**Project Overview**

**Project Title**: Environmental Monitoring System

**Description**: This project involves designing a PCB to monitor environmental parameters such as temperature, humidity, and air quality. The system integrates various sensors, processes the data using a microcontroller, and transmits the information to a remote server or displays it locally.

**Purpose of the Project**

**Why We Do This Project**:

1. **Environmental Awareness**: Monitoring environmental conditions is crucial for understanding and managing the quality of the air we breathe and the climate conditions we live in. This project aims to provide real-time data on key environmental parameters.
2. **Health and Safety**: By keeping track of air quality, temperature, and humidity, the system can help identify hazardous conditions, improving health and safety standards in homes, offices, and public spaces.
3. **IoT Integration**: This project leverages IoT technology to create a connected device that can communicate environmental data to a server, enabling remote monitoring and analysis.

**System Architecture**

**Block Diagram**: (Refer to the above block diagram)

**System Components**:

1. **Power Supply**:
   * **Voltage Regulator**: AMS1117-3.3 to provide a stable 3.3V power supply.
   * **Capacitors and Resistors**: For power filtering and stabilization.
2. **Microcontroller (ESP32)**:
   * Central unit for data processing and communication.
   * Features built-in Wi-Fi for data transmission.
3. **Sensors**:
   * **DHT22**: Measures temperature and humidity.
   * **MQ-135**: Monitors air quality (detects various gases).
4. **Communication Module**:
   * **Wi-Fi**: Integrated within the ESP32, enables data transmission to a remote server.
5. **Display (Optional)**:
   * **OLED Display (SSD1306)**: For local visualization of data. Connects via I2C interface.

**Functionality**:

1. **Data Collection**: Sensors collect real-time environmental data.
2. **Data Processing**: The ESP32 processes the collected data.
3. **Communication**: Data is transmitted to a remote server using Wi-Fi.
4. **Power Management**: The system is powered efficiently using voltage regulators and filtering components.

**Detailed Component List**

1. **ESP32**: Microcontroller with Wi-Fi and Bluetooth capabilities.
2. **DHT22**: Temperature and humidity sensor.
3. **MQ-135**: Air quality sensor.
4. **AMS1117-3.3**: Voltage regulator for 3.3V power supply.
5. **Capacitors**: Various values for power supply filtering.
6. **Resistors**: For sensor biasing and pull-up requirements.
7. **SSD1306 (Optional)**: OLED display for data visualization.

**System Operation**

1. **Initialization**: The system powers up, initializes the ESP32, and configures the sensors.
2. **Data Acquisition**: Sensors start collecting temperature, humidity, and air quality data.
3. **Data Processing**: The ESP32 processes the sensor data and prepares it for transmission.
4. **Data Transmission**: The ESP32 uses Wi-Fi to send the data to a remote server for storage and analysis.
5. **Local Display (Optional)**: The OLED display shows real-time data locally.

**Conclusion**

This environmental monitoring system provides a comprehensive solution for tracking essential environmental parameters. By integrating modern sensors and microcontroller technology, the system can offer valuable insights into environmental conditions, promoting better health, safety, and awareness.