**Core Electronics**

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| **Component** | **Details / Notes** |
| **ESP32 Dev Board** | Main microcontroller with 38 pins, Wi-Fi and dual-core support |
| **DHT22 Sensor** | Temperature and Humidity Sensor |
| **0.96" OLED Display** | 128x64 SPI OLED (7-pin, SSD1306 controller) |
| **4-Channel Relay Module** | JQC3F-05VDC-C relays, opto-isolated |

**Power Supply**

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| **Component** | **Details / Notes** |
| **2x 18650 Li-ion Batteries** | 3.7V, 5000mAh each, used in parallel (3.7V total) |
| **5V Power Bank Module** | Step-up boost converter to provide 5V from 3.7V battery |
| **External Toggle/Push Switch** | Used to control power to ESP32 (ON/OFF functionality) |
| **Voltage Divider Resistors** | 100kΩ and 47kΩ for battery voltage monitoring that connects to ESP32 GPIO 34 Pin |

**Communication Interfaces**

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| **Component / Protocol** | **Purpose** |
| **Wi-Fi** | Internet connection for MQTT, HTTP, UDP |
| **MQTT (via PubSubClient)** | Sensor and relay data transmission |
| **HTTP Client (via HTTPClient.h)** | Data upload to phys.cmb.ac.lk and to pre created web inteface |
| **UDP (via WiFiUDP.h)** | Relay control via PC command line |

**Relay Outputs**

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| **Relay Channel** | **Usage** |
| Relay 1 | Living Room Light |
| Relay 2 | Bedroom Light |
| Relay 3 | Kitchen Light |
| Relay 4 | Garden Light (With scheduled control) |

**Software Libraries Used**

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| **Library** | **Purpose** |
| WiFi.h, WebServer.h | WiFi & HTTP server control |
| PubSubClient.h | MQTT support |
| NTPClient.h | Time sync with NTP |
| WiFiUDP.h | UDP communication |
| HTTPClient.h | HTTP POST to remote server |
| DHT.h | DHT22 sensor reading |
| Adafruit\_GFX.h | OLED graphics library |
| Adafruit\_SSD1306.h | OLED driver |
| ArduinoJson.h | For live JSON updates in web UI |
| SPI.h | For OLED SPI communication |
| esp\_sleep.h | For deep sleep power saving |
| TimeLib.h | (optional, if used) for easier time handling |