

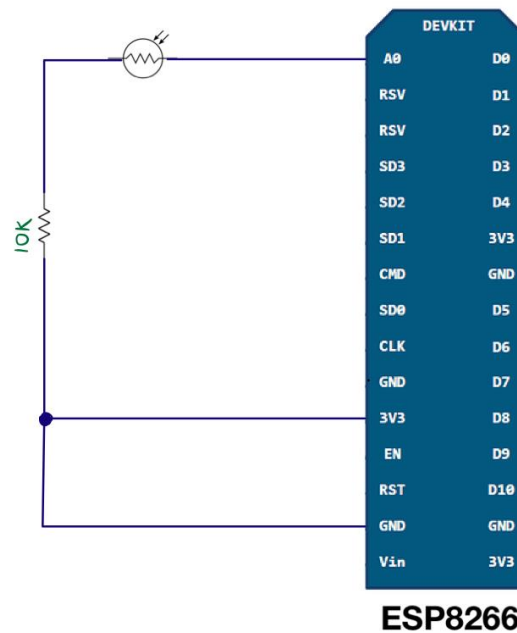
## Components

- Raspberry Pi
- ESP8266
- Photoresistor (Light Sensor)
- LEDs (Red, Yellow, Green, and White)
- Buttons (Start/Reset, UDP Packet Loss Simulation)

## Schematic Description

### ESP8266

1. Photoresistor (Analog Light Sensor):
  - One side: Connected to 3.3V.
  - Other side: Connected to A0 (analog input) on the ESP8266.
  - Use a pull-down resistor (typically 10k $\Omega$ ) between the photoresistor and ground.
2. Onboard LED of ESP8266:
  - Onboard LED of the ESP8266, no extra connections needed as it's controlled via code.



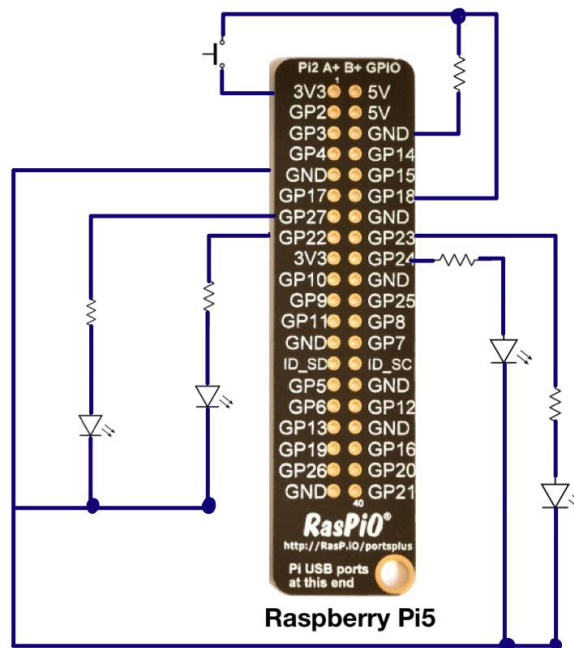
### Raspberry Pi

1. LEDs
  - All LEDs have a 330 $\Omega$  resistor between the GPIO pin and LED anode to limit current.

- Red LED: Anode (long leg): GPIO 27, Cathode (short leg): Connect to GND.
- Yellow LED: Anode (long leg): GPIO 22, Cathode (short leg): Connect to GND.
- Green LED: Anode (long leg): GPIO 23, Cathode (short leg): Connect to GND.
- White LED: Anode (long leg): GPIO 24, Cathode (short leg): Connect to GND.

## 2. Button

- Pin: GPIO 15
- Ground: Connect the other leg to a GND pin (pin 6)
- Resistor: 10k $\Omega$  pull-down resistor between the button and GND



## Protocol

The Raspberry Pi and ESP8266 are connected over a UDP communication protocol.

Raspberry Pi (IP: 192.168.1.xxx) sends and receives UDP messages on a specific port.

ESP8266 (IP: 192.168.1.xxx) listens for instructions from the Pi to start or stop collecting data.

### UDP Message Flow & Data Transmission

- Start Communication:

Raspberry Pi → ESP8266: "START"

ESP8266 → Raspberry Pi: "DATA: <average\_value>" (every 2 seconds)

- Error Handling:

Raspberry Pi detects no response from the ESP8266 for 10 seconds.

Raspberry Pi → User: White LED flashes every 0.5 seconds to indicate an error.

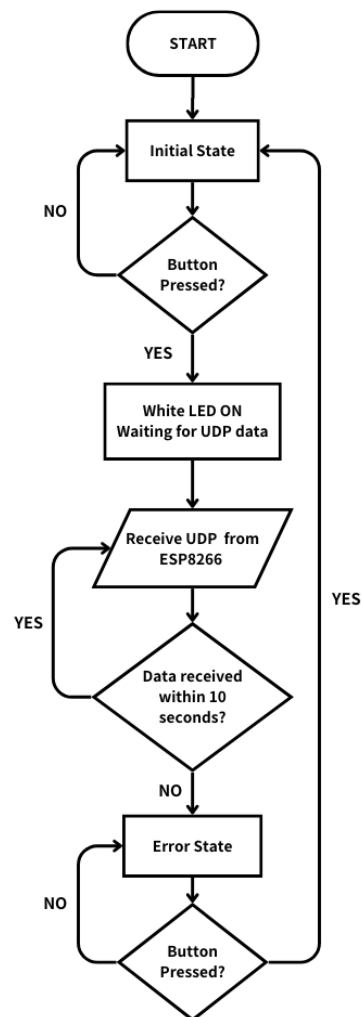
Button press required to reset the system and re-establish communication.

- Stop Communication:

Raspberry Pi → ESP8266: "STOP"

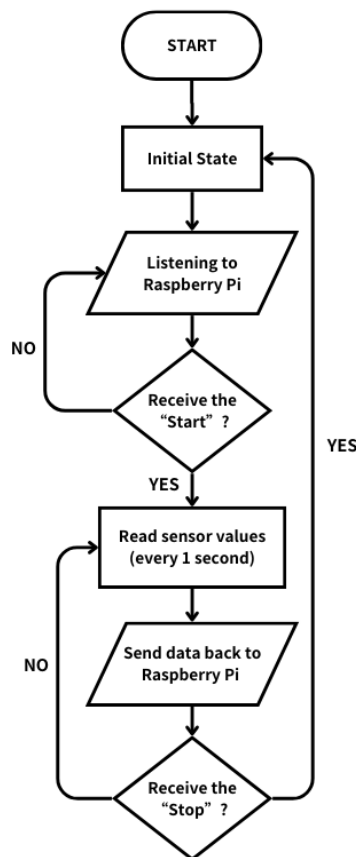
ESP8266 halts data collection and turns off its onboard LED.

## Flow-chart



### Flow-chart of Raspberry Pi

The flowchart illustrates the operation of the Raspberry Pi system, beginning with the initial state where it awaits user interaction. When the button is pressed, the system activates the white LED and enters a waiting state for UDP data from the ESP8266. If data is received within 10 seconds, the process continues; otherwise, the system enters an error state until the button is pressed again to reinitialize communication.



### Flow-chart of ESP8266

The flowchart depicts the operation of the ESP8266 system, starting from its initial state where it waits for commands from the Raspberry Pi. Upon receiving a "Start" message, the ESP8266 begins reading sensor values every second and sends the collected data back to the Raspberry Pi. If a "Stop" message is received, the ESP8266 ceases its data collection and returns to the initial state, ready for the next command.

## Main Functionality

1. Initialization: Pressing the button on the Raspberry Pi activates the white LED and sends a UDP message to the ESP8266 to establish communication.
2. ESP8266 Response: Upon receiving the UDP message, the ESP8266 begins flashing its onboard LED every 0.5 seconds, collects light sensor values every second, and sends UDP responses with the average light sensor value every 2 seconds after a 5-second data collection period.
3. Raspberry Pi Reaction: When the Raspberry Pi receives light sensor data, it controls its RGB LEDs according to the received value: one LED for LOW, two for MEDIUM, and all three for HIGH, with configurable threshold values.
4. Error Handling: If the Raspberry Pi does not receive a message from the ESP8266 within 10 seconds, it flashes the white LED to indicate an error, refraining from reestablishing the connection until the button is pressed again.
5. Reset: Pressing the button again sends a different UDP message to the ESP8266, turns off all RGBW LEDs, stops data collection, turns off the onboard LED, and resets both devices to their initial states.

### DEMO link:

[https://drive.google.com/file/d/1eb1Ryeq-JZTNZldM9p7p94Wu8D1bjBXA/view?usp=drive\\_link](https://drive.google.com/file/d/1eb1Ryeq-JZTNZldM9p7p94Wu8D1bjBXA/view?usp=drive_link)