Project: Home Automation(Hardware Implementation)

Aim

To design and implement a Home Automation System that monitors gas levels, temperature, and humidity using an ESP32 microcontroller, and provides real-time data to the user through an LCD display and the Blynk IoT platform. The system also includes a notification mechanism for gas detection alerts.

Equipment and Components

HARDWARE

- **ESP32 Development Board** - Acts as the central controller and connects to the internet for Blynk integration.
- **MQ-2 Gas Sensor** - Monitors gas concentration levels.
- **DHT11 Sensor** - Measures temperature and humidity.
- **LCD with I2C** - Displays real-time sensor data.
- **LED** - Indicator for system status or alerts.
- **Breadboard** - For connections and circuit building.
- **Jumper Wires** - For connecting components.

SOFTWARE

- **Arduino IDE** - To program the ESP32.
- **Blynk IoT Platform** - For real-time monitoring and notifications.

LIBRARIES REQUIRED

- **BlynkSimpleEsp32.h** - For Blynk IoT integration.
- **LiquidCrystal_I2C.h** - For LCD control.
- **DHT.h** - For DHT11 sensor data reading.
- **WiFi.h** - For WiFi connectivity.

Theory

The Home Automation System leverages IoT technology to monitor environmental parameters and notify users about potential hazards.

1. ESP32 connects to a WiFi network and integrates with the Blynk IoT platform for real-time data transmission and event handling.
2. MQ-2 Gas Sensor detects the concentration of gases such as LPG, smoke, or CO. When the gas value exceeds a predefined threshold, an alert is triggered via the Blynk app.
3. DHT11 Sensor measures temperature and humidity levels and displays the data on an LCD.
4. Blynk App allows users to monitor data in real-time, control connected devices, and receive alerts.
5. The system can be extended to control appliances or further enhanced for disaster prevention mechanisms.

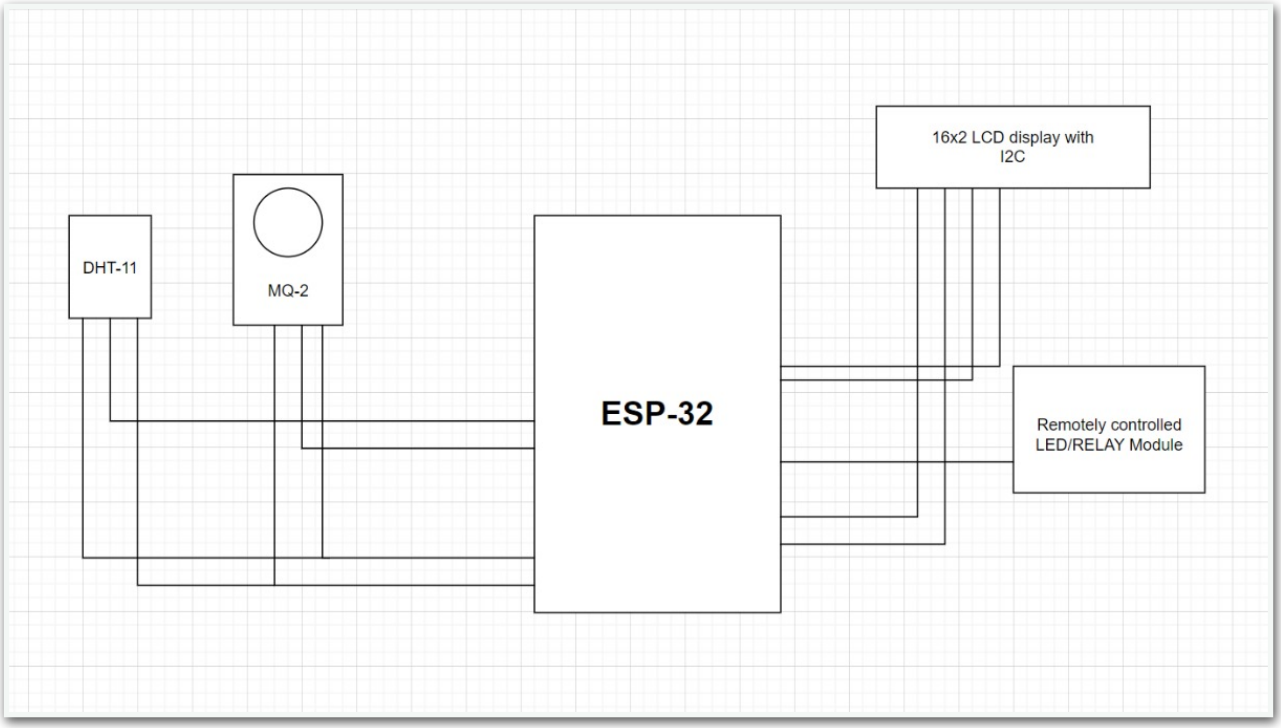
Source Code

```
#define BLYNK_PRINT Serial

// Blynk device details
#define BLYNK_TEMPLATE_ID "TMPL3fXpXORWY"
#define BLYNK_TEMPLATE_NAME "Home Automation"
#define BLYNK_AUTH_TOKEN "e8sQqZlhSMIwzC-I9d5ern-2aHyrwbE1"

#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <DHT.h>
```

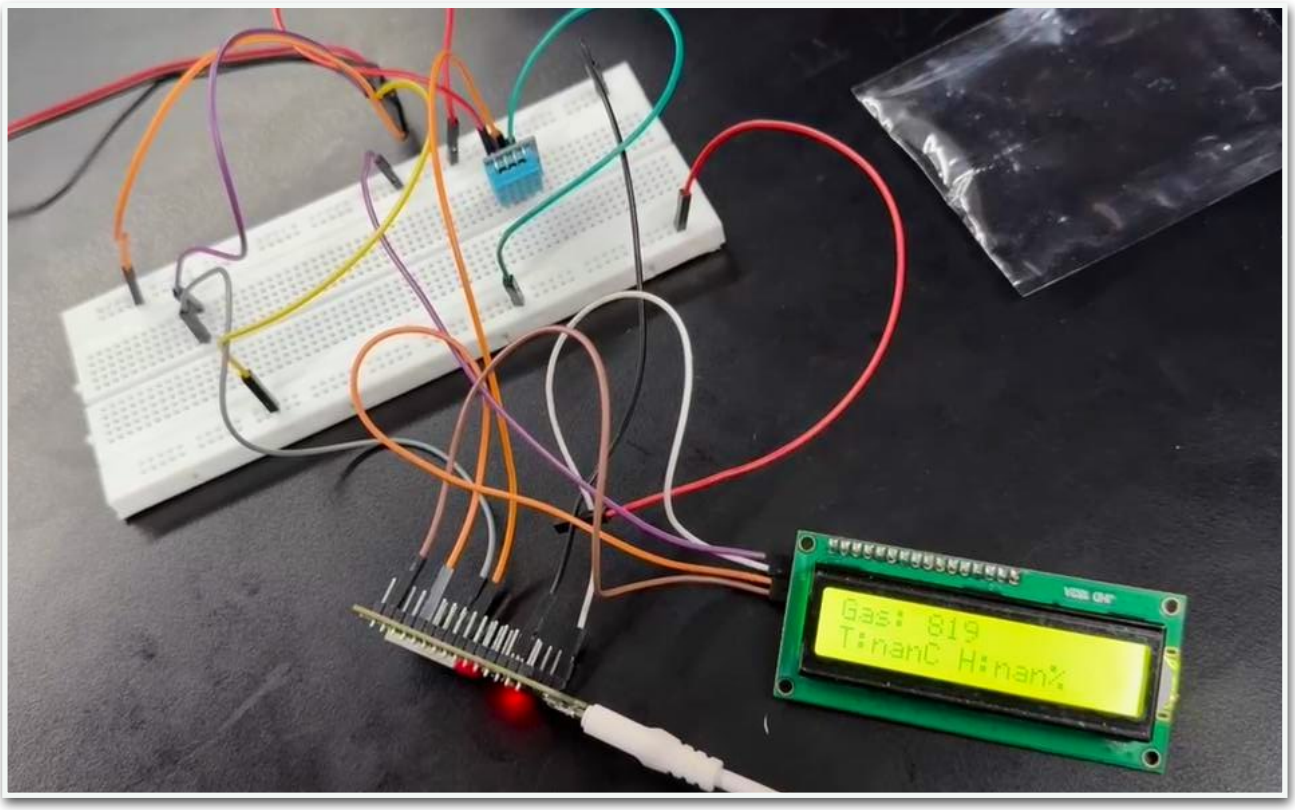
```
#include <BlynkSimpleEsp32.h>
#include <WiFi.h>
#include <WiFiClient.h>

// WiFi credentials
char ssid[] = "iQOO Neo9 Pro";
char pass[] = "244466666";

// Initialize LCD
LiquidCrystal_I2C lcd(0x27, 16, 2);

// Sensor pins
const int gasSensorPin = 34; // Analog pin for the MQ-2 gas sensor
const int dhtPin = 33;       // Data pin for the DHT11 sensor

// DHT11 sensor setup
#define DHTTYPE DHT11
DHT dht(dhtPin, DHTTYPE);

void setup() {
  // Initialize Serial Monitor for debugging
  Serial.begin(9600);

  // Initialize Blynk connection
  Blynk.begin(BLYNK_AUTH_TOKEN, ssid, pass);

  // Initialize LCD
  lcd.init();
  lcd.backlight();
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Initializing...");

  // Configure pins and initialize sensors
  pinMode(gasSensorPin, INPUT);
  pinMode(dhtPin, INPUT);
  dht.begin();
  pinMode(4, OUTPUT); // LED pin
  delay(2000); // Allow sensors to stabilize
}

void loop() {
  // Run Blynk to keep it connected
  Blynk.run();

  // Read gas sensor value and scale it
  int gasValue = analogRead(gasSensorPin) / 5;
  Blynk.virtualWrite(V0, gasValue);

  // Read temperature and humidity from the DHT11 sensor
  float temperature = dht.readTemperature(true); // Temperature in
Fahrenheit
```

```
  float humidity = dht.readHumidity();

  // Send an alert if gas value exceeds the threshold
  if (gasValue > 2000) {
    Blynk.logEvent("gas__detected", "Gas alert..");
  }

  // Display gas value on LCD
  lcd.setCursor(0, 0);
  lcd.print("Gas: ");
  lcd.print(gasValue);
  lcd.print("       "); // Clear old data with padding

  // Display temperature and humidity on LCD
  lcd.setCursor(0, 1);
  lcd.print("T:");
  lcd.print(temperature);
  lcd.print("C H:");
  lcd.print(humidity);
  lcd.print("%  ");

  // Turn on LED
  digitalWrite(4, HIGH);

  // Delay for a fixed update interval
  delay(2000);
}
```

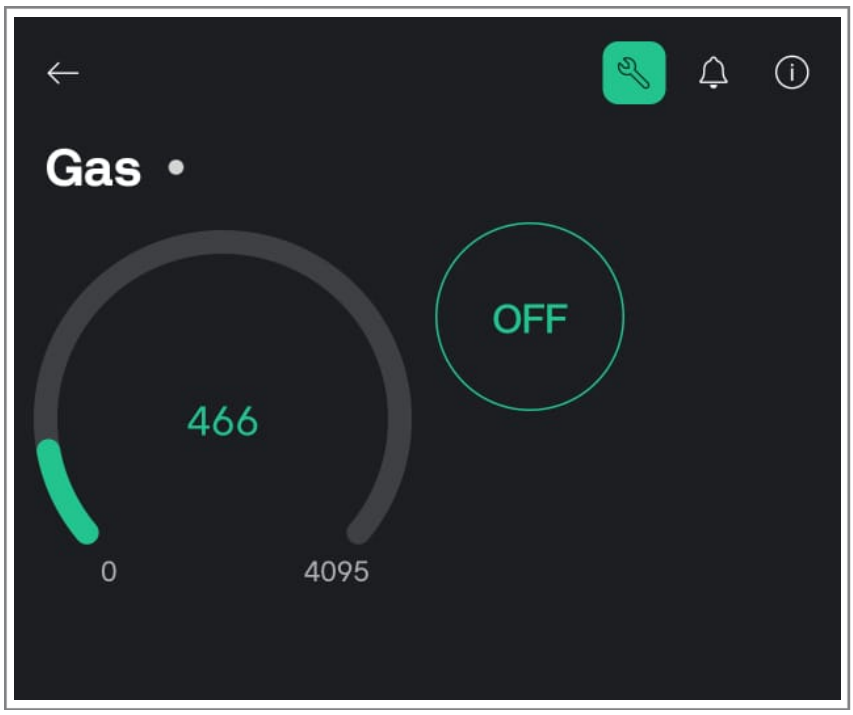
Output



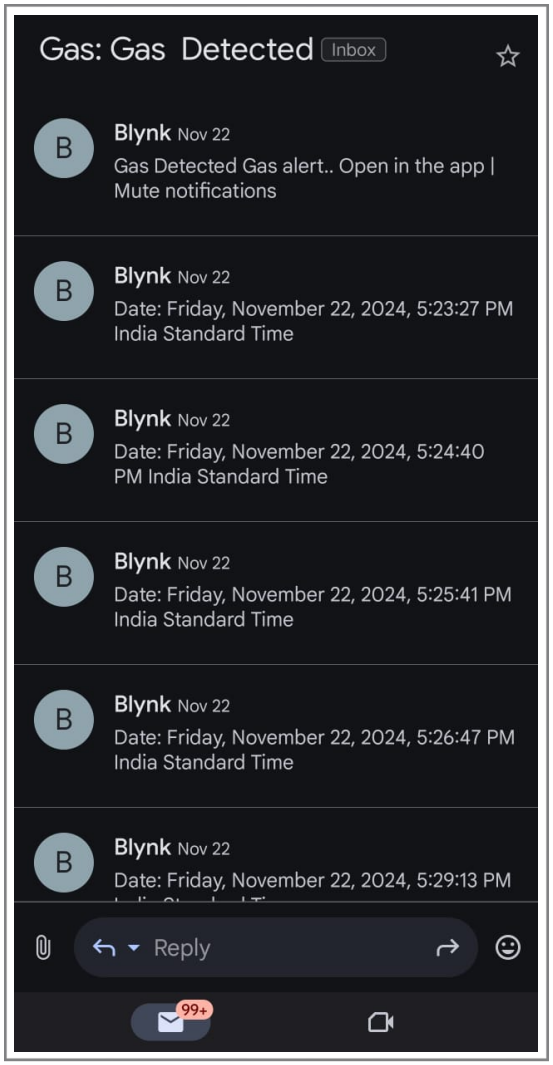
Pin Diagram



Hardware connections



Blynk App User Interface
1.Realtime gas sensor Data
2.Led on/off Button



Result

- The system successfully monitors gas concentration, temperature, and humidity.
- Real-time data is displayed on the LCD and transmitted to the Blynk app.
- Alerts are sent to the user's phone if gas levels exceed the threshold.

Discussion

- The MQ-2 sensor is sensitive to LPG, methane, and smoke, making it suitable for gas leakage detection.
- The DHT11 sensor provides accurate readings of environmental conditions but has a slower response time.
- The integration with the Blynk IoT platform ensures real-time notifications and control from anywhere with internet access.
- Future enhancements could include adding control for household appliances and integrating more sensors (e.g., motion detection).

Conclusion

The implemented Home Automation System efficiently monitors environmental conditions and notifies users of potential hazards in real-time. It demonstrates the potential of IoT in enhancing safety and convenience in daily life.