

Amrita School of Computing, Amritapuri Campus

Amrita Vishwa Vidyapeetham

Department of Computer Science and Engineering

PROJECT ABSTRACT

Smart Classroom Energy Management

Course Code and title: 22AIE211 Introduction to Communication & IoT

Student Details:

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ABSTRACT

Sustainable development focuses on conscientious use of resources to protect the environment, economy, and society. On campuses, resources are wasted where lights and fans are left open in empty rooms. With increasing technology, especially in the sector of the Internet of Things (IoT), smart solutions are available to better utilize energy. IoT-based automation enables smart regulation of electrical appliances based on occupancy, thus limiting wastage and encouraging sustainability.

The system proposed will perform the following operations:

- Identify the presence of a human in a room.
- Identify if the devices in a room are ON or OFF.
- Manage the devices by turning them ON/OFF according to human detection
- Ongoing monitoring of a space for entry/exit by any human being

Past studies have identified different IoT-based energy management systems. For example, researches in IEEE and Elsevier publications have emphasized sensor-based automation efficiency in lowering the energy usage in buildings. Real-time monitoring by cloud platforms using data and the use of techniques like occupancy detection with PIR sensors have proven effective in energy efficiency. Such studies illustrate the feasibility and efficiency of smart systems in overcoming issues of sustainability.

The system under proposal uses PIR motion sensors to sense human presence and regulate light and fan switching accordingly. The microcontroller (ESP32/Arduino) reads sensor data and controls appliances automatically using relay modules. An IoT platform such as Blynk will be used for remote monitoring and manual override features. The process involves designing a circuit with sensors and actuators, integrating it with the microcontroller, and having real-time communication with the cloud. A block diagram will describe the system architecture as a whole, whereas coding will concentrate on handling sensor data and automated control logic.

Hardware Requirements

- Microcontroller (ESP32/Arduino): Manages sensor data processing and appliance control.
- PIR (Passive Infrared) Motion Sensors: Detects motion to determine classroom occupancy.
- Relay Modules: Controls the switching of lights and fans via voltage signals.
- LEDs: Used for testing the control logic before connecting actual appliances.
- Power Supply: Provides necessary power to the microcontroller and connected components.
- Wiring & Connectors: For establishing secure connections between components.

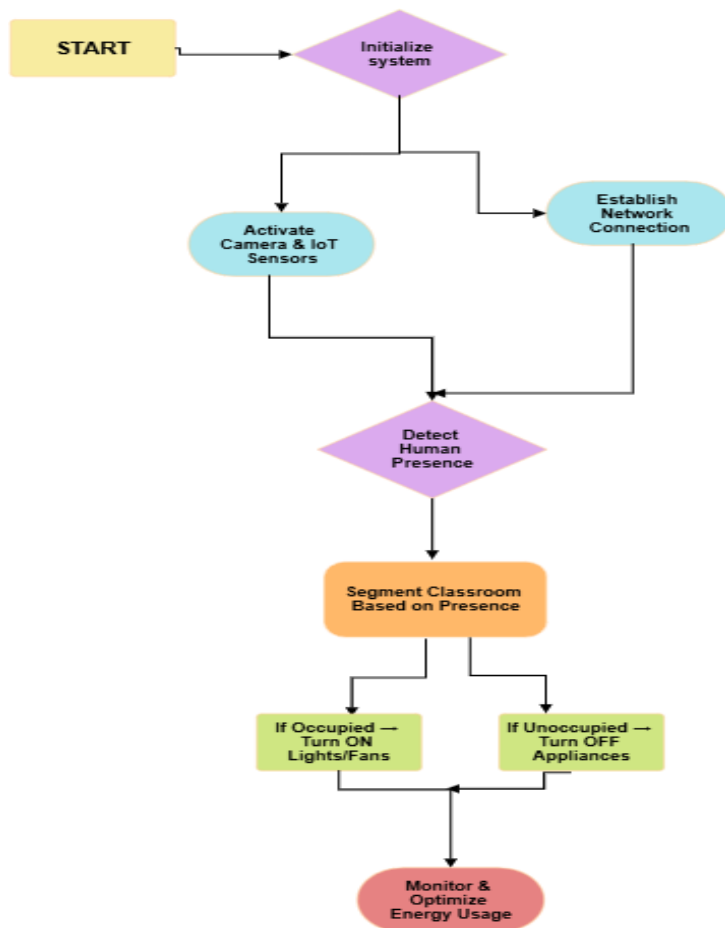
Software Requirements

- Programming Language: C/C++ for microcontroller control logic.
- Libraries/Frameworks:
 - ESP8266WiFi/ESP32WiFi for network connectivity.
 - MQTT Protocol for communication between the IoT device and cloud services.

- Development Platform: Arduino IDE for coding and uploading to the microcontroller.

Cloud Services

- Blynk: For creating a mobile dashboard to monitor and control appliances remotely.
- Thingspeak: Optional service for data logging and visualization.



References:

- [1] Talal H. Noor, El-Sayed Atlam, Abdulqader M. Almars, Ayman Noor, and Amer S. Malki, "An IoT-Based Energy Conservation Smart Classroom System" International Journal of Advanced Computer Science and Applications,(IJACSA),2022
(https://www.researchgate.net/publication/362806572_An_IoT-Based_Energy_Conservation_Smart_Classroom_System)
- [2] Prajas Kadepurkar, Prim Rochelle Dsouza, and Nivya Jomichan , "IoT Based Smart Classroom" International Journal of Applied Sciences and SmartTechnologies,Volume3,Issue1,June,2021
(https://www.researchgate.net/publication/352570013_IoT_Based_Smart_Classroom)
- [3] Mustafa Burunkaya and Kazım Duraklar, "Design and Implementation of an IoT-Based Smart Classroom Incubator" *Applied Sciences*, 2022, Volume12,Issue4,Article2233 (<https://www.mdpi.com/2076-3417/12/4/2233>)