**Final Project: Real-Time Weather Monitoring System**

**1. Project Title:**

**Real-Time Weather Monitoring System Using IoT**

**2. Objective:**

The goal of this project is to design a Real-Time Weather Monitoring System that provides real-time data such as temperature, humidity, atmospheric pressure, rain levels, and air quality using various sensors. This system is IoT-based, providing data monitoring through the Blynk app on a smartphone. The system uses a microcontroller (ESP8266) to send data from sensors (DHT11, BMP180, MQ-2, and Rain Sensor) to the Blynk cloud.

**3. Components Required:**

1. **ESP8266 Wi-Fi Module**
2. **DHT11 Temperature & Humidity Sensor**
3. **BMP180 Atmospheric Pressure Sensor**
4. **MQ-2 Gas and Air Quality Sensor**
5. **Rain Sensor**
6. **16x2 LCD Display (I2C interface)**
7. **Jumper Wires**
8. **Breadboard**
9. **Power Supply**
10. **Smartphone with Blynk App**

**4. Interfacing:**

**Sensor 1: DHT11 (Temperature and Humidity)**

* **Pin Connections:**
  + VCC to 3.3V (ESP8266)
  + GND to GND
  + Data Pin to D2 (GPIO4)

**Sensor 2: BMP180 (Pressure and Altitude)**

* **Pin Connections:**
  + VCC to 3.3V (ESP8266)
  + GND to GND
  + SDA to D1 (GPIO5)
  + SCL to D0 (GPIO16)

**Sensor 3: MQ-2 (Air Quality Sensor)**

* **Pin Connections:**
  + VCC to 5V
  + GND to GND
  + A0 to A0 (analog pin)

**Sensor 4: Rain Sensor**

* **Pin Connections:**
  + VCC to 5V
  + GND to GND
  + Analog Pin (A0) to Analog Input on ESP8266

**LCD Display (I2C)**

* **Pin Connections:**
  + VCC to 3.3V (ESP8266)
  + GND to GND
  + SDA to D2 (GPIO4)
  + SCL to D1 (GPIO5)

**ESP8266 Wi-Fi Module:**

* **Wi-Fi Module Configuration:**
  + ESP8266 will act as the controller, collecting data from all sensors and sending it via Wi-Fi to the Blynk cloud. The module uses the Blynk library to interface with the cloud.

**5. Software Setup:**

**Libraries Used:**

1. **ESP8266WiFi**: For Wi-Fi connection and internet communication.
2. **BlynkSimpleEsp8266**: For communication with the Blynk app.
3. **Wire**: For I2C communication.
4. **LiquidCrystal\_I2C**: To interface with the I2C LCD display.
5. **DHT**: To interface with the DHT11 sensor for temperature and humidity readings.
6. **Adafruit\_BMP085\_U**: For interacting with the BMP180 sensor.
7. **MQ2**: For detecting gases and air quality.

**Blynk Setup:**

* **Blynk Template ID** and **Template Name**: Used to link your Blynk app with the hardware.
* **Blynk Virtual Pins**: V1, V2, V3, and V4 are used for displaying temperature, humidity, air quality, and atmospheric pressure, respectively.

**Code Overview:**

* The code sets up all the sensors, connects to Wi-Fi, and initializes the Blynk communication.
* Data from the sensors (DHT11, BMP180, MQ-2, and Rain Sensor) is read and sent to the Blynk app via virtual pins every 2 seconds.
* The LCD displays real-time temperature and humidity values.
* The system monitors air quality (via MQ-2) and atmospheric pressure (via BMP180).

**6. Project Results:**

* The system successfully collects real-time environmental data from the sensors.
* Data is transmitted to the Blynk app, where the user can monitor it remotely.
* The LCD shows real-time temperature and humidity values.
* The app shows real-time readings for temperature, humidity, air quality, and atmospheric pressure.

**7. Conclusion:**

The **Real-Time Weather Monitoring System** is a comprehensive IoT-based project that uses a variety of sensors and Wi-Fi technology to monitor and display environmental data. The integration of the **Blynk app** allows remote monitoring, providing users with live updates. This project demonstrates how sensors like **DHT11**, **BMP180**, **MQ2**, and **Rain Sensor** can be integrated with IoT devices to create real-time weather-monitoring systems.

Future improvements can include:

1. **Adding more sensors**: To monitor additional parameters like light or soil moisture.
2. **Data logging**: Storing historical data in a cloud service like Firebase or Google Sheets for analysis.
3. **Power management**: Implementing power-saving techniques or using a battery for portable operation.