Robotics - IOT based home automation

Introduction

IoT-based home automation involves connecting and controlling smart devices like lights, thermostats, and security systems over the internet. Users can automate tasks, monitor and control devices remotely using smartphones, enhancing convenience, energy efficiency, and security in homes.

The uses of IoT-based home automation include:

1. Convenience: Remote control of devices for easy management of home functions.

2. Energy Efficiency: Automated control of appliances and systems to optimize energy usage.

3. Security: Integration of smart security systems for monitoring and securing the home.

4. Automation: Setting up routines and schedules for devices to perform tasks automatically.

5. Remote Monitoring: Checking and controlling home devices from anywhere with an internet connection.

6. Data Insights: Gathering and analysing data to gain insights into energy consumption and user preferences.

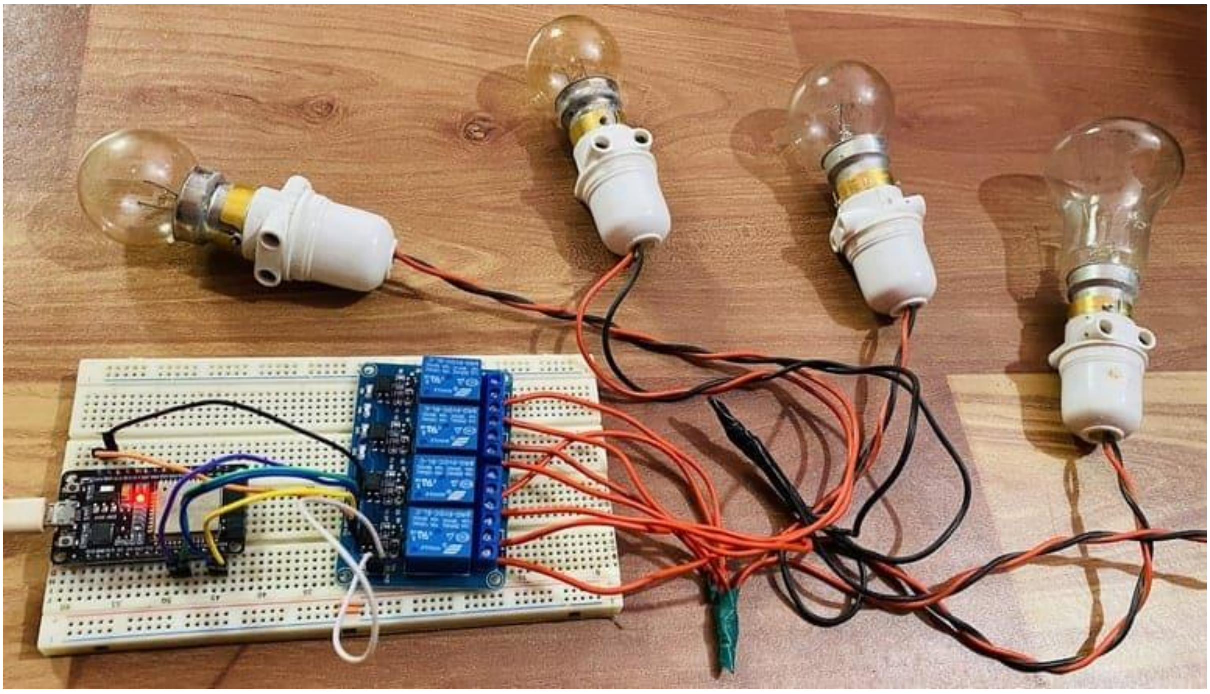

Figure 1: IOT based home automation project.

Components Used

1. ESP32: A powerful microcontroller with Wi-Fi and Bluetooth capabilities.

2. Relay Module: Used to control the high voltage (AC) circuit with a low voltage (DC) signal from the ESP32.

3. Light Bulbs with Holders: The load being controlled.

4. Breadboard: For assembling the circuit without soldering.

5. Jumper Wires: For making connections between the components.

6. USB Cable: To program the ESP32 and provide power.

Procedure

1. Set Up the ESP32 and Relay Module:

   - Connect the VCC and GND pins of the relay module to the 3.3V and GND pins of the ESP32, respectively.

   - Connect the IN1, IN2, IN3, and IN4 pins of the relay module to GPIO pins on the ESP32 (e.g., GPIO 23, GPIO 22, GPIO 21, GPIO 19).

2. Connect the Light Bulbs:

   - Connect one terminal of each light bulb holder to the Normally Open (NO) terminal of each relay.

   - Connect the other terminal of the light bulb holders together and then to the AC live wire.

   - Connect the common (COM) terminals of each relay together and then to the AC neutral wire.

3. Programming the ESP32:

   - Install the necessary libraries for ESP32 in the Arduino IDE.

   - Connect the ESP32 to your computer using a USB cable.

   - Open the Arduino IDE and select the appropriate board and port.

   - Upload the following code to the ESP32.

Arduino Code

Here is the simple code to control the relays (and thus the light bulbs) via the ESP32. This example uses basic GPIO control to switch the relays on and off.

```
#define RELAY1 23

#define RELAY2 22

#define RELAY3 21

#define RELAY4 19
```

```
void setup() {
  // Initialize serial communication
  Serial.begin(115200);

  // Set relay pins as outputs
  pinMode(RELAY1, OUTPUT);
  pinMode(RELAY2, OUTPUT);
  pinMode(RELAY3, OUTPUT);
  pinMode(RELAY4, OUTPUT);

  // Initially set all relays to off
  digitalWrite(RELAY1, HIGH);
  digitalWrite(RELAY2, HIGH);
  digitalWrite(RELAY3, HIGH);
  digitalWrite(RELAY4, HIGH);
}

void loop() {
  // Turn on Relay 1
  Serial.println("Turning on Relay 1");
  digitalWrite(RELAY1, LOW);
  delay(1000);  // Wait for a second

  // Turn off Relay 1
  Serial.println("Turning off Relay 1");
  digitalWrite(RELAY1, HIGH);
  delay(1000);  // Wait for a second

  // Repeat for other relays
  Serial.println("Turning on Relay 2");
  digitalWrite(RELAY2, LOW);
  delay(1000);
  Serial.println("Turning off Relay 2");
  digitalWrite(RELAY2, HIGH);
  delay(1000);

  Serial.println("Turning on Relay 3");
  digitalWrite(RELAY3, LOW);
  delay(1000);
  Serial.println("Turning off Relay 3");
  digitalWrite(RELAY3, HIGH);
  delay(1000);

  Serial.println("Turning on Relay 4");
  digitalWrite(RELAY4, LOW);
  delay(1000);
  Serial.println("Turning off Relay 4");
  digitalWrite(RELAY4, HIGH);
  delay(1000);
}
```

This code will turn each relay (and corresponding light bulb) on and off sequentially, with a 1-second delay between each action. Make sure to adjust the GPIO pin numbers in the code if they differ from your actual wiring.

Safety Note

When working with high voltage (AC) circuits, always ensure safety precautions are followed. Double-check all connections, and if you're not confident with handling high voltage, seek assistance from someone experienced.