well, and minimize errors, ensuring accessible learning with minimal human intervention.

SMART EDUCATION 

PSE404 - AI-Powered Virtual Teaching Assistant

Develop an AI-driven virtual assistant that provides instant answers to student queries, explains complex topics, and offers personalized study recommendations, enhancing remote and self-paced learning.

PSE405 - Smart Attendance and Engagement Monitoring System

Create an AI-based system that uses facial recognition and behavioral analytics to automate attendance tracking and assess student engagement during online and offline classes, improving learning outcomes.

PSE406 - AI-Enabled Career Guidance and Skill Assessment

Design an AI-powered platform that analyzes student interests, skills, and academic performance to recommend suitable career paths, relevant courses, and industry-aligned skill development programs.

PSR501 - Automated Street Light Monitoring & Energy Saving System

Develop an intelligent street lighting system that uses ambient light and motion sensors to automate lighting based on real-time conditions. Integrate IoT technology for remote monitoring, energy usage tracking, and fault detection to enhance efficiency, reduce power consumption, and minimize maintenance efforts.

PSR502 - Smart Monitoring & Optimization for Solar Efficiency

Build a software platform to monitor and optimize the performance of solar panels, ensuring maximum energy generation and reducing maintenance costs

PSR503 - AI-Driven Energy Management for Smart Cities

Build an AI-powered energy management system that optimizes energy consumption, predicts demand, and ensures sustainability in smart cities, addressing the complexities of energy management. This system aims to reduce inefficiencies, lower costs, minimize environmental impact, and maximize energy savings, ultimately helping to reduce carbon footprints in urban environments.

PSR504 - Smart Grid Fault Detection & Auto-Recovery System

Develop an IoT-enabled smart grid monitoring system that detects power failures, predicts faults, and automatically reroutes electricity to ensure uninterrupted power supply, reducing outages in urban and rural areas.

PSR505 - AI-Integrated Smart Building Energy Controller

Design an AI-powered energy management system that autonomously controls lighting, HVAC, and appliances in commercial and residential buildings based on occupancy and weather conditions, improving energy efficiency.

PSR506 - Smart AI-Driven Electrical Fault Monitoring System

Electrical infrastructure faces challenges in monitoring earth leakage, continuity, and resistance, which can lead to safety hazards, equipment failures, and inefficient maintenance. Traditional inspection methods rely on manual checks, making it difficult to detect faults in real-time, increasing the risk of electrical failures.

PSA601 - Crop and Soil Management System

Develop an app to assist farmers in crop selection, soil management, and disease identification, improving productivity and sustainability .

PSA602 - Effective Farming System

Design a cost-effective, mechanized system for puddling, seeding, transplanting, and harvesting crops to improve agricultural efficiency

PSA603 - Smart Greenhouse Automation

Create an IoT-enabled smart greenhouse system that monitors and controls temperature, humidity, and soil conditions using AI and automation, improving crop yield and reducing resource wastage.

PSA604 - Blockchain-Based Agri-Supply Chain

Design a blockchain-integrated agricultural supply chain platform to enhance transparency, traceability, and fair pricing for farmers, reducing post-harvest losses and ensuring better market access.

PSA605 - Precision Irrigation Management System

Create a smart irrigation system that uses IoT sensors and AI-driven analytics to monitor soil moisture levels, optimize water usage, and enhance crop growth while reducing water wastage.

PSA606 - AI-Powered Pest and Disease Detection System

Develop an AI-based system that uses image processing and IoT sensors to detect crop diseases and pest infestations in real time, enabling timely interventions and reducing yield losses.

PSW701 - IoT Enabled Waste Management for Efficient Collection

IoT-Based Smart Waste Management System: Create a smart garbage bin that uses IoT sensors to detect overflow and send alerts for timely waste collection.

PSW702 - E Waste Tracker: Smart Monitoring & Recycling Management System

E-Waste Monitoring System: Build a software platform to track, monitor, and recycle e-waste generated by government and private organizations.

PSW703 - Smart Waste Segregation System

Develop a sensor-based waste segregation system using IoT and AI to automatically identify and separate biodegradable, recyclable, and non-recyclable waste at collection points, improving recycling efficiency.

PSW704 - IoT-Enabled Biodegradable Waste Converter

Design a compact, IoT-powered biodegradable waste converter that speeds up composting using controlled temperature, moisture, and microbial activity, making it suitable for homes and small communities.

PSW705 - AI-Powered Waste Collection Route Optimization

Create an AI-based waste collection system that analyzes real-time bin fill levels, traffic conditions, and optimized routes to reduce fuel consumption and improve collection efficiency for municipal corporations.

PSW706 - Citizen Waste Reporting & Reward App

Develop a mobile app that allows citizens to report uncollected waste or overflowing bins, track their environmental contributions, and earn rewards for responsible waste disposal and recycling efforts.

PSW707 - AI-Powered Waste Recognition & Recycling Assistant

Develop a mobile or web-based application that uses AI and image recognition to help users identify waste types and suggest proper disposal or recycling methods. The system should provide real-time feedback and integrate with local recycling centers for better waste management.

CYBERSECURITY & EDGE COMPUTING

PSC801 - AI Powered Real-Time Phishing Detection & Protection

Develop an AI-powered Phishing Detection Tool to protect individuals and organizations from cyber threats by analyzing emails, URLs, and messages for phishing indicators. The tool should provide real-time alerts, flag suspicious content, and educate users on cybersecurity best practices to prevent data breaches

PSC802 - AI-Powered Ransomware Detection & Prevention

Develop an AI-driven system that detects ransomware attacks by analyzing unusual file encryption patterns, alerts users in real time, and provides automated mitigation strategies to prevent data loss.

PSC803 - AI-Driven Intrusion Detection for IoT Networks

Develop an AI-powered intrusion detection system that monitors IoT network traffic, identifies anomalies, and prevents cyber threats in real-time, ensuring enhanced security for connected devices.

CYBERSECURITY & EDGE COMPUTING

PSC804 - Blockchain-Based Secure Data Sharing

Design a blockchain-enabled system for secure and tamper-proof data sharing between organizations, ensuring data integrity, privacy, and protection against unauthorized access.

PSC805 - Secure Edge Computing for Healthcare Data

Create an edge computing solution that enables secure, real-time processing of patient health data while ensuring compliance with privacy regulations and reducing dependency on cloud storage.

PSC806 - Energy-Efficient Edge Computing for Smart IoT Networks

Low-Power Edge Device for IoT: Develop a low-power edge computing device for real-time data processing in IoT networks, such as smart homes.

AUGMENTED/VIRTUAL REALITY

PSV901 - Immersive Learning on Climate Change and Ecosystems

Create a VR simulation to teach students about the impact of climate change on ecosystems. The simulation should let users explore different environments like forests, oceans, and polar regions, showing how they are affected by climate change. It should be interactive, engaging, and easy to use, helping students better understand climate change and its effects on the planet.

PSV902 - Adaptive AR & VR Therapy for Guided Rehabilitation

The system should use AR & VR to create interactive exercises that assist in physical therapy, allowing patients to perform guided rehabilitation exercises in a virtual environment. The system should track the patient's movements, provide real-time feedback on their progress, and adapt the difficulty based on the patient's recovery level.

AUGMENTED/VIRTUAL REALITY

PSV903 - AR-Based Interactive Learning for STEM Education

Develop an AR app that creates interactive 3D models to help students learn STEM concepts easily. Users should be able to view and manipulate virtual objects like molecules or physics experiments through a smartphone or AR device. The app should be intuitive, engaging, and enhance understanding. Keep the design simple and feasible for a college hackathon project.

PSV904 - VR-Based Fire Safety and Disaster Preparedness Training

Create a VR training module that simulates real-life fire and disaster scenarios, allowing users to practice emergency response procedures in a safe, controlled environment to improve preparedness and decision-making.

AUGMENTED/VIRTUAL REALITY

PSV905 - AR Navigation and Assistance for Visually Impaired Individuals

Design an AR-based navigation system that provides real-time assistance to visually impaired individuals by detecting obstacles, recognizing landmarks, and offering audio guidance for safer mobility in public spaces.

PS001 - Harnessing the Power of Student Innovation: Encouraging Young Minds to Develop Creative, Technology-Driven Solutions that Address Real-World Challenges, Foster Sustainable Development, and Shape a Smarter, More Connected Future.