



PROJECT REPORT SMART HOME

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CLASS: EE4348

PHẠM ĐÌNH DƯƠNG

CONTENT

1. OBJECTIVE
2. SCENARIO
3. DESIGN
4. IMPLEMENTATION
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OBJECTIVE

A smart home is a place where all human activities are supported and assisted in a flexible manner. Moreover, the home is capable of managing itself intelligently and autonomously.

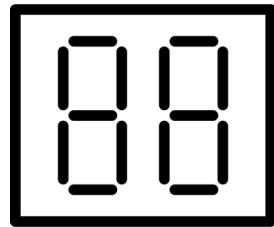


OBJECTIVE



- 1) Face recognition for door unlocking
- 2) Adjustable room lighting according to user preference
- 3) Bedroom temperature control ($\pm 6^{\circ}\text{C}$ adjustment)
- 4) Display of temperature and humidity information
- 5) Infrared sensor for automatic light control and intrusion detection alarm
- 6) Gas leakage sensor

Use Case Scenario



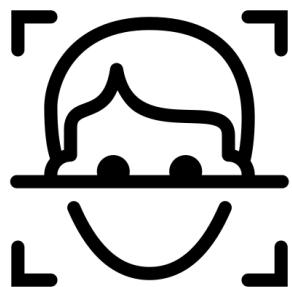
Display Temperature and Humidity Information:

An LCD screen continuously displays the temperature and humidity both outside and inside the house to keep occupants informed.



Temperature Control:

The room temperature can be adjusted according to the user's preference. By default, this function is inactive unless the user enables it.



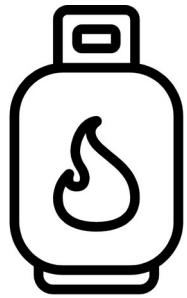
Automatic Door:

There are two modes to open the door: face recognition and password entry.

Password mode: The user enters a password to unlock the door.

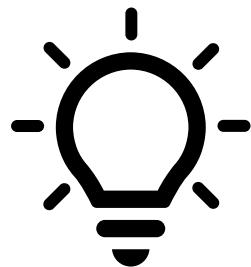
Face recognition mode: A camera verifies whether the detected face belongs to a household member and opens the door accordingly.

Use Case Scenario



Gas Leakage:

Monitors the air in the kitchen for any gas leaks.



Lighting:

Adjusts the room lighting according to the selected brightness level.



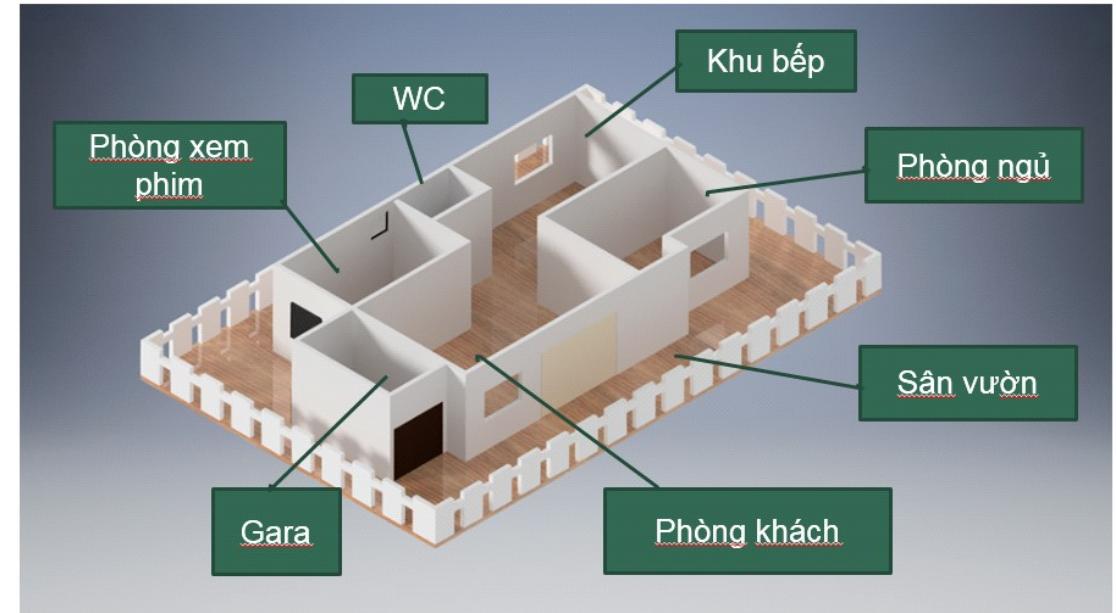
Infrared Sensor:

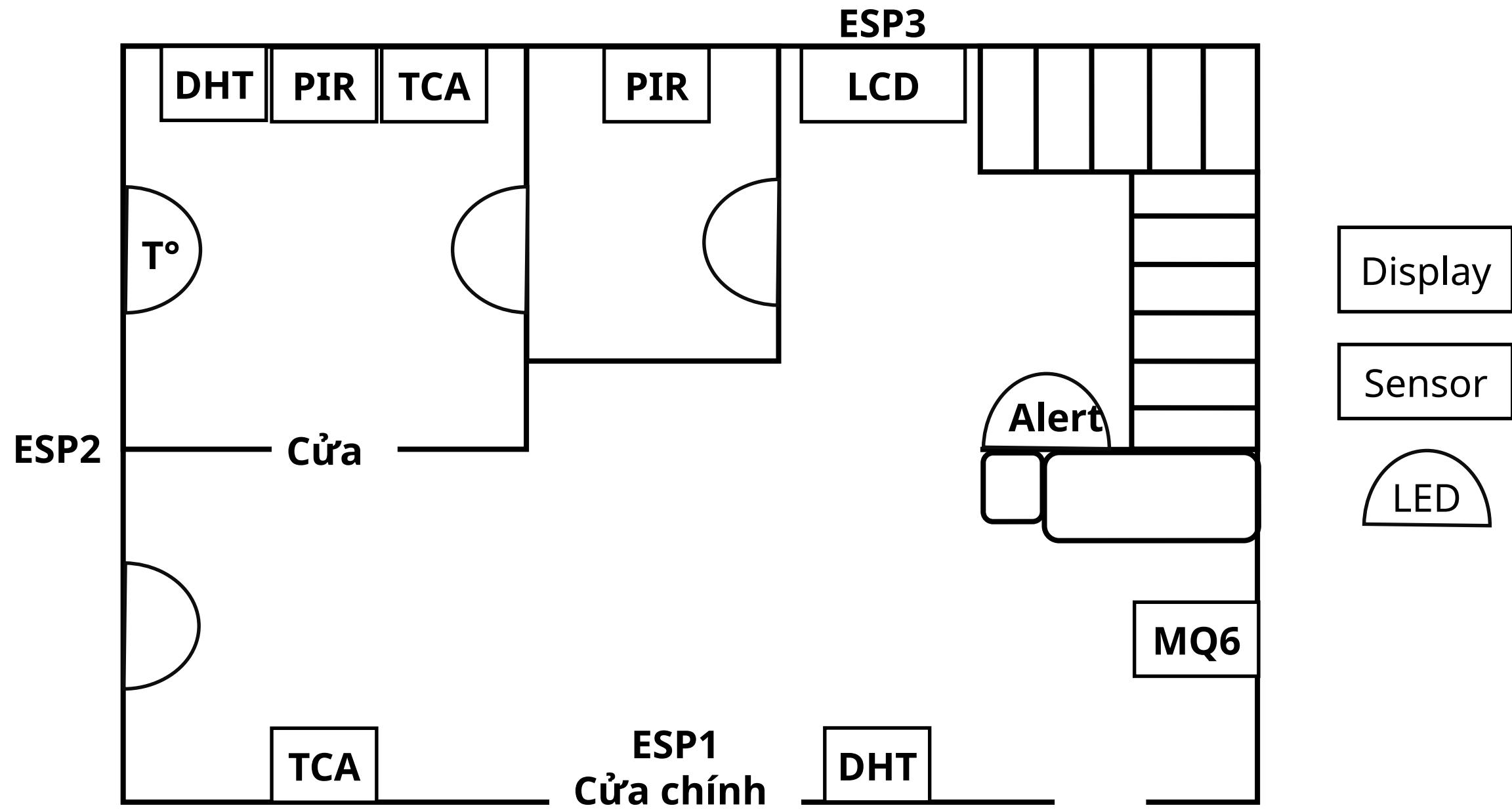
Controls turning the bathroom lights on/off and triggers an intrusion alarm.

MECHANICAL DESIGN

The smart home structure includes:

- Overall indoor space: 60 cm x 40 cm
- Bedroom: 15 cm x 15 cm
- Bathroom: 10 cm x 13 cm
- Kitchen area: 15 cm x 15 cm
- Living room
- Staircase
- Porch: 5 cm x 60 cm
- Entrance door







SYSTEM DESIGN

➤ Face Recognition System:

- Mode 1: Password: User inputs a password via a 4x4 keypad.
- Mode 2: Face Recognition: Uses a laptop camera for face detection and recognition.
- The Python code employs MTCNN for face detection and FaceNet for face recognition.
- Communication: The laptop communicates with the ESP8266 microcontroller via UART.

➤ Temperature Control:

- Actuator: A low-power incandescent bulb is used as a heat source.
- Control Mechanism: The voltage supplied to the bulb is controlled using PWM (Pulse Width Modulation) to adjust the current through the filament, thereby regulating the heat output.
- Controller: A PI or I controller is used, considering the temperature control system has significant inertia.

SYSTEM DESIGN

- **Gas Leakage Detection**
- A gas sensor module (MQ5) monitors the air for any gas leaks. When gas leakage is detected, the sensor sends a signal to the ESP microcontroller to activate lights and a buzzer alarm to alert the occupants.
- **Body Temperature Sensor**
- An infrared PIR sensor (SR505 Mini) is used for motion detection.
- **Bathroom Lighting Control**
- When a person is inside the bathroom, the light remains on. After the person leaves, the light turns off with an 8-second delay.
- **Living Room Security**
- When the house is in "Away" mode, if an intruder is detected, the PIR SR505 sensor sends a signal to the ESP to turn on the lights and sound the alarm. Simultaneously, an alert notification is sent to the homeowner's phone.

SYSTEM DESIGN

- **Lighting Control:**
 - Actuator: A high-power LED bulb with high luminous flux.
 - Control Mechanism: The voltage supplied to the LED is controlled by Pulse Width Modulation (PWM), thereby adjusting the emitted luminous flux. The relationship between the applied voltage and luminous flux is approximately linear.
 - Controller: Since the response is almost instantaneous, a lookup table combined with linear interpolation is used to determine the required voltage from the desired luminous flux.
- **Temperature and Humidity Measurement and Display:**
 - Temperature and humidity are continuously measured by sensors at a frequency of once per minute.
 - The data is displayed on a 16x2 LCD screen.

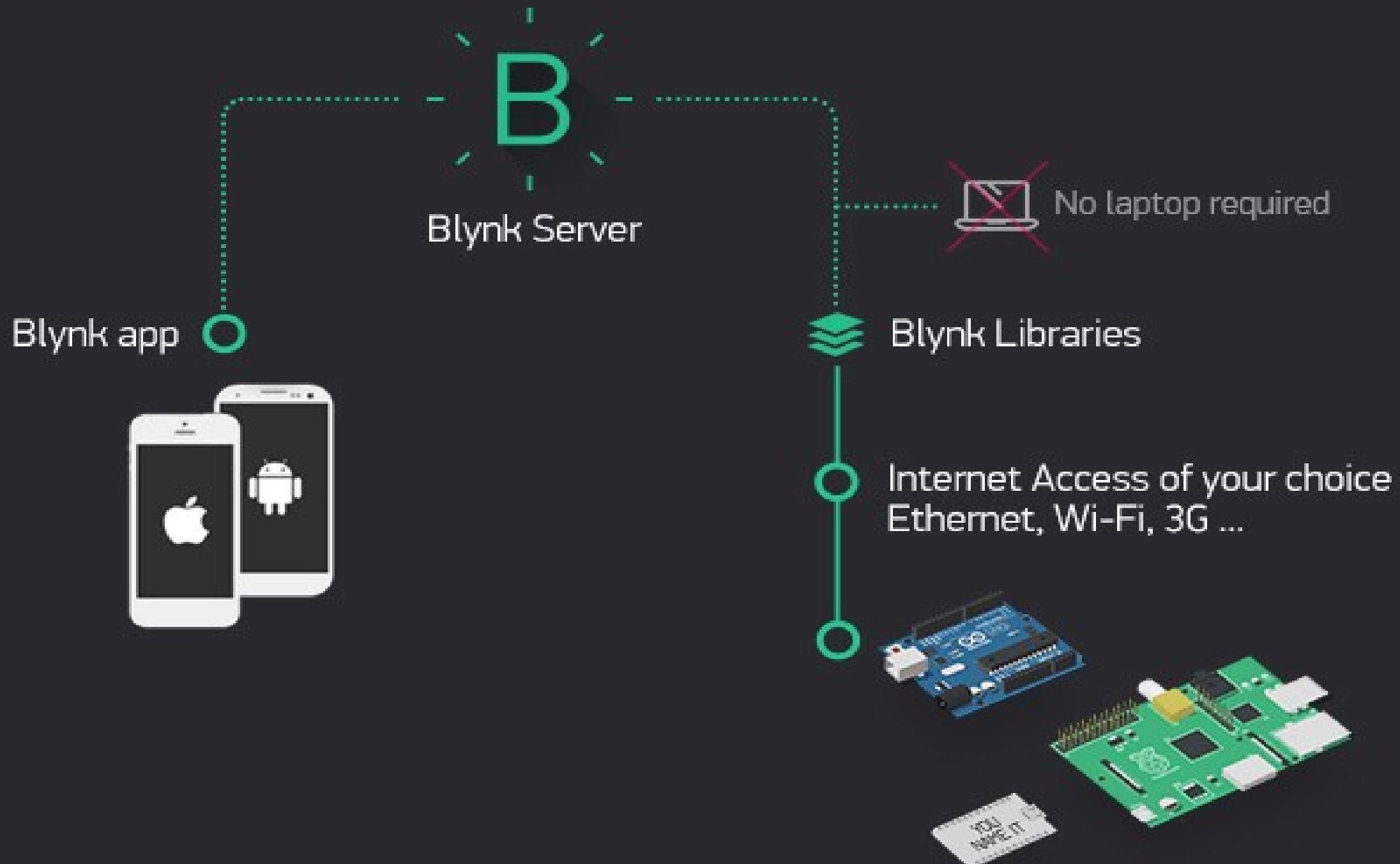
BLYNK PLATFORM



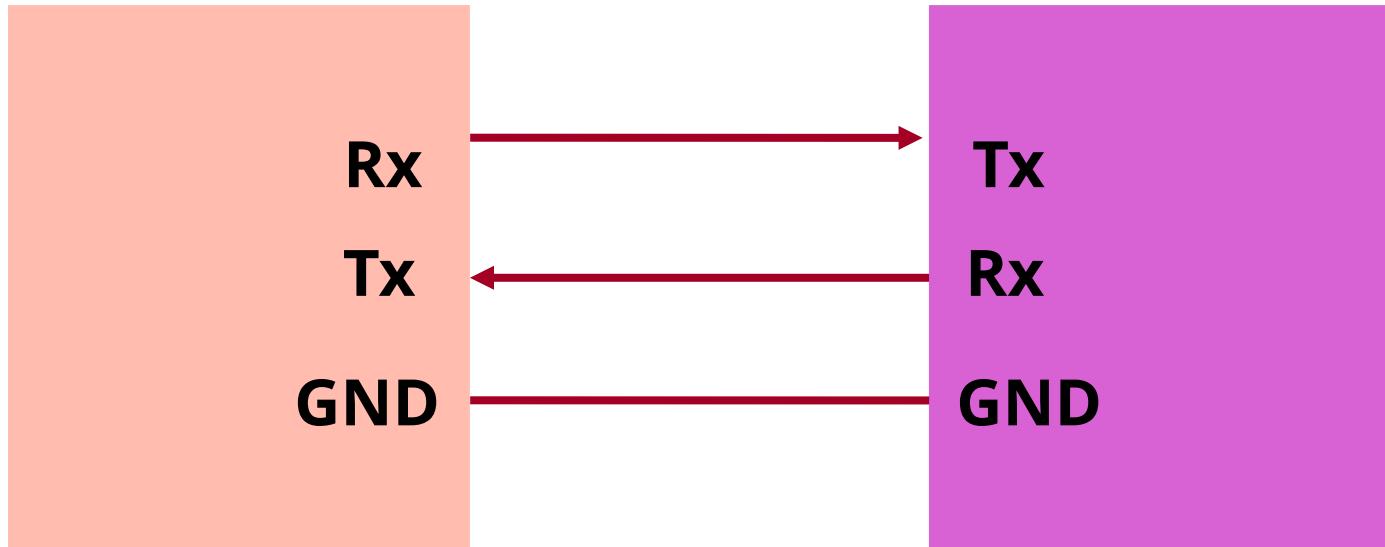
Blynk is an open-source software platform designed for Internet of Things (IoT) applications. It allows users to remotely control hardware, display sensor data, store data, perform data transformations, and more. Blynk supports hardware such as Arduino, Raspberry Pi, ESP8266, and many other popular modules.

The Blynk platform consists of three main components:

- Blynk App: A mobile application that enables users to create custom user interfaces for their projects.
- Blynk Server: Responsible for two-way communication between the mobile device and the hardware. You can use the public Blynk server, but it has limitations on energy points.
- Blynk Library: A collection of libraries supporting popular platforms that simplify communication between hardware and the Blynk server.

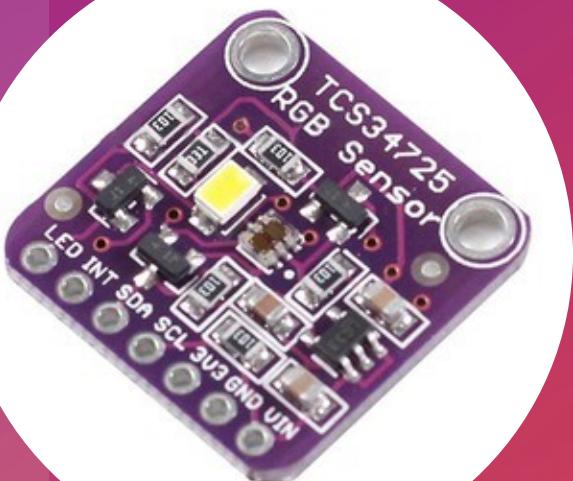


UART PROTOCOLS



UART (Universal Asynchronous Receiver/Transmitter) is a hardware communication protocol used for asynchronous serial communication between devices. It converts parallel data from a processor into serial form for transmission and vice versa for reception. UART operates without a shared clock signal; instead, it uses start and stop bits to frame each data byte, making it simple and cost-effective for short-distance, low-speed communication, commonly used in embedded systems, microcontrollers, and serial devices like GPS modules and Bluetooth adapters.

DEPLOYMENT



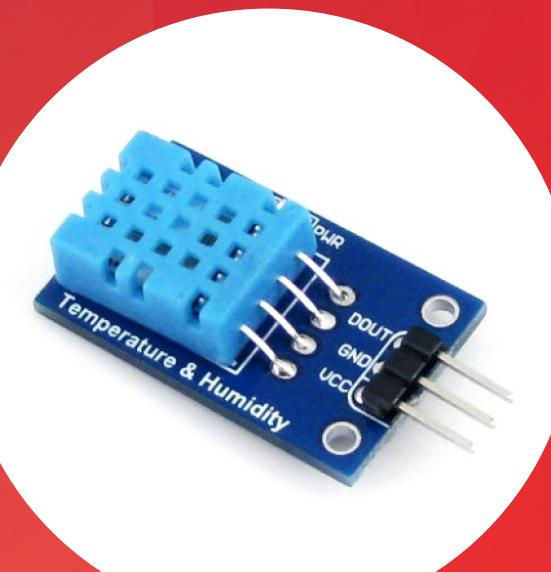
Color Sensor
TCS34725



Gas Sensor
MQ5

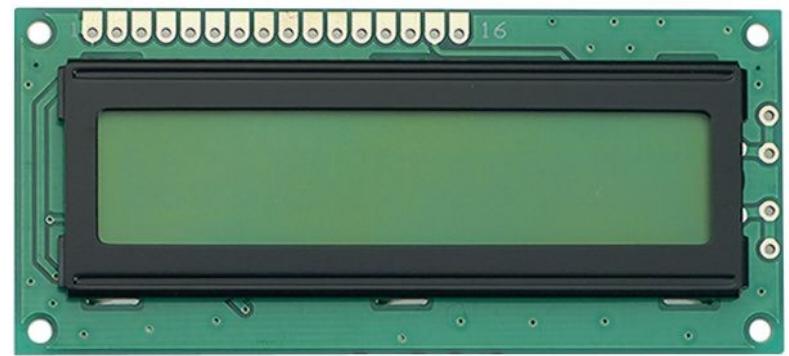


Motion Sensor
PIR SR505 mini



Temperature,
Humidity sensor
DHT11

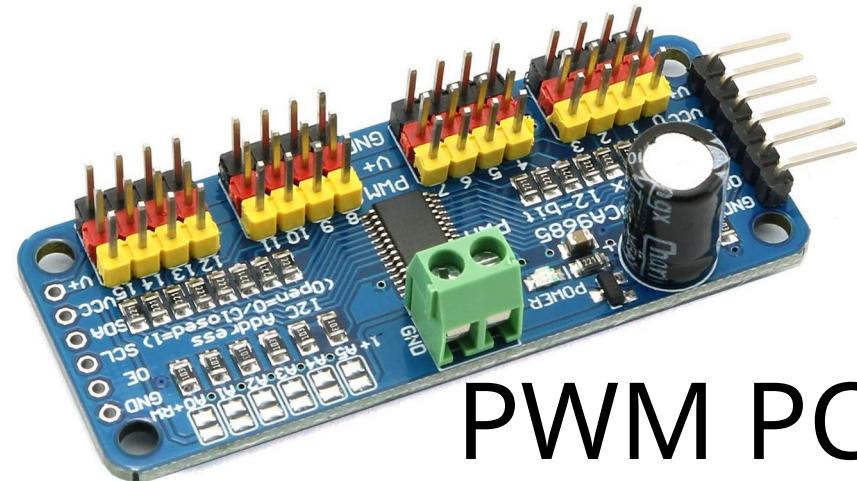
DEPLOYMENT



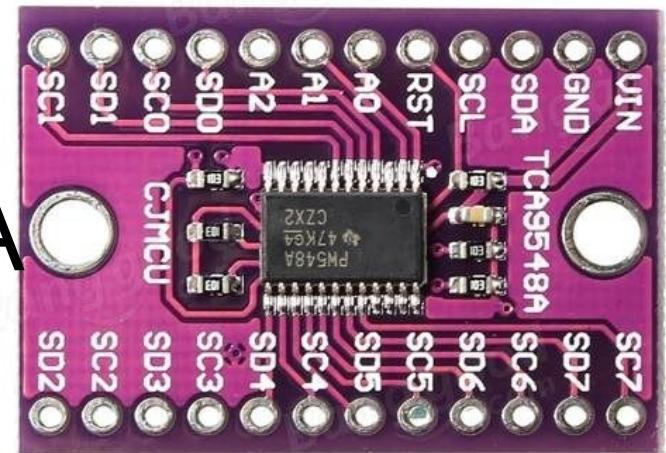
LCD1602 TCA9548A



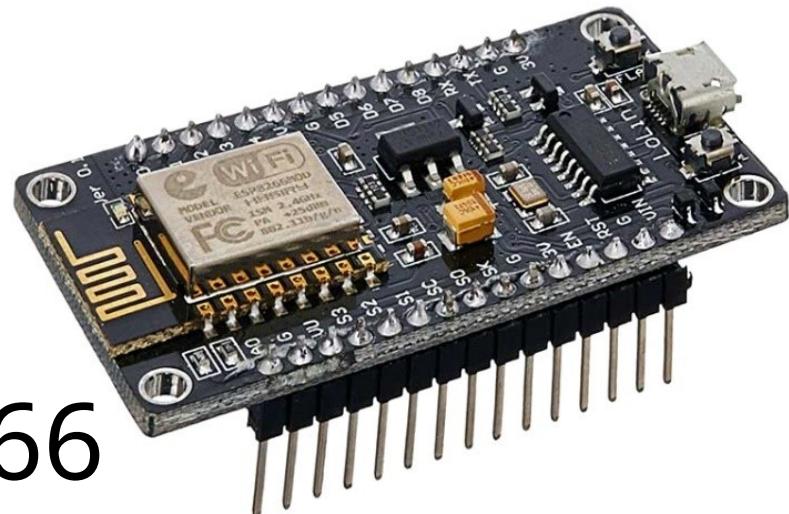
LED



PWM PCA9685

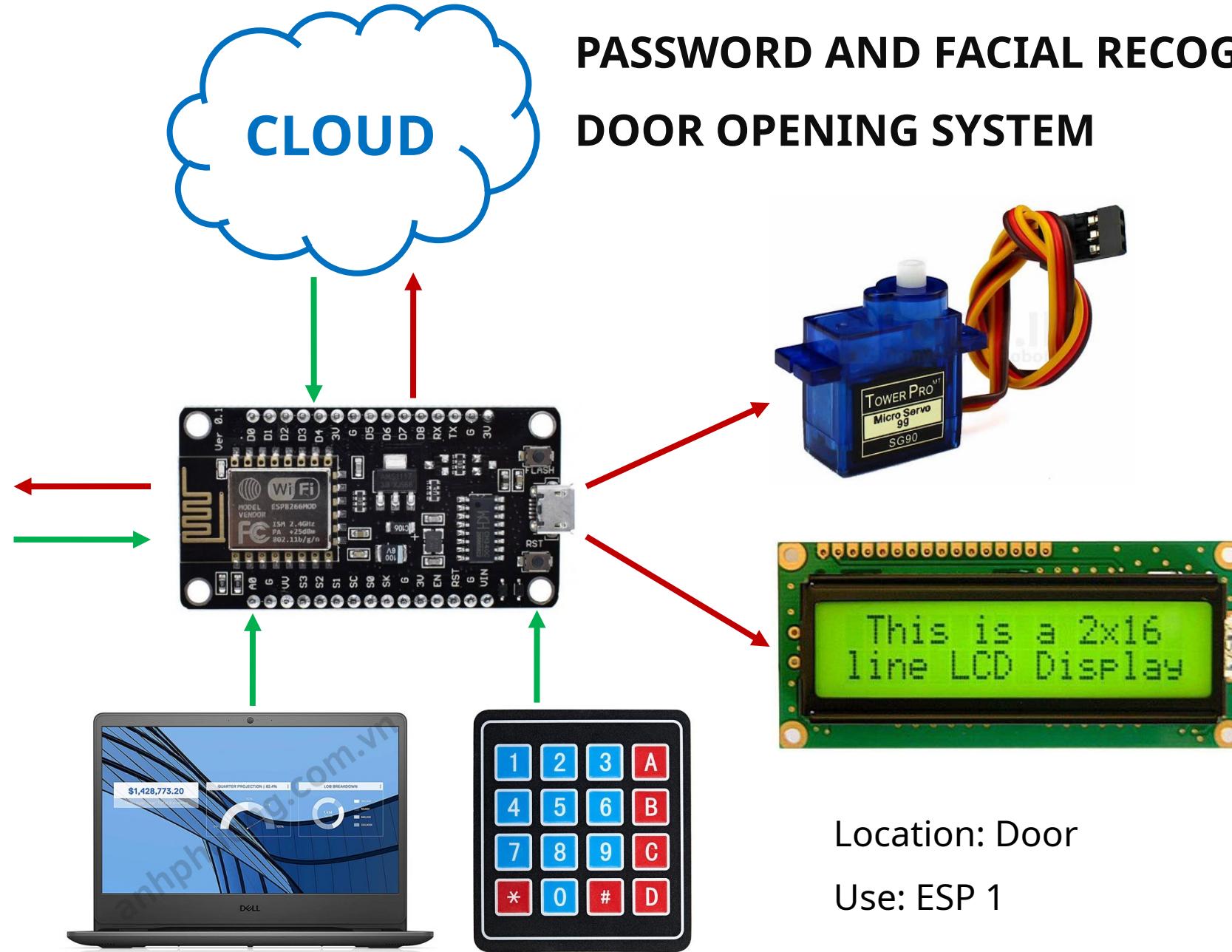
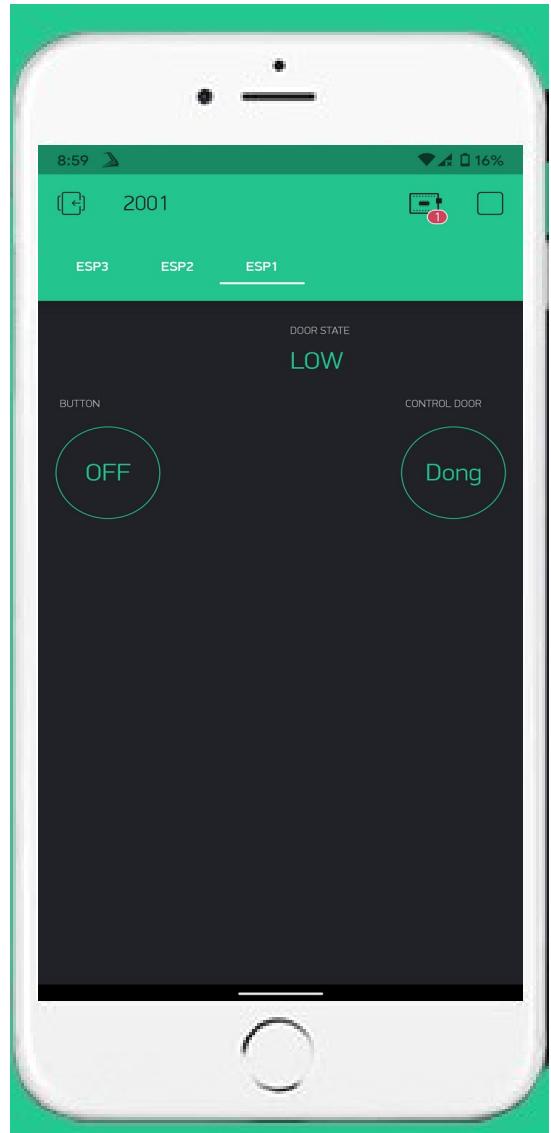


TCA9548A



ESP8266

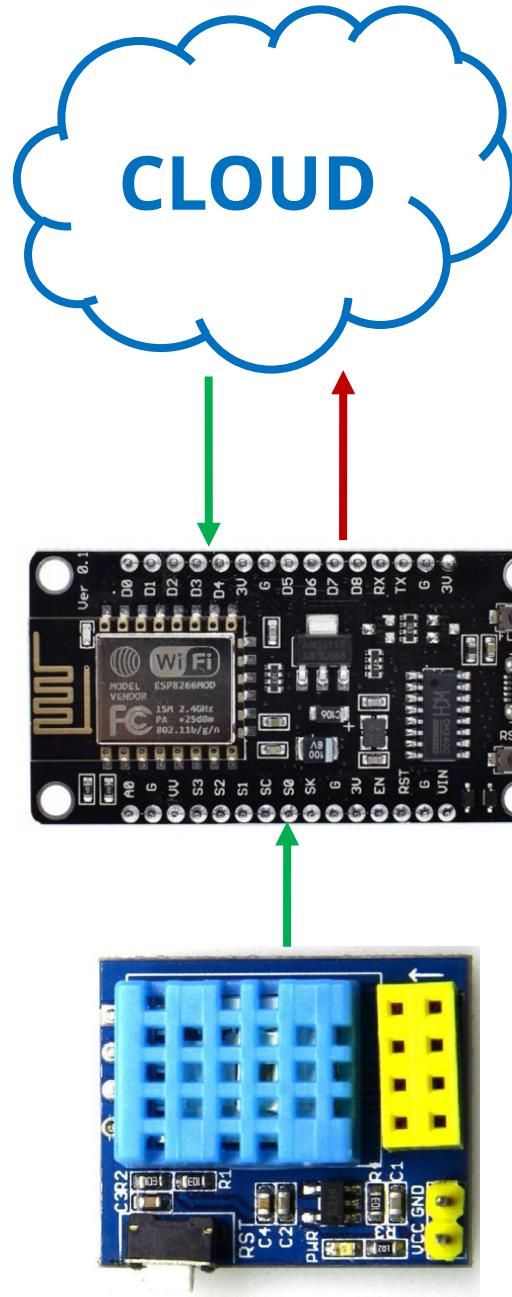
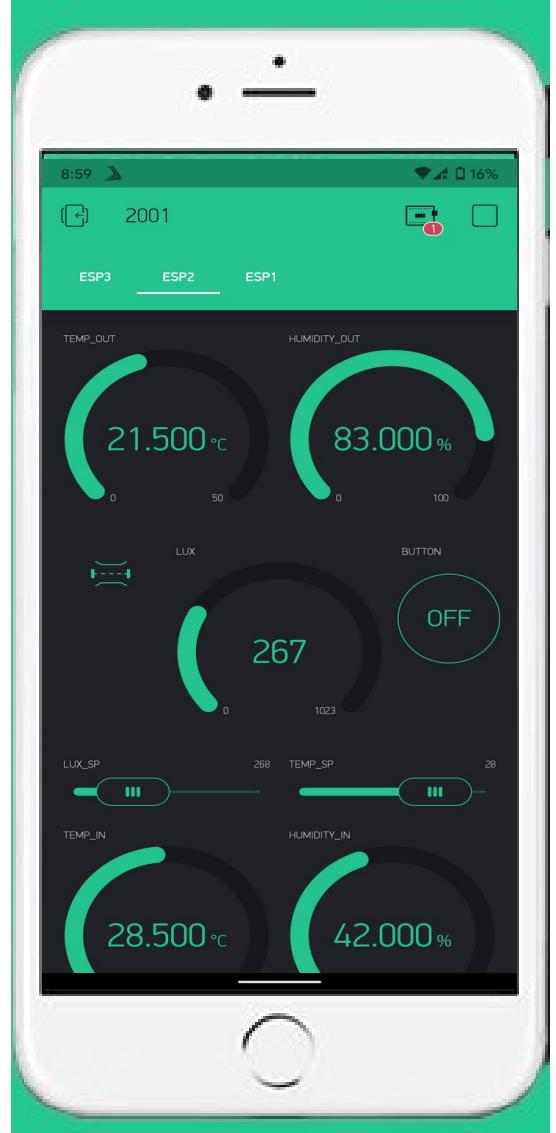
PASSWORD AND FACIAL RECOGNITION DOOR OPENING SYSTEM



EXPERIMENT

DOOR OPENING SYSTEM



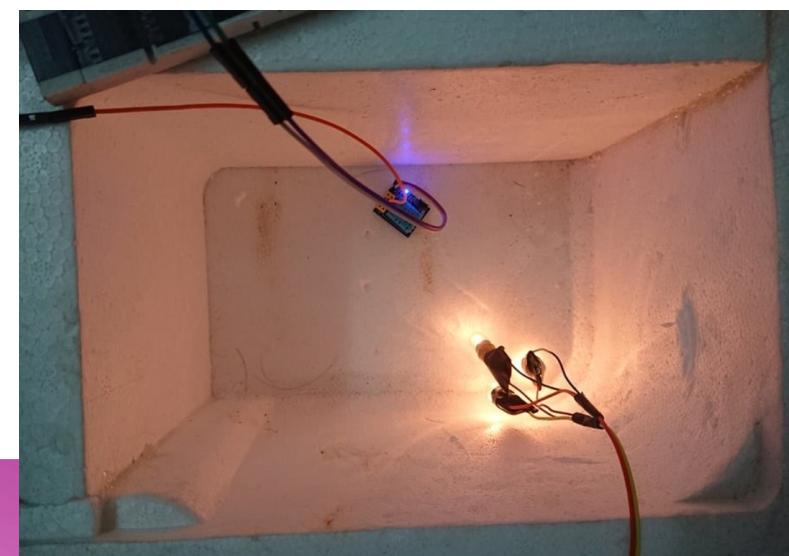


TEMPERATURE AND HUMIDITY DISPLAY SYSTEM COMBINED WITH TEMPERATURE CONTROL



Location: bedroom and LCD display near stairs
Use: ESP 2

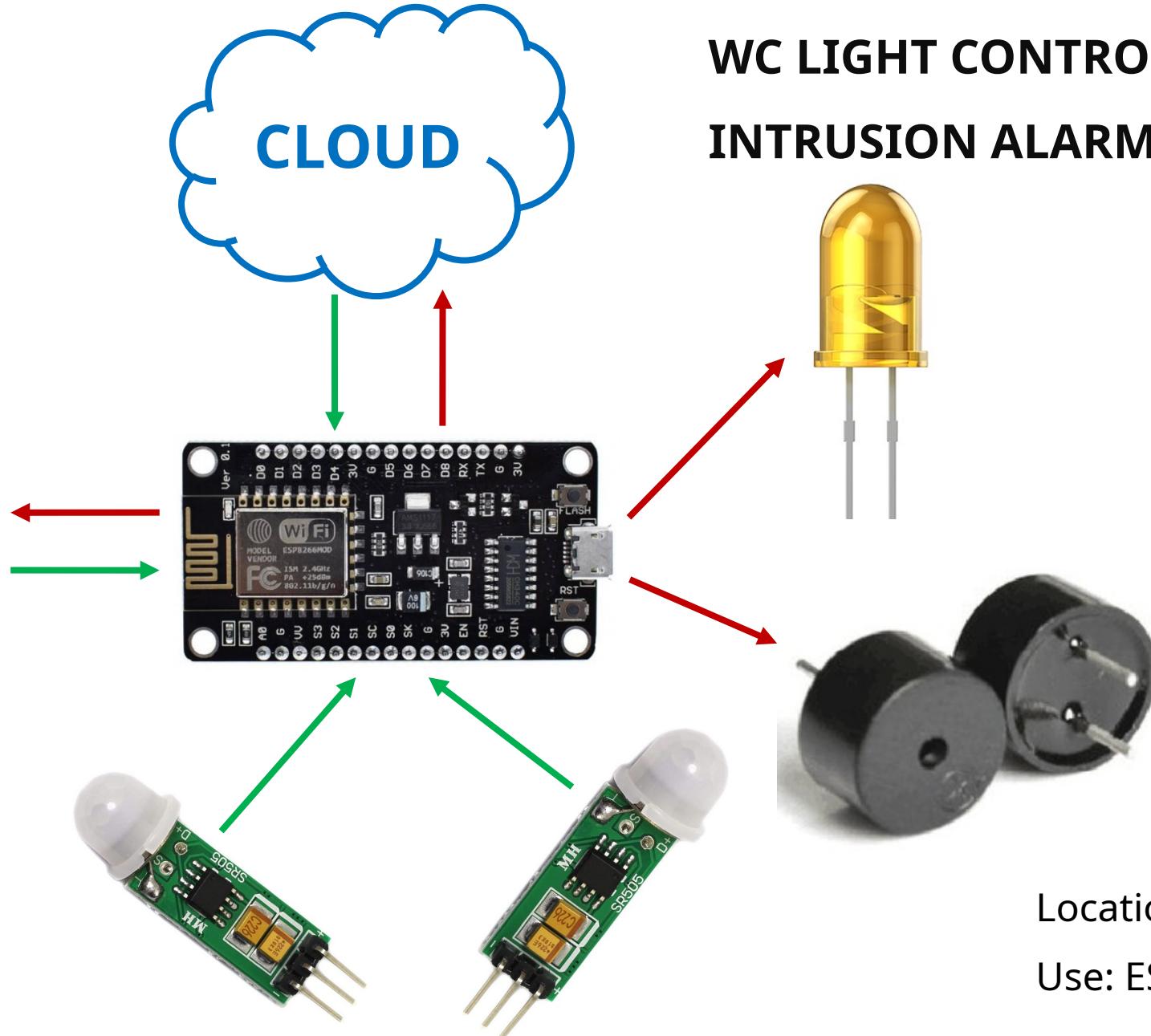
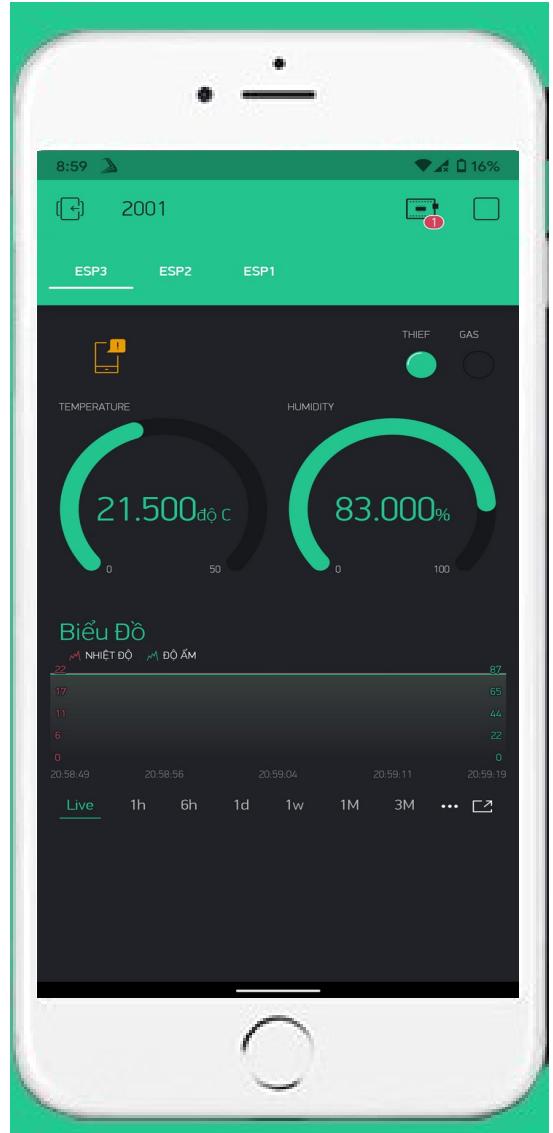
DEPLOYMENT



EXPERIMENT

Temperature Control





WC LIGHT CONTROL SYSTEM AND INTRUSION ALARM

Location: Toilet
Use: ESP 3

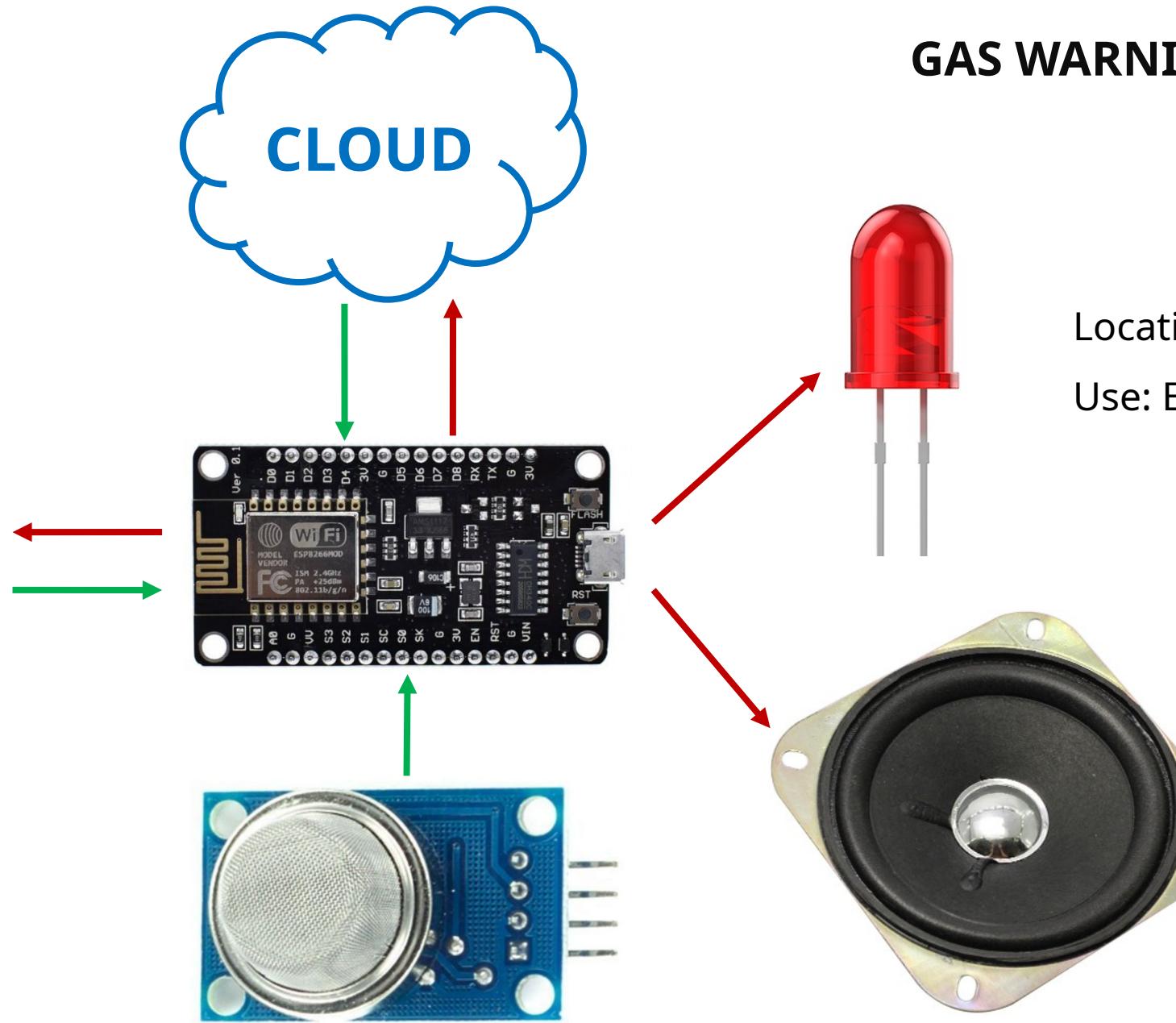
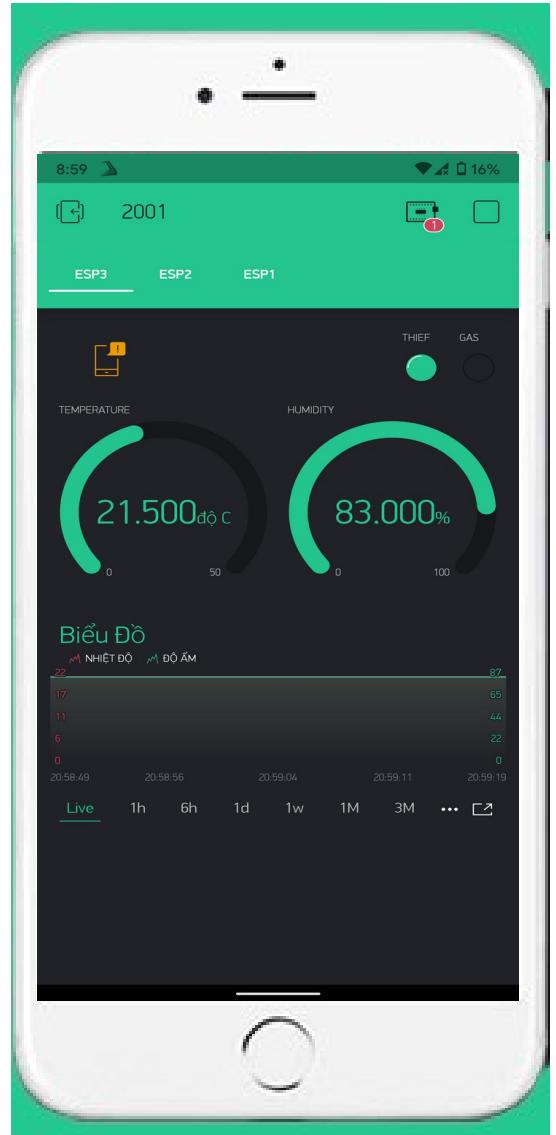
Location: Living Room
Use: ESP 3

EXPERIMENT

Body Temperature Sensor



GAS WARNING SYSTEM

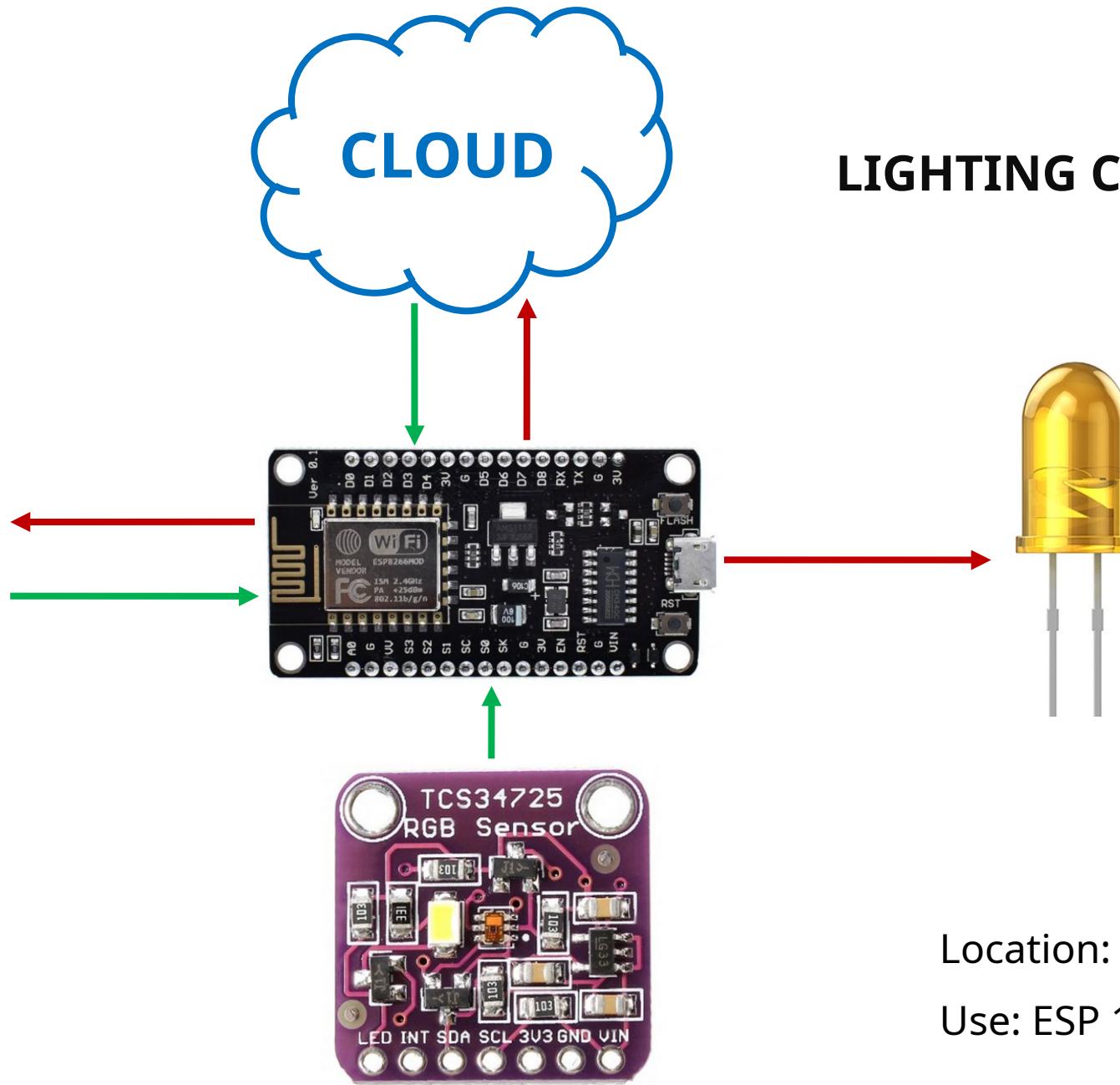
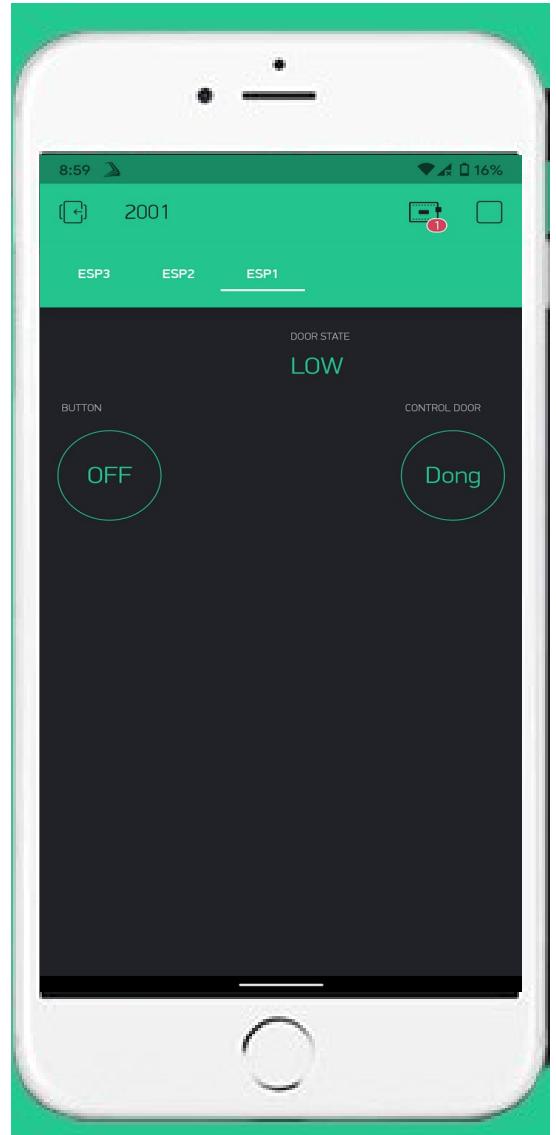


Location: Kitchen
Use: ESP 3

EXPERIMENT

Gas Warning





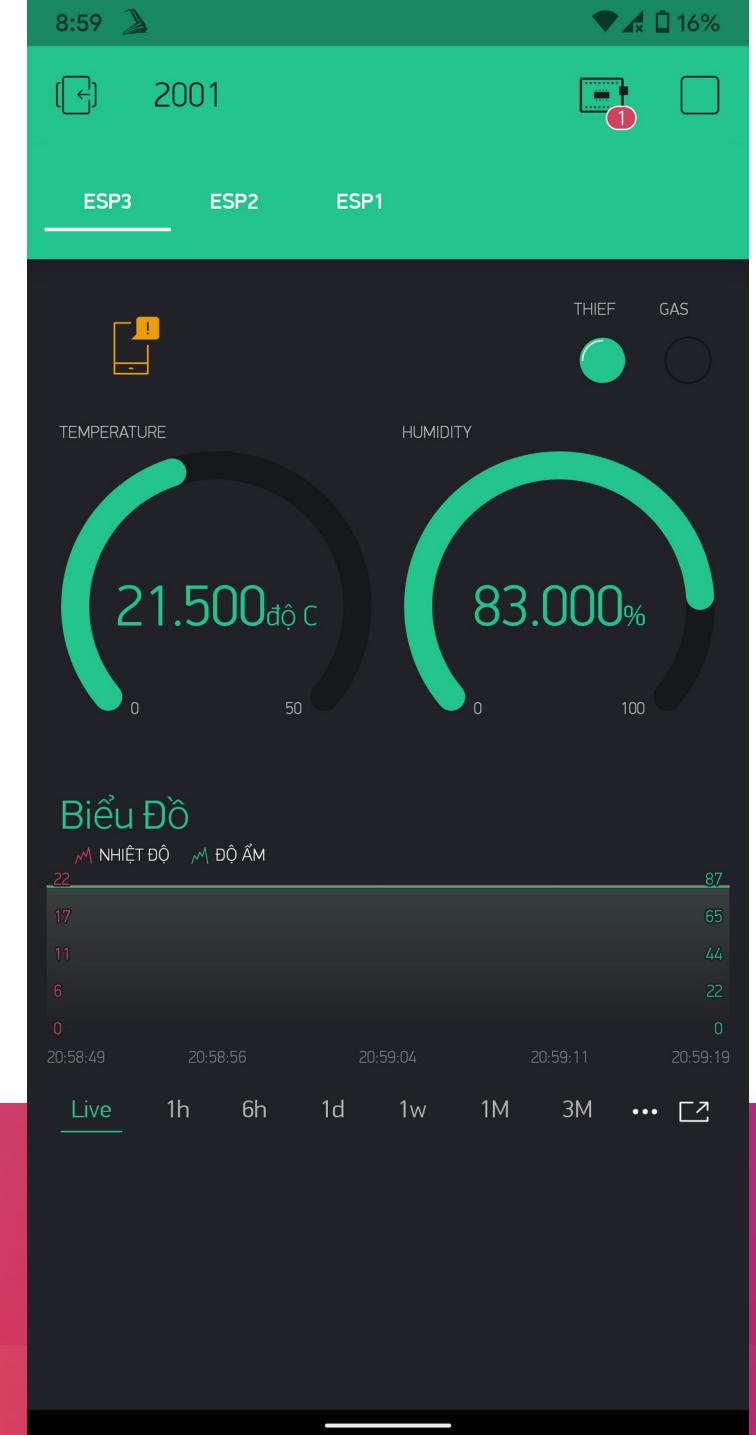
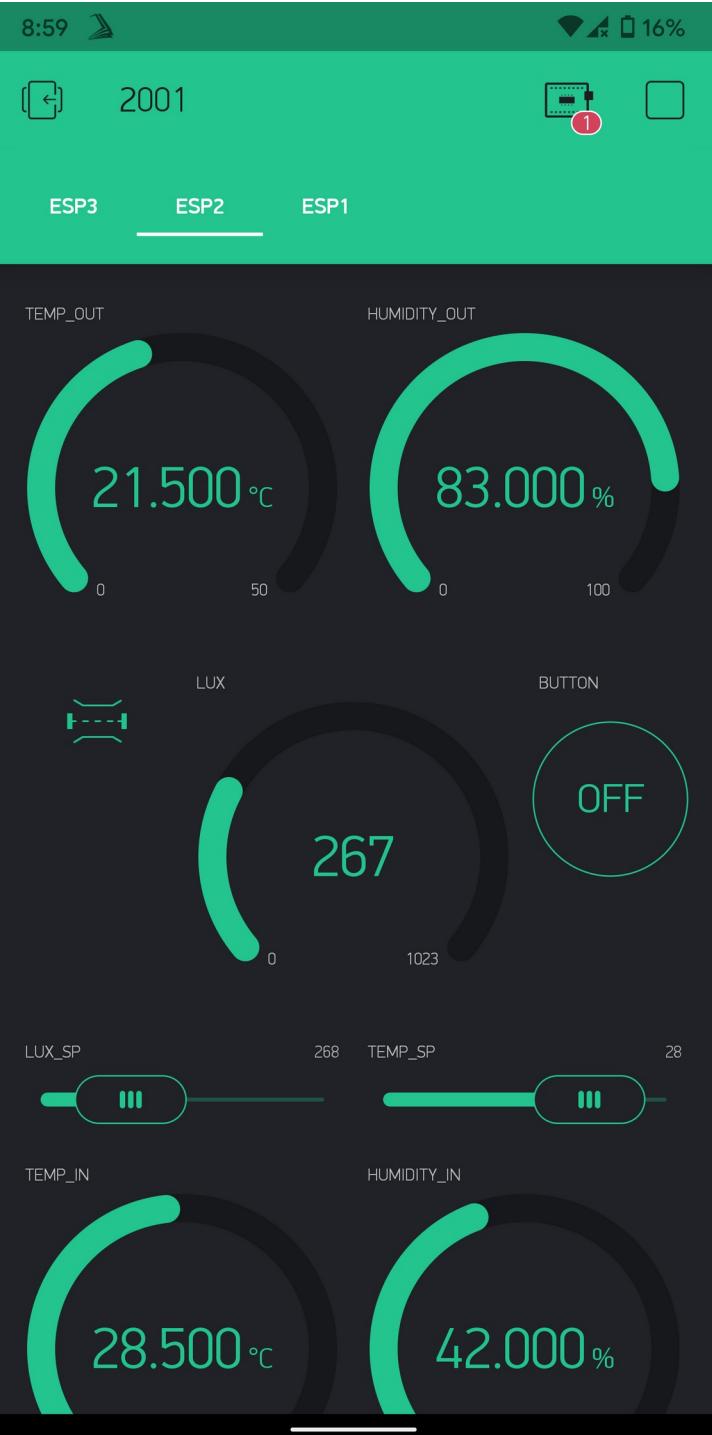
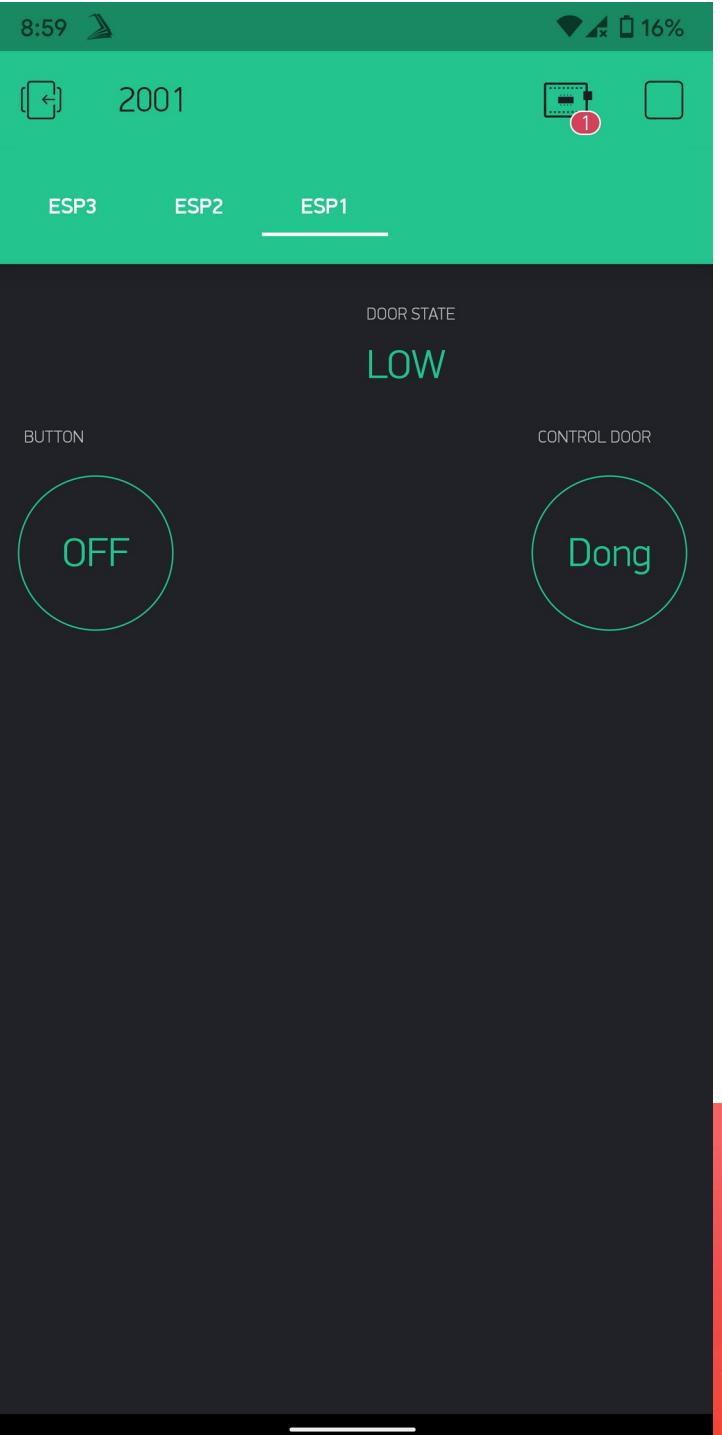
LIGHTING CONTROL SYSTEM

Location: Study Desk
Use: ESP 1

EXPERIMENT

Light Adjustment





**THANK YOU FOR
WATCHING**