Advanced Computing Lab

Course:	Internet of Things (Lab)
https://aclab-hcmut.github.io/	

Project Description

Subject: Internet of Things Application Development (CO3037 - CO3038)
Class: L01 (HK242)
Teachers:
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- Cao Tiến Đạt

Group: 8386
Students:
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Overview

The **Intelligent Meeting Room Management** is a comprehensive IoT solution that optimizes meeting room utilization while enhancing the meeting experience in modern office environments. The system leverages real-time monitoring of room occupancy, environmental conditions, and equipment status to address common meeting room challenges, including inefficient space utilization, booking conflicts, inadequate meeting environments, and energy saving.

Features

Automated scheduling
- Releases rooms for others to use if meetings end early or participants don't show up.

Energy saving
- Automatically turns off lights, HVAC systems, and other devices when the room is unoccupied.

Environmental monitoring
- Monitors environmental factors like light, temperature, humidity, and air quality in real-time.
- Alarm notification for poor air quality.
- Customize quick modes for meeting setup:
  - Dark Presentation mode: Dimmed lights, closed curtains
  - Bright Presentation mode: Bright lights, closed curtains
  - Collaboration mode: Balanced lights, open curtains
  - Focus mode: Balanced lights, closed curtains

Technical Specification

Hardware used

Microcontroller: ESP32-WROOM-32 (WiFi and Bluetooth enabled)
Sensors:

- DHT20: Humidity and temperature sensor
- LD2410: Human presence sensor mmWave 24GHz
- Light sensor
- MQ135: air quality sensor

Output:

- Indicator lights and a buzzer for the alarm
- Step motor for curtain controller
- Relay module to control the HVAC and lighting system

Power source: Wall power (5V)

Technology used

IoT Platform: CoreIoT is a Thingsboard-based, Cloud-based platform with dashboard visualization.
Connectivity: WiFi with MQTT protocol
Library:

- Arduino.h: Provides core functions for Arduino programming.
- Wire.h: Provides communication over I2C protocol, used by DHT20 sensor.
- WiFi.h: Provides support for WiFi connectivity on the ESP32 board.
- DHT20.h: Provides a specific library to interface with the DHT20 temperature and humidity sensor.
- Arduino_MQTT_Client.h: Provides an MQTT client for Arduino-based boards.
- ThingsBoard.h: Provides connectivity from ESP32 to ThingsBoard
- MQ135.h: Provides air quality control equipment for buildings/offices and is suitable for detecting NH3, NOx, alcohol, Benzene, smoke, CO2, etc.
- LD2410.h: Provides control for Frequency Modulated Continuous Wave radar, which makes it good for presence detection, and its sensitivity at different ranges to both static and moving targets can be configured.

Project Milestones & Timeline

Requirements Analysis & Design Phase (1 week)

- Requirement elicitation and solution specification
- Design system architecture and component interactions
- Develop UI/UX wireframes for the dashboard

Hardware Development Phase (1 week)

- Sensor calibration and testing
- Relay module controller for HVAC and lighting systems

Firmware & Edge Computing Development (1 week)

- ESP32 firmware development
- Sensor data acquisition and processing
- Local edge-based analytics implementation

Dashboard & Cloud Integration (2 weeks)

- Dashboard & Visualization
- Mock API for meeting schedule
- Customize the modes for the meeting room

Integration & System Testing (1 week)

- End-to-end system integration
- Functional testing of all components

Final Presentation & Report (1 week)

- Prepare demonstration
- Finalize the assignment report
- Create presentation slides
- Complete all deliverables