Home Automation Project Report

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1 Introduction

Objective: This project aims to develop a smart home automation system that monitors temperature, detects motion, measures distance, and visualizes real-time data using a Python-based GUI. The system integrates multiple sensors and uses MQTT.

2 System Overview

2.1 Components Used

- **Arduino**: Main microcontroller unit.

- **ESP8266 Wi-Fi Module**: For sending data to the server via MQTT.

- **Temperature Sensor**: Measures temperature and humidity.

- **PIR Motion Sensor**: Detects motion.

- **Ultrasonic Sensor**: Measures distance.

- **LEDs**: Indicators for temperature, motion, and distance.

3 Setup and Working

3.1 Hardware Setup

- **Arduino Connections:**

  - **Temperature and Humidity Sensor**:
    1. VCC to Arduino 5 V
    2. GND to Arduino ground
    3. DHT pin to digital pin 3
    4. Working : Using DHT library read

  - **PIR Sensor**:
    1. VCC to Arduino 5 V
    2. GND to Arduino ground

3. PIR pin to digital pin 2

4. Working : Using pir State reading

    – **Ultrasonic Sensor**:

1. VCC to Arduino 5 V

2. GND to Arduino ground

3. Trigger PIN to digital pin 9

4. Echo Pin to digital pin 10

5. Working : The ultrasonic sensor emits a pulse and measures the time it takes for the echo to return. The distance is calculated based on the time delay and the speed of sound.

    – **LEDs**: Connected to digital output pins

    – **ESP8266**: Connected via serial communication for data transfer. Power given by USB and information using RX pin of ESP and TX pin of Arduino.

3.2   Software Setup

Arduino : The Arduino code reads sensor data, controls LEDs, and sends data to the ESP8266 module.

    ESP8266 : Uses ESP8266 WiFi Library to connect to internet and PubSubClient to establish MQTT connection.

3.3   Data Visualization

The Python-based GUI subscribes to the MQTT topic and displays the data using paho-mqtt. It uses tkinter and json for proper display of data.
Codes are included in zip

4   Implemented Functionalities

1. **Temperature and Humidity Monitoring** : The DHT sensor measures the Temperature and if is above a threshold i.e. **30 degree Celsius**, it writes a digital pin high and makes the red LED glow

2. **Motion Detection** : The motion is detected using PIR sensor, which when detected a motion makes pirState high making green led glow.

3. **Distance Measuring** : It uses Ultrasonic sesnor and when distance ¡ 10 cm , yellow LED glows

4. **Sending Data to Server** : ESP takes Arduino data and uses MQTT to send it to server which is a MQTT broker . We have used Mosquitto which is free and open source.

5. **Data Visualization** : We used Python GUI to subscribe to MQTT broker on a unique topic esp8266/cs667paras432 and uses tkinter to visualize the data

5   Conclusion

The home automation system successfully integrates temperature monitoring, motion detection, and distance measuring functionalities. Real-time data is transmitted via MQTT and visualized using a Python GUI. We have recorded a video showcasing the
Link : Demo$_V ideo$

6   References

- Arduino Documentation

- ESP8266 Documentation

- MQTT Protocol Documentation

- Python Tkinter Documentation

- ArduinoIDE Libraries