CS667: Introduction to IoT and its Industrial Applications

Assignment: Smart Monitoring System

Total Points: 100
Group Size: 3 students/group

Submission Deadline: August 31, 2024 11:59:59 pm

Alisha's modern apartment featured a Smart Home Energy Management System with DHT temperature, PIR motion, and Ultrasonic sensors. This system intelligently adjusts heating, cooling, and lighting based on occupancy and environmental conditions, ensuring comfort year-round. It efficiently kept the apartment cool during hot summers and warm in chilly winters, all while reducing energy bills. Alisha appreciated its seamless automation, making her home more comfortable and energy efficient.

Create a circuit with a DHT temperature sensor, PIR motion sensor, and ultrasonic sensor so that she can simulate a realistic environment for monitoring and prediction using Arduino Uno. Ensure that the output readings from all sensors are visible on the serial monitor of the Arduino IDE for monitoring and analysis.

Components Provided:

1. Arduino Uno Board with USB Cable
2. HC-SR04 Ultrasonic Distance Sensor
3. DHT Temperature Sensor
4. Breadboard and ESP8266
5. Three LEDs and Three Resistors (One for each sensor)
6. Passive Infrared (PIR) motion sensor.
7. Jumper Wires (20 M-M, 15 F-F)

Expected functionalities from your smart home setup:-

1. Temperature Monitoring: The temperature sensor values (Temperature, Humidity) should be displayed on the Serial Monitor. LED1 should glow at a predefined temperature threshold, decided by your group. The threshold value should be set so that exceeding this value causes the LED1 to glow.

2. Motion Detection: The smart monitoring system should detect motion using the PIR sensor. When motion is detected, it should display "Motion Detected" on the Arduino IDE serial monitor. LED2 should glow whenever motion is detected.

3. Distance Measuring: The system should continuously monitor the distance to an object using the ultrasonic sensor. The distance should be displayed on the Arduino IDE serial monitor in both Centimeters and inches. LED3 should glow at a threshold distance (in cm), decided by the group. The threshold value should be set so that exceeding this value causes the LED3 to glow.

4. Sending data to the server: Using the ESP8266 Wi-Fi Module the system should send the collected sensor data (distance, temperature, humidity, and motion status) to a server using the MQTT protocol. The data should be sent in a structured format, enabling it to be easily parsed and used by the GUI in the next step.

5. Data Visualization: You should visualize the real-time data using a Python-based GUI. The GUI should subscribe to the MQTT topic and display the following:

    Distance: Showing distance in cms.
    Temperature: Displaying the current temperature in Celsius.
    Humidity: Showing humidity value.
    Motion Status: (YES/NO) Indicating whether motion is detected or not.

Deliverables:

1. Create a Demo of your work in the form of a video. It should include the working of the hardware setup and real-time output of the sensors on the GUI. Add this video link to the Report.
2. PDF report should contain the information of setup and working of the Home Automation. Please mention the names and email IDs of each group member on the front page of the report.
3. The solution for the assignment should be submitted as a zip file. Please submit a single file per group. The zip file must contain the above-mentioned PDF Report and Codes (.ino file and code of GUI part).

Note: Codes should be submitted as a separate file in the zipped folder. Name the zipped folder in the following format:

<div align="center">Group<Number>_CS667_Assignment1.zip</div>

Evaluation Scheme for Assignment:

You will be given time slots to show the live working demo of the setup which will be included for the evaluation. The evaluation scheme is as follows:

1. Building the Circuit to demonstrate the connections. This will be evaluated based on the glowing LEDs.   (15 Marks)
2. Functionality of the smart monitoring system based on the expected deliverables. This includes Sending data to the server and Data Visualization steps.   (20 + 20 = 40 Marks)
3. Writing Report for the experiment setup including video.   (15 Marks)
4. Final Live Demo and Q&A session.   (30 Marks)