

1. Brief Description

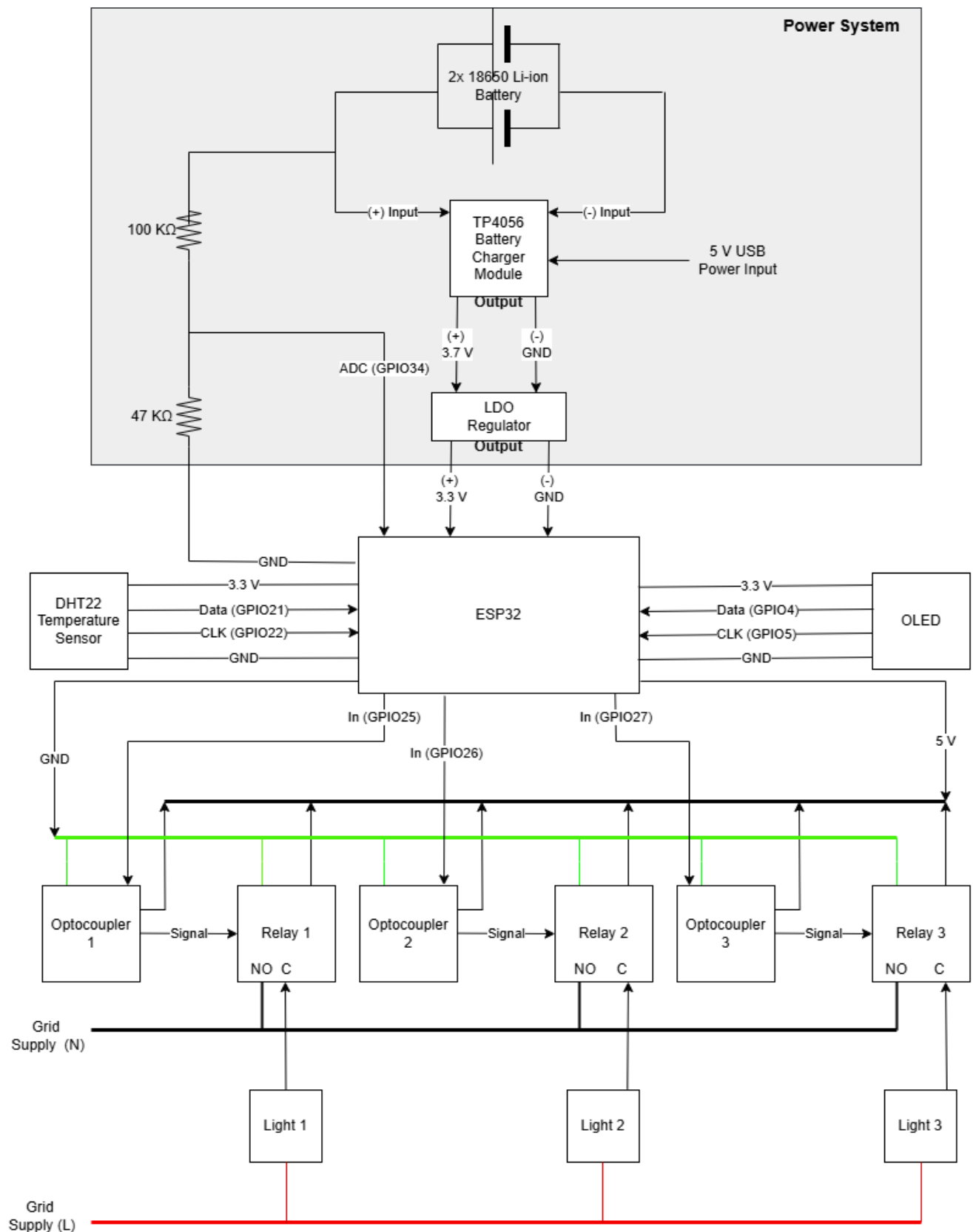
The proposed project is a **Home Lighting Controller** based on the ESP32 microcontroller, designed to control lights remotely via WiFi. This system allows users to turn lights on and off using WiFi-based commands while monitoring temperature, humidity, and battery status. It integrates multiple data transmission methods, including **MQTT, HTTP, and UDP**, for seamless communication. Additionally, the device includes an **OLED display** for real-time status updates and an **NTP time synchronization** feature to maintain accurate time. The entire system will be **battery-powered** with a **minimum runtime of 24 hours**, ensuring reliability even during power outages.

The device will prioritize **low power consumption** by utilizing deep sleep mode and efficient circuit design. A **power monitoring system** will be implemented to track battery voltage levels, send alerts, and shut down the device when necessary. To enhance usability, a **web-based user interface** will allow users to monitor device status and configure settings. The system will be enclosed in a protective **3D-printed or plastic case** to ensure durability.

2. List of Components

Component	Purpose
ESP32 Dev Board	Main microcontroller for WiFi, control, and data transmission
18650 Li-ion Battery	Power source
TP4056 Battery Charger Module	Battery charging and protection
HT7333 LDO Regulator	Converts 3.7V to 3.3V for ESP32
OLED Display (SSD1306, I2C)	Display for status updates
DHT22 / BME280 Sensor	Temperature and humidity monitoring
Opto Coupler (PC817 or similar)	Isolation between ESP32 and relays
1-Channel Relay Module	Controls lights via WiFi commands

3. Block Diagram of the System with Power System



4. Conclusion

This project aims to develop an efficient and reliable **WiFi-based Home Lighting Controller** with additional monitoring capabilities. By implementing **low-power design strategies, real-time data transmission, and an intuitive user interface**, the system will provide an advanced, energy-efficient solution for smart home lighting automation. The project will demonstrate multiple communication protocols (**MQTT, HTTP, UDP**) and integrate essential features such as **NTP time synchronization, battery monitoring, and OLED status display**. The final product will be **housed in a protective enclosure** to ensure durability and usability in real-world applications.