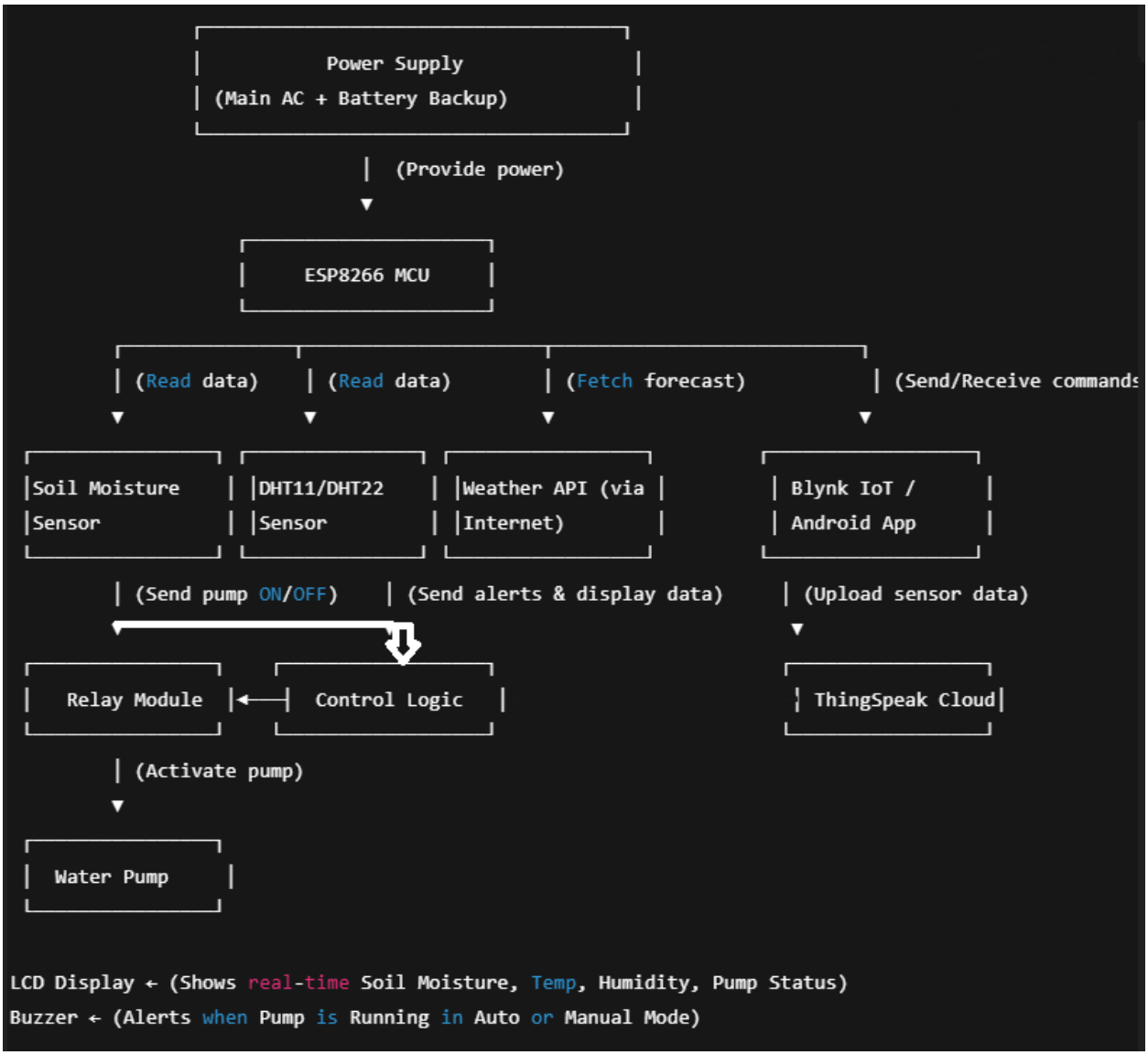
Smart Irrigation System – Project Structure



1. Hardware Components

- **ESP8266 Wi-Fi Module** – central microcontroller with Wi-Fi connectivity.
- **Soil Moisture Sensor** – detects volumetric water content in the soil.
- **DHT11/DHT22 Sensor** – measures the temperature & humidity.
- **Relay Module** – controls pump on/off.
- **Water Pump** – irrigates the field based on control signals.
- **LCD Display (16×2)** – real-time display of sensor readings & pump status.
- **Power Supply**
    - **Primary:** Household charging cable (AC to DC adapter).

    - **Backup:** Rechargeable battery pack for power outages.
- **Sound Sensor with Alert Buzzer** – alerts when pump is active in either mode.

2. Software Stack

- **Arduino IDE** – firmware development for ESP8266.
- **Blynk IoT Platform** – remote monitoring & control.
- **ThingSpeak** – cloud platform for data storage & analytics.
- **Android Studio** – backup mobile control app in case Blynk is unavailable.

3. Modes of Operation

Mode 1 – Fully Automated

- Soil moisture measured continuously.
- If moisture < preset threshold → Relay ON → Pump activates.
- If **weather prediction indicates rain** → skip irrigation cycle.
- Auto cut-off water when soil moisture ≥ target.

Mode 2 – Fully Manual

- User manually controls pump via Blynk or Android app.
- LCD shows real-time soil moisture, temperature, humidity, and pump status.

4. Extra Features

- **Dual Power Supply:** Automatic switch to battery backup if main power fails.
- **Alert System:** Sound sensor triggers buzzer when pump is running.
- **Data Logging & Analysis:** ThingSpeak for graphical data visualization.
- **Failover Control:** Android app control when Blynk is unavailable.

5. AI Chatbot Integration(Extra Feature if wanted)

- **Purpose:** Provide crop advisory, troubleshooting, irrigation scheduling tips.
- **Tech Stack:**

    - OpenAI / Rasa / Dialogflow for chatbot.
    - NLP for answering farming-related queries.
    - Integration into mobile app UI.
- Weather-based irrigation suggestions.