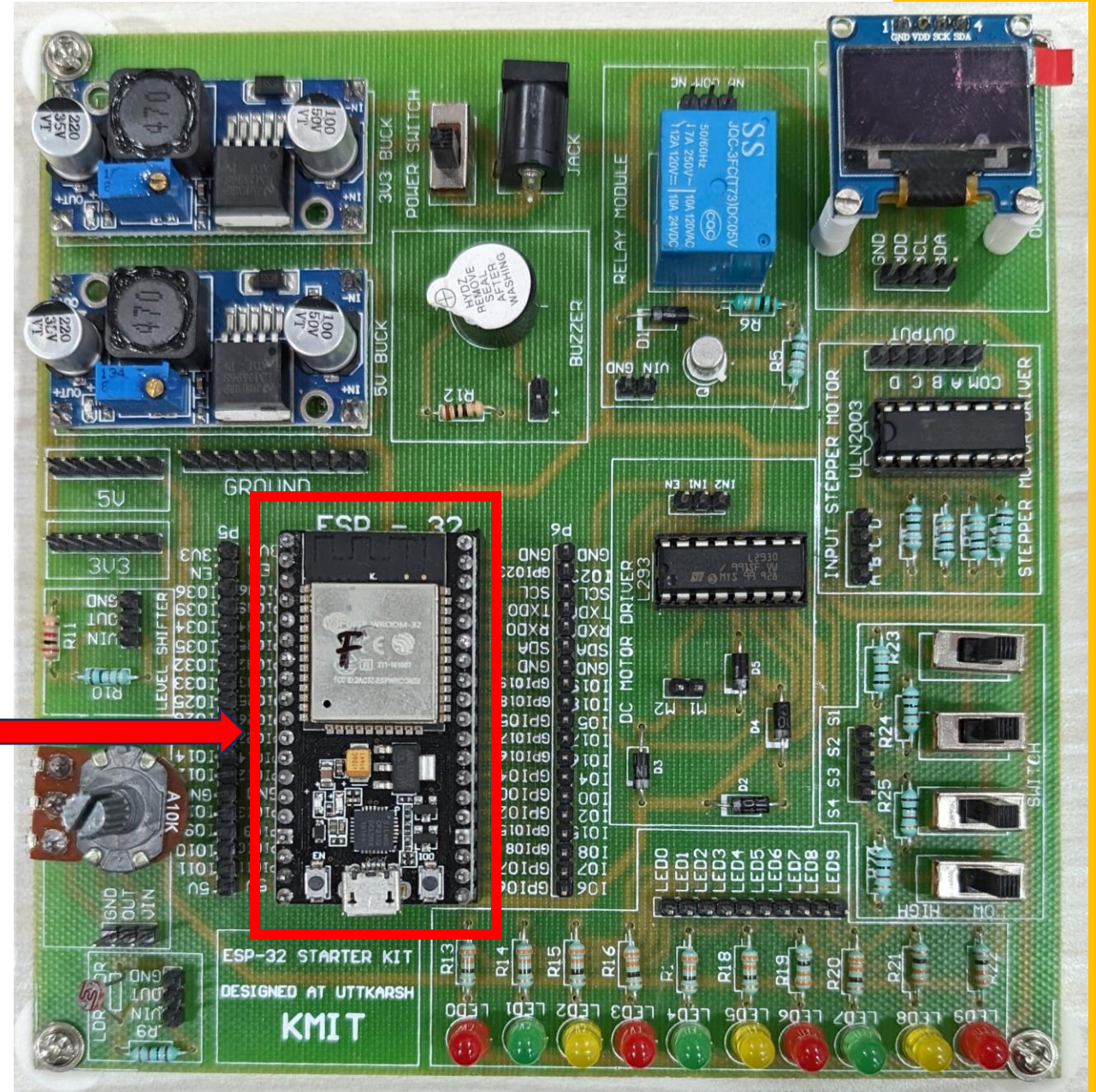




IOT Project Challenge '24

ESP32 STARTER KIT

ESP32 Microcontroller



ESP32 STARTER KIT

Components:

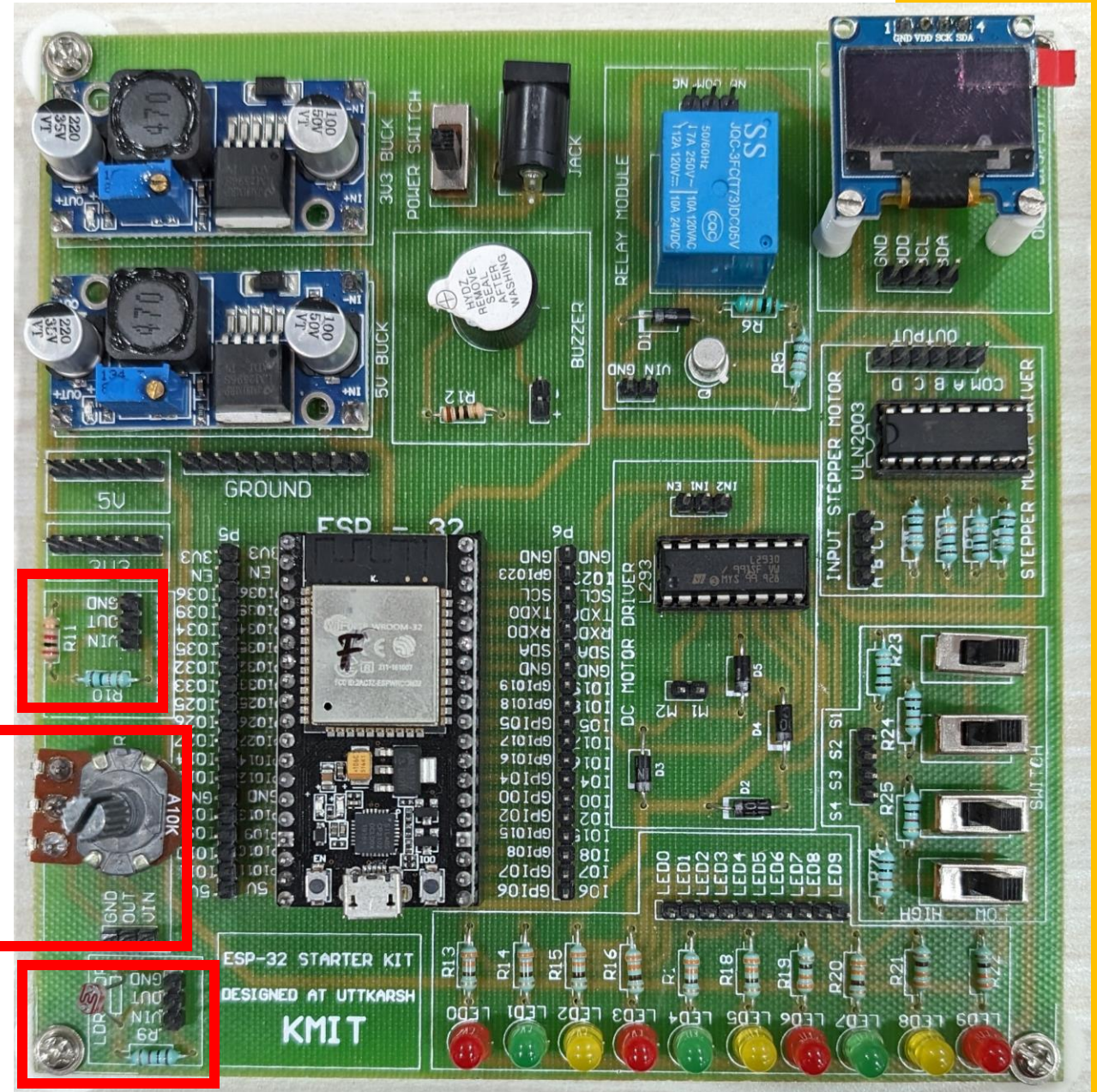
Level Shifter



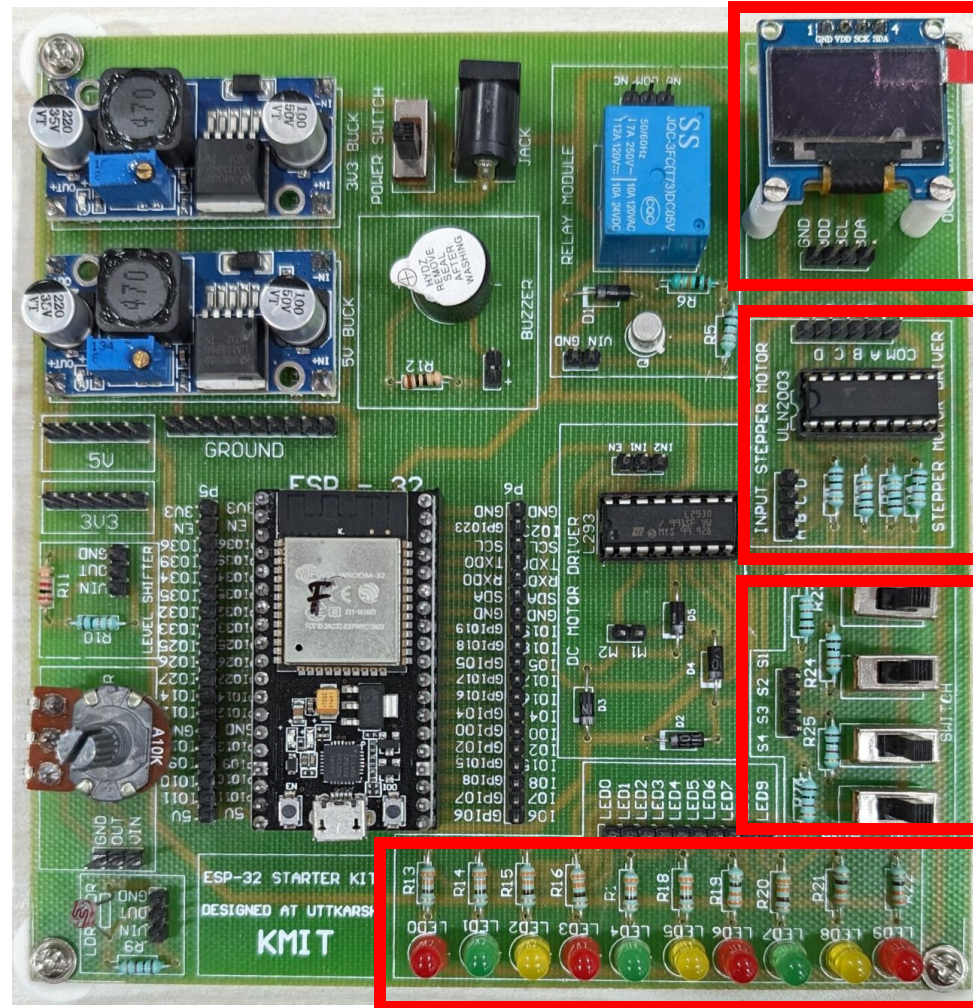
Potentiometer



LDR Sensor



COMPONENTS OF ESP32 STARTER KIT



← OLED Display

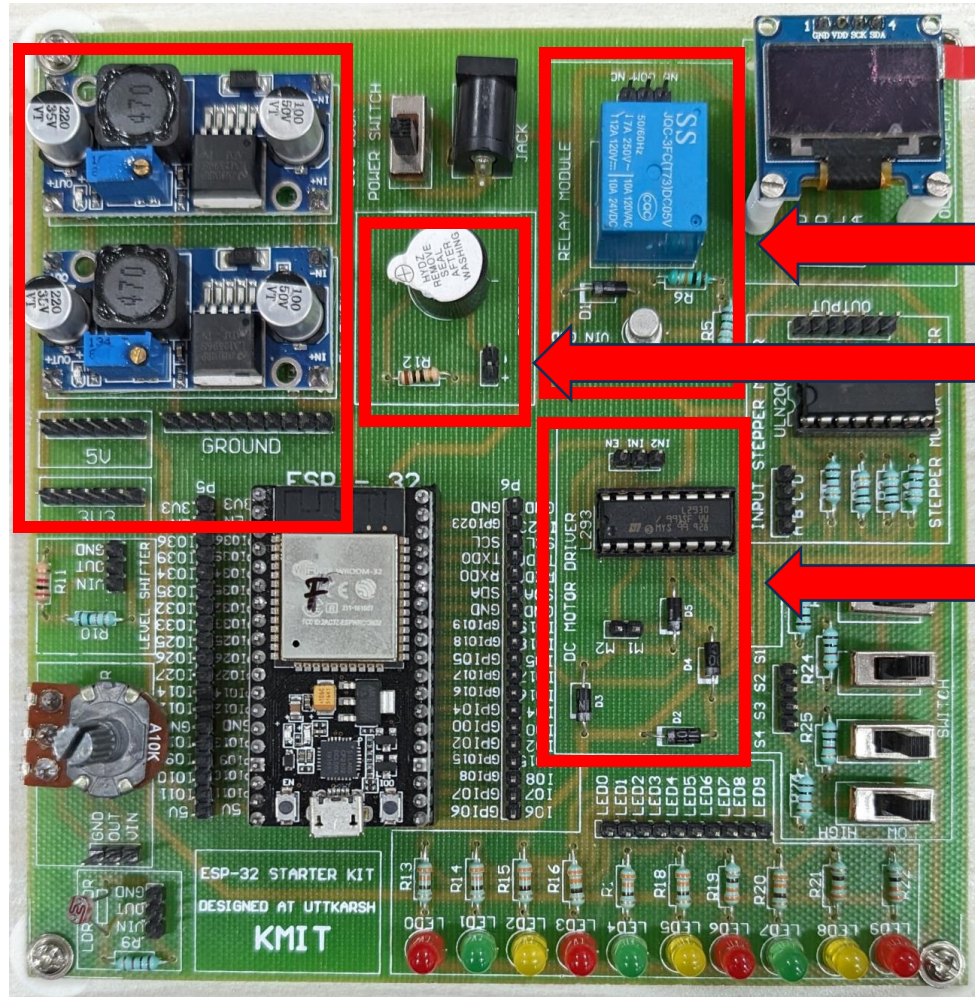
← Stepper Motor Driver

← Switches

← LEDs(red, green, yellow)

COMPONENTS OF ESP32 STARTER KIT

5V & 3.3V
Buck
converters



Relay

Buzzer

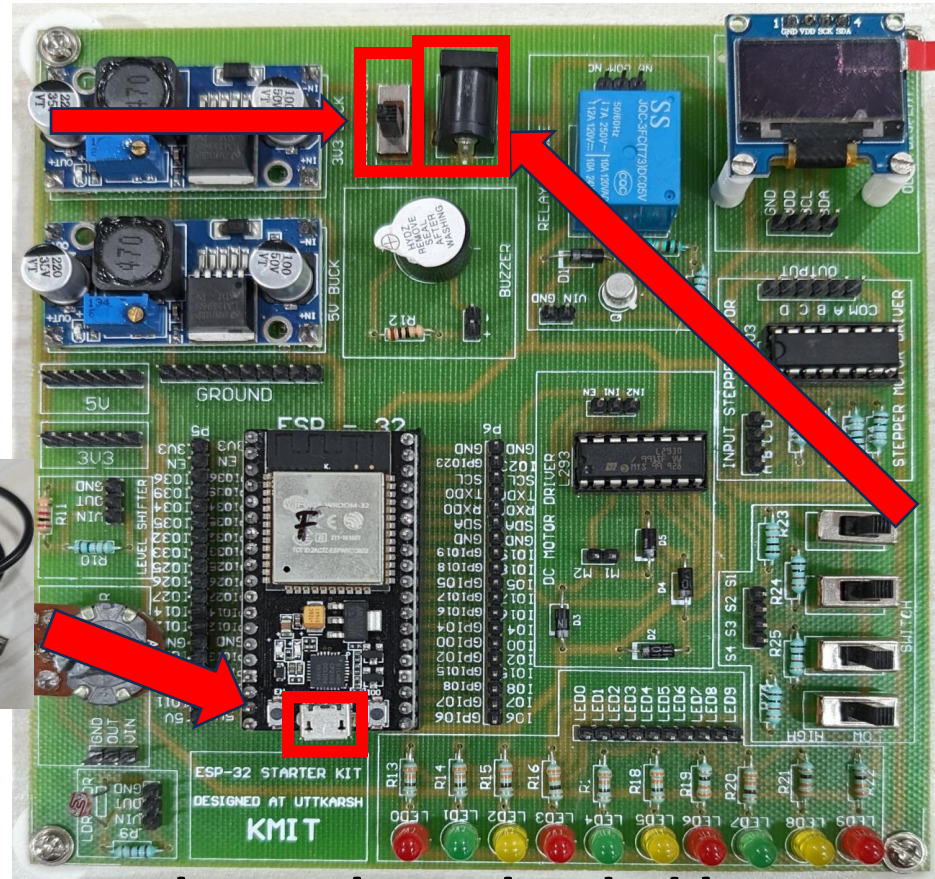
DC Motor Driver

Powering the ESP32 Kit

Power on/off
Switch

Micro USB
Cable

12 volts DC
power Adapter



Note: Firmware has to be uploaded by connecting the USB cable to the Laptop.

Silicon Labs CP210x USB to UART Bridge VCP Drivers

- You need to install drivers for the USB-to-Serial chip on your ESP32 board. <https://www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers?tab=downloads>

SILICON LABS Products ▾ Applications ▾ Ecosystems ▾ Resources ▾ Company ▾ English ▾

🏠 // Developers // USB to UART Bridge VCP Drivers

Download and Install VCP Drivers

Downloads for Windows, Macintosh, Linux and Android below.

*Note: The Linux 3.x.x and 4.x.x version of the driver is maintained in the current Linux 3.x.x and 4.x.x tree at www.kernel.org.

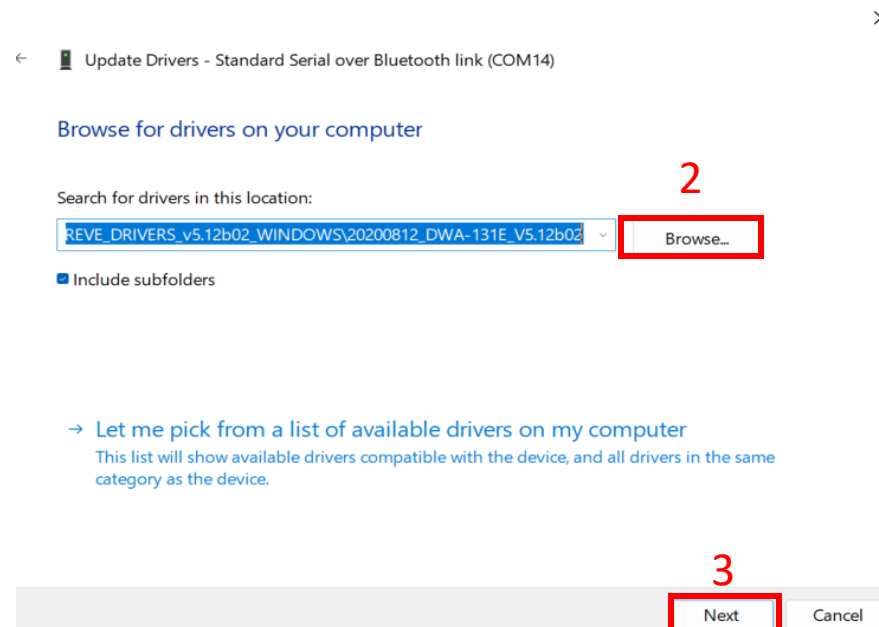
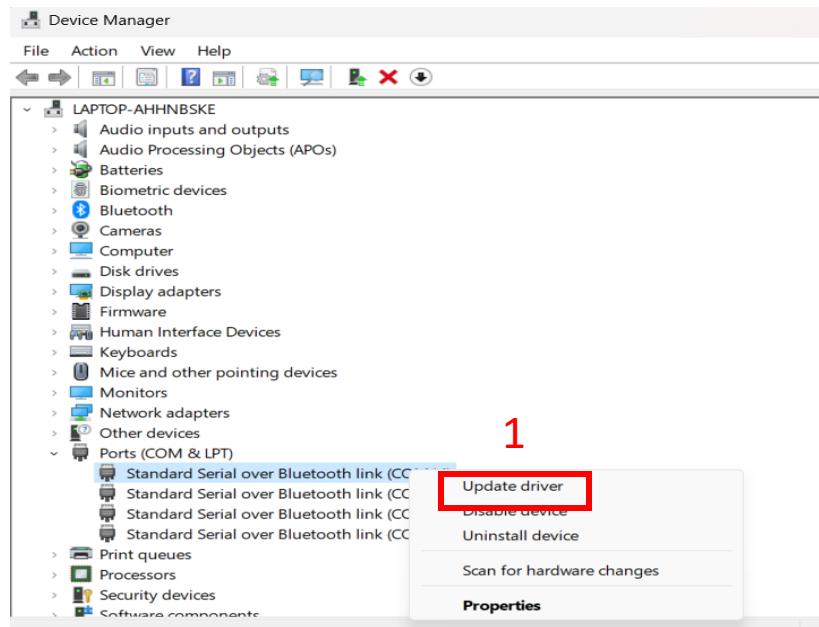
Software Downloads

[Software](#) (10)

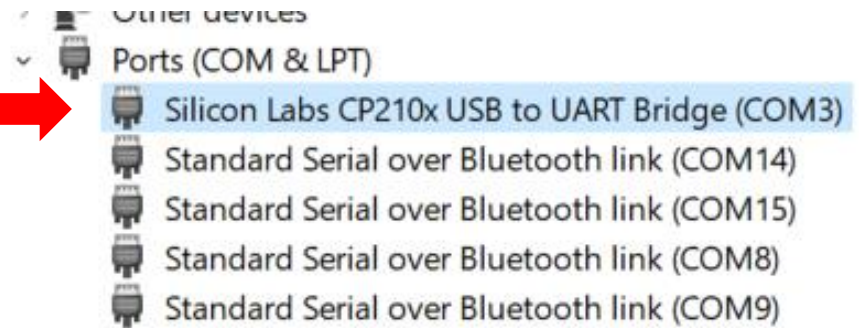
Software · 10

CP210x Universal Windows Driver	v11.3.0 6/24/2023
CP210x VCP Mac OSX Driver	v6.0.2 10/26/2021
CP210x Windows Drivers	v6.7.6 9/3/2020
CP210x Windows Drivers with Serial Enumerator	v6.7.6 9/3/2020
CP210x_5x_AppNote_Archive	9/3/2020

- Extract the folder
- Open Device Manager and Go to -> Ports
- Connect your esp32 to laptop using micro-USB cable
- It shows a new port, right click on it and select Update Driver
- Browse the driver for extracted folder and click next



- After uploading it shows



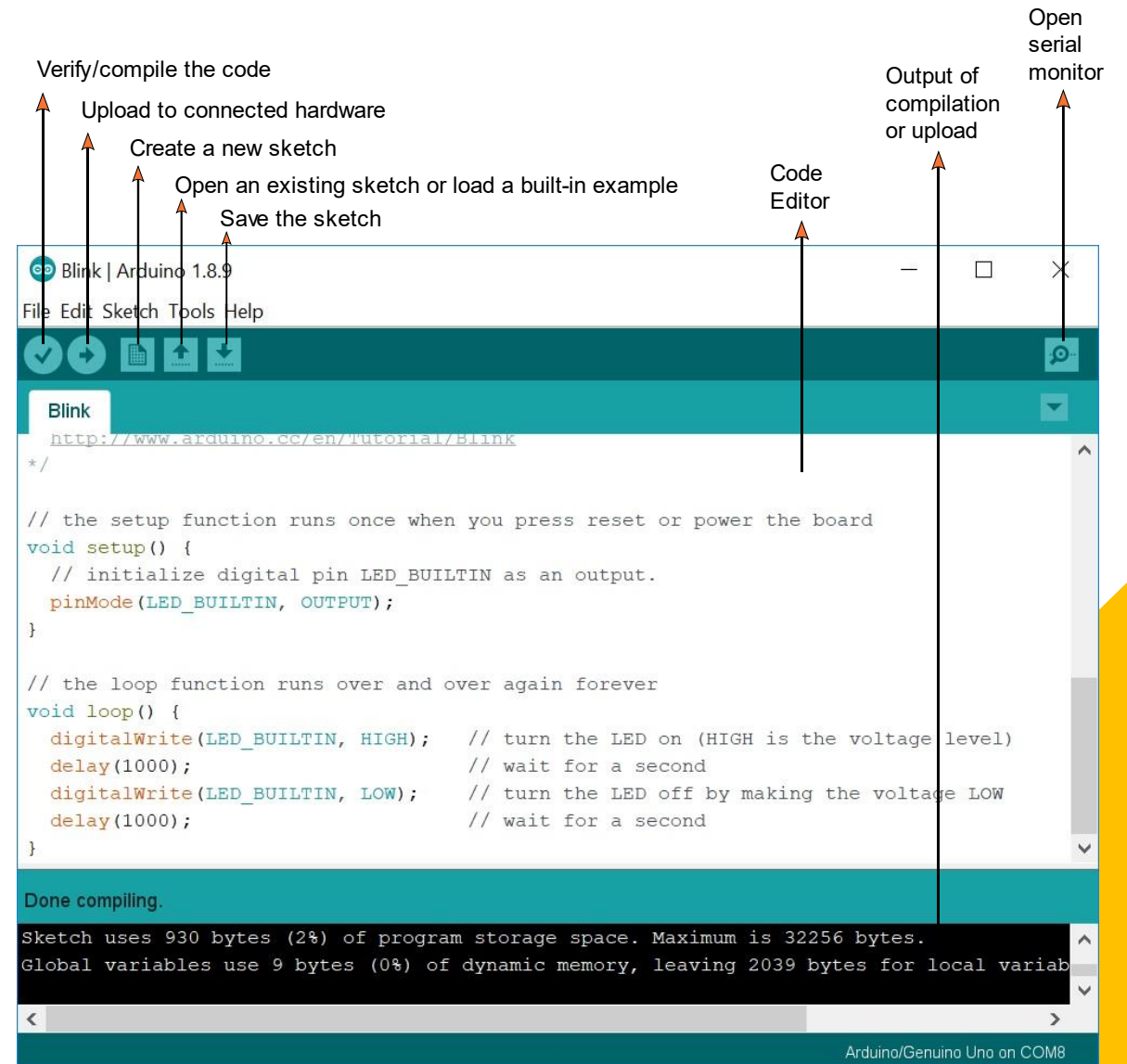
ARDUINO



- Arduino is Open source based electronic programmable board (microcontroller) and software (IDE)
- Accepts analog and digital signals as input and gives desired output
- No extra hardware required to load a program into the controller board

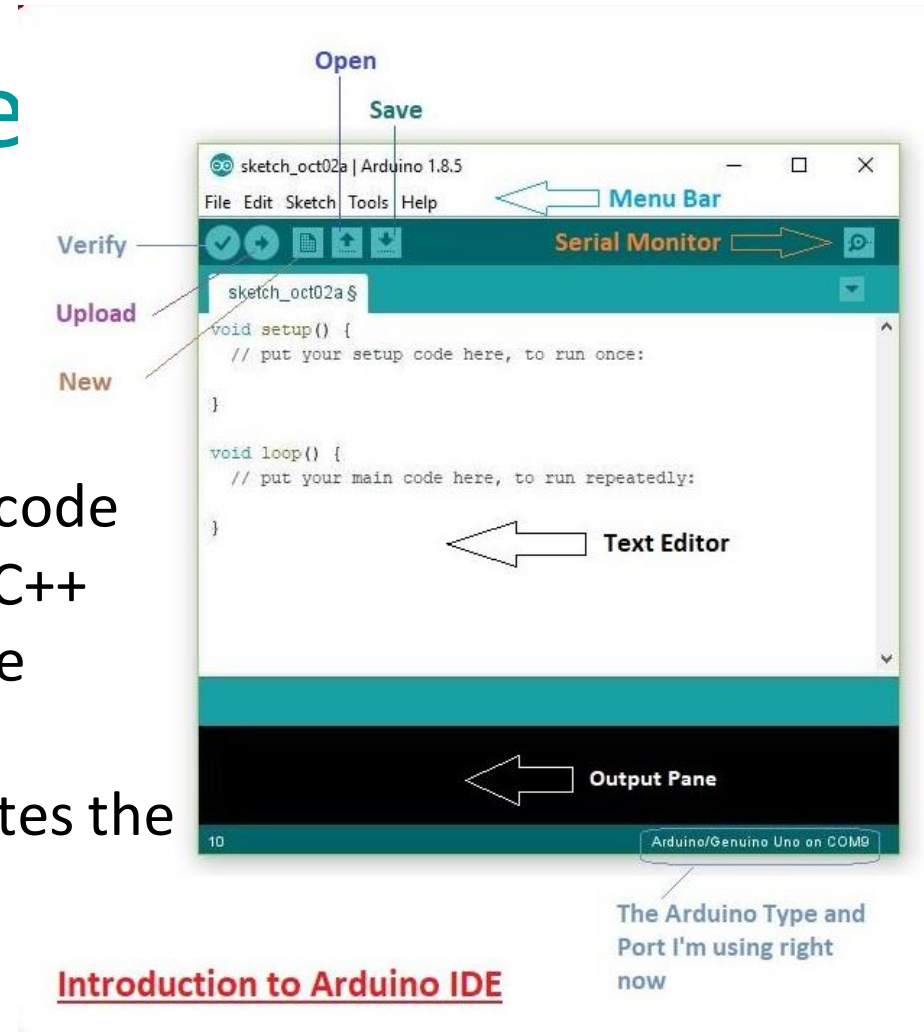
ARDUINO IDE

- Arduino IDE is an open source software that is used to program the Arduino compatible controller board
- Based on variations of the C and C++ Programming language
- It can be downloaded from Arduino's official website and installed into PC
- <https://www.arduino.cc/en/software>



Arduino Sketch Structure

- A sketch can be divided into two parts:
 - Setup ()
 - Loop()
- The function setup() is the point where the code starts, just like the main() function in C and C++
- I/O Variables, pin modes are initialized in the Setup() function
- Loop() function, as the name suggests, iterates the specified task in the program



Arduino Function Libraries

- Input/Output Functions:
 - The arduino pins can be configured to act as input or output pins using the pinMode() function

```
Void setup ()  
{  
    pinMode (pin , mode);  
}
```

- Pin- pin number on the Arduino board
- Mode- INPUT/OUTPUT

A screenshot of the Arduino IDE interface. The title bar reads "Blink | Arduino 1.8.5". The menu bar includes "File", "Edit", "Tools", and "Help". The toolbar contains icons for opening files, saving, compiling, uploading, and a serial monitor. The main text area shows the "Blink" example code. It starts with a comment: "This example code is in the public domain." followed by a URL: "http://www.arduino.cc/en/Tutorial/Blink". The code defines two functions: void setup() and void loop(). The setup function initializes the built-in LED pin as an output. The loop function turns the LED on for one second and off for one second. The status bar at the bottom indicates "32" and "Arduino/Genuino Uno on COM1".

```
Blink | Arduino 1.8.5  
  
Blink §  
  
This example code is in the public domain.  
  
http://www.arduino.cc/en/Tutorial/Blink  
*/  
  
// the setup function runs once when you press reset or power the board  
void setup() {  
  // initialize digital pin LED_BUILTIN as an output.  
  pinMode(LED_BUILTIN, OUTPUT);  
}  
  
// the loop function runs over and over again forever  
void loop() {  
  digitalWrite(LED_BUILTIN, HIGH); // turn the LED on (HIGH is the voltage level)  
  delay(1000); // wait for a second  
  digitalWrite(LED_BUILTIN, LOW); // turn the LED off by making the voltage LOW  
  delay(1000); // wait for a second  
}
```

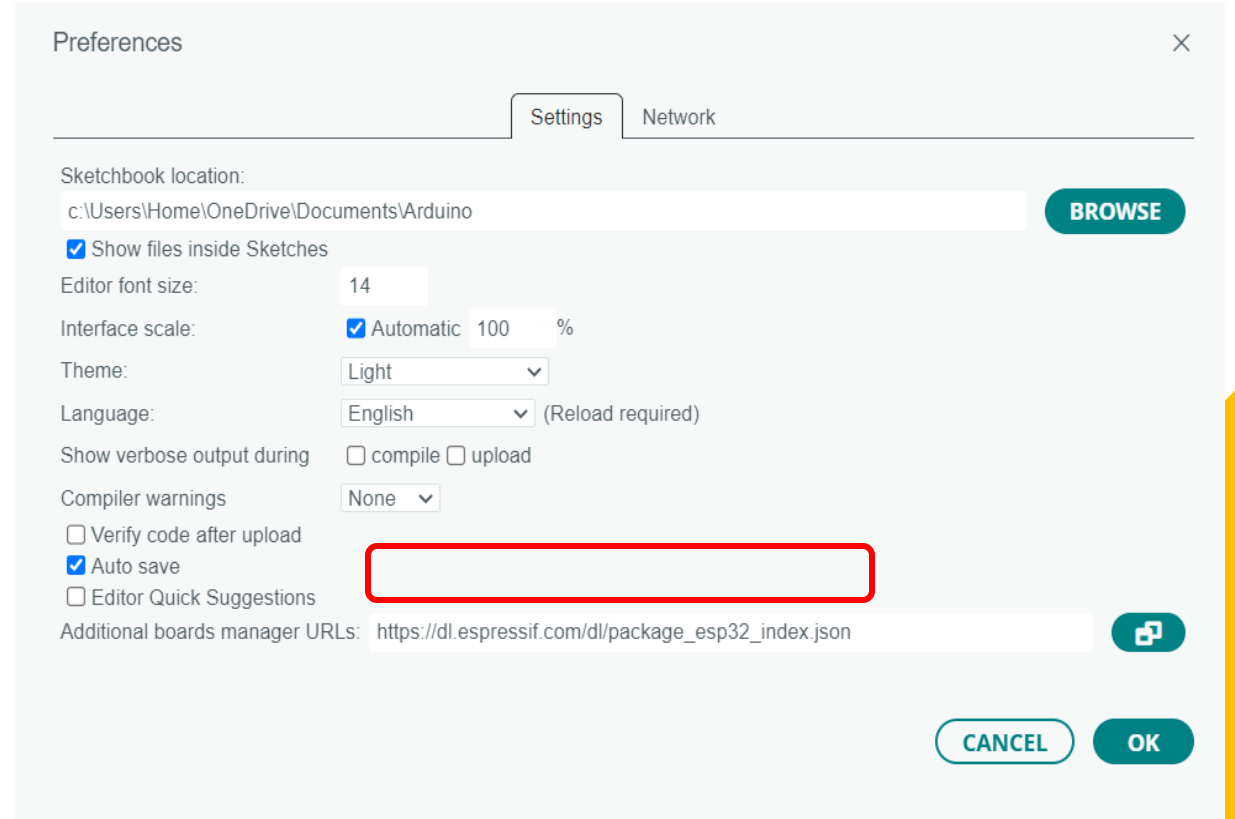

32 Arduino/Genuino Uno on COM1

Arduino Function Libraries (Contd..)

- **digitalWrite()** : Writes a HIGH or LOW value to a digital pin
- **analogRead()** : Reads from the analog input pin i.e., voltage applied across the pin
- Character functions such as `isdigit()`, `isalpha()`, `isalnum()`, `isxdigit()`, `islower()`, `isupper()`, `isspace()` return 1(true) or 0(false)
- **Delay()** function is one of the most common time manipulation function used to provide a delay of specified time. It accepts integer value (time in milliseconds)

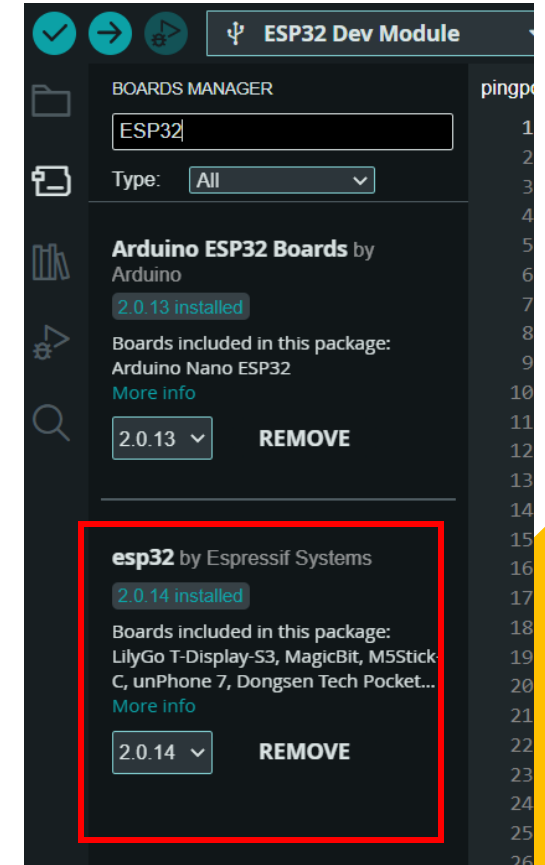
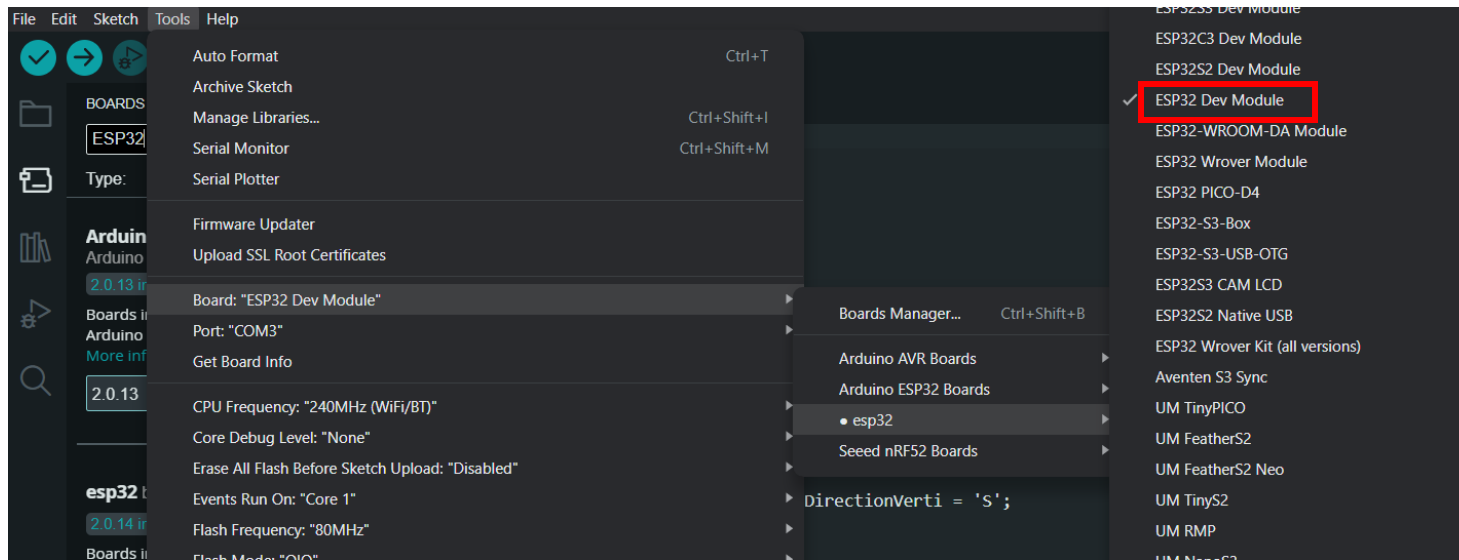
ESP32 BOARD SUPPORT TO ARDUINO IDE

- Open Arduino IDE.
- Go to File -> Preferences.
- In the "Additional Boards Manager URLs" field, add this URL: https://dl.espressif.com/dl/package_esp32_index.json
- Click OK to close the Preferences window.

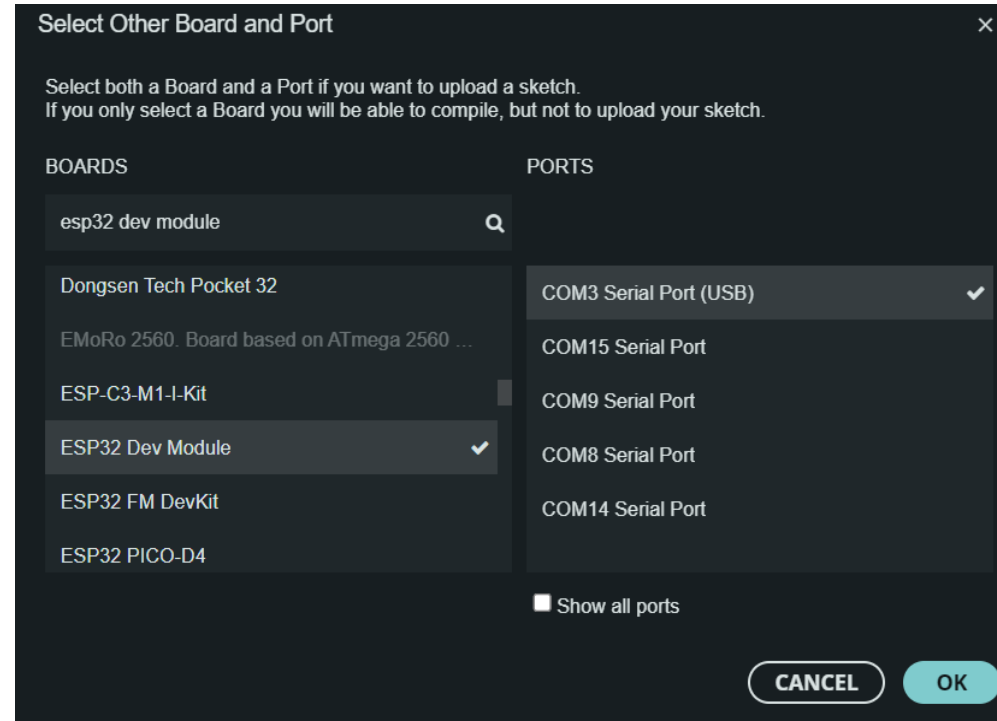
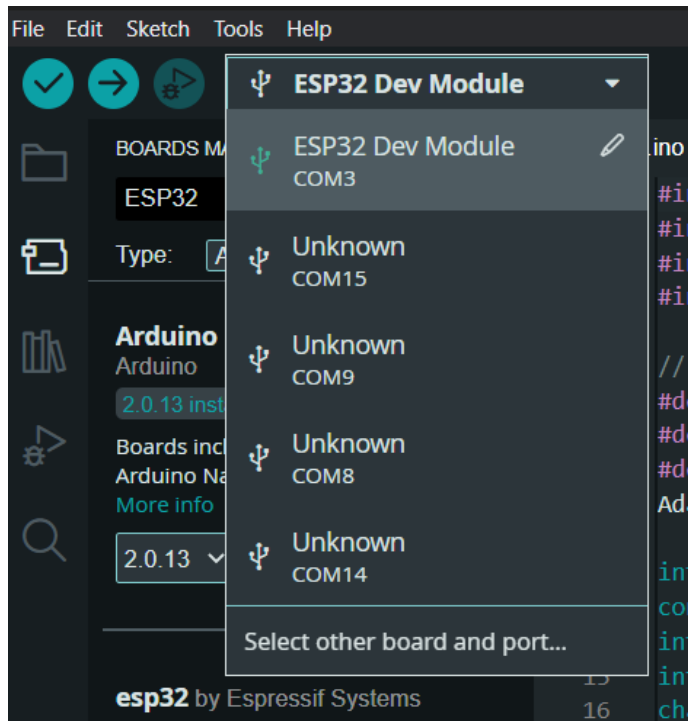


INSTALL ESP32 BOARD PACKAGE

- Go to Tools -> Board -> Boards Manager.
- Type "ESP32" in the search bar.
- Install "esp32" by Espressif Systems.
- Go to Tools -> Board.
- Select your ESP32 board from the list. ("ESP32 Dev Module" for most generic ESP32 boards)



- Open Arduino ide and select board and port
- After selecting Board and Port you are good to upload your code.



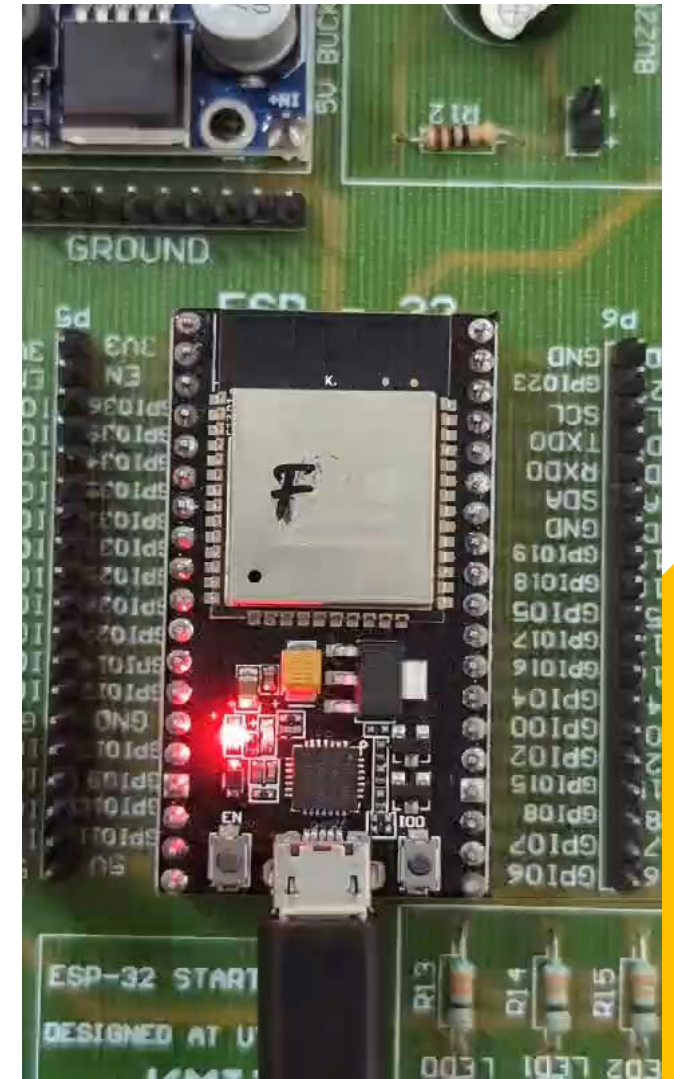
ESP32 Example code

Output:

```
const int ledPin = 2; // GPIO 2 for built-in LED

void setup() {
  pinMode(ledPin, OUTPUT);
}

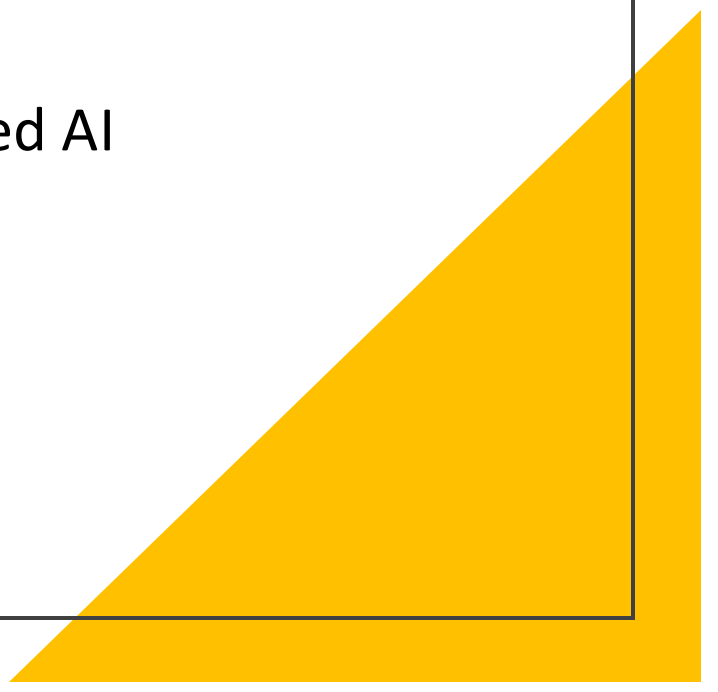
void loop() {
  digitalWrite(ledPin, HIGH); // Turn the LED on
  delay(1000);                // Wait for 1 second
  digitalWrite(ledPin, LOW);  // Turn the LED off
  delay(1000);                // Wait for 1 second
}
```



Voice-controlled smart home with AI

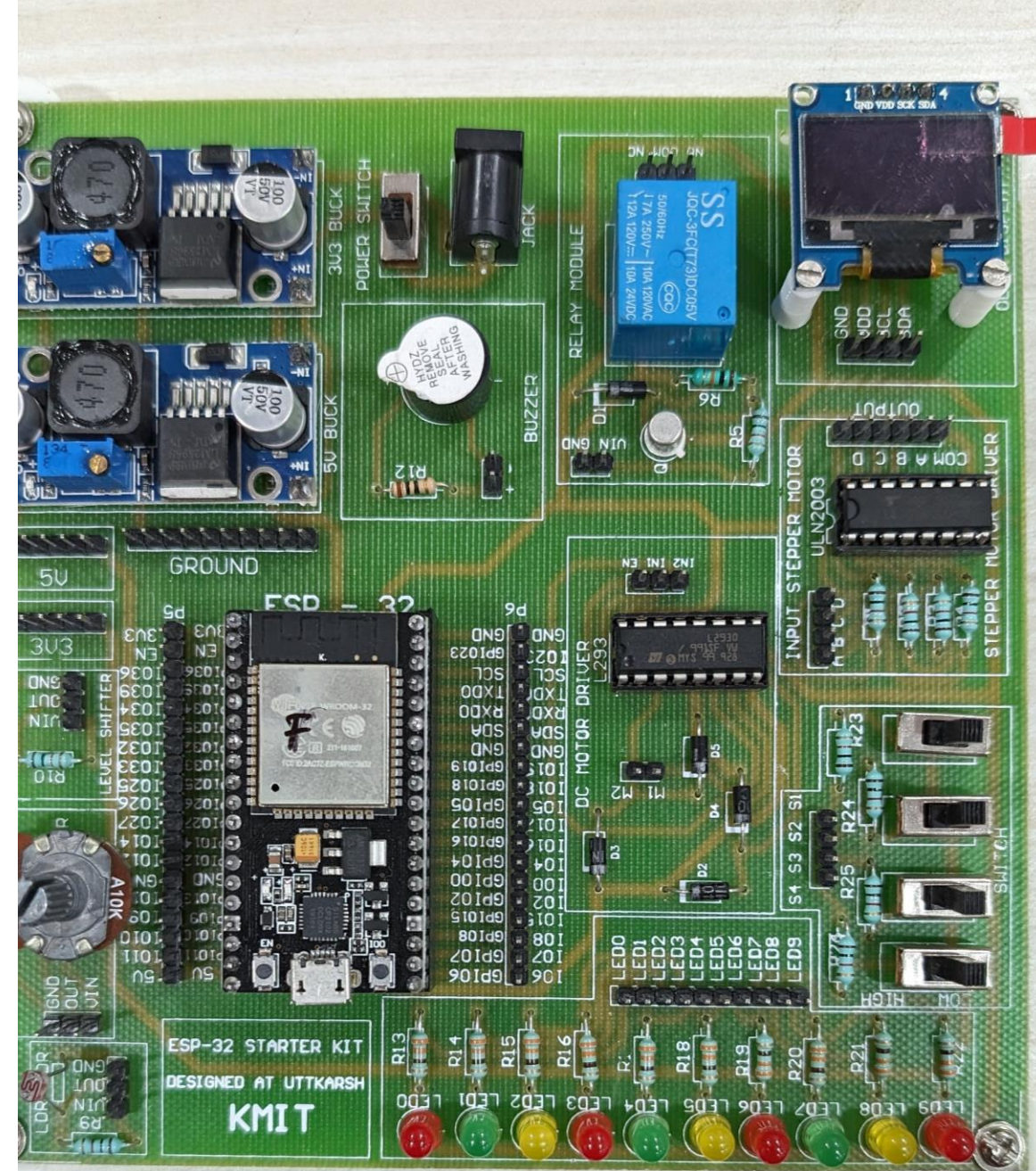
Challenge #1

Problem Statement

- Connect various devices to a microcontroller (lights, thermostat, etc.).
 - Implement a voice recognition system using a pre-trained AI model to control the devices.
- 
- A large yellow triangle is positioned in the bottom right corner of the slide, pointing towards the top right.

Components used:

- Laptop with Microphone (Built-in or external)
- Bulb module
- KMIT ESP32 Development Kit



Jumper wires:

Jumper wires are simple electrical wires used to create connections between different points on a breadboard, electronic components, or between different components on a circuit board. They are a fundamental part of prototyping and building electronic circuits.

Types of Jumper Wires:

Male to Male (M-M):

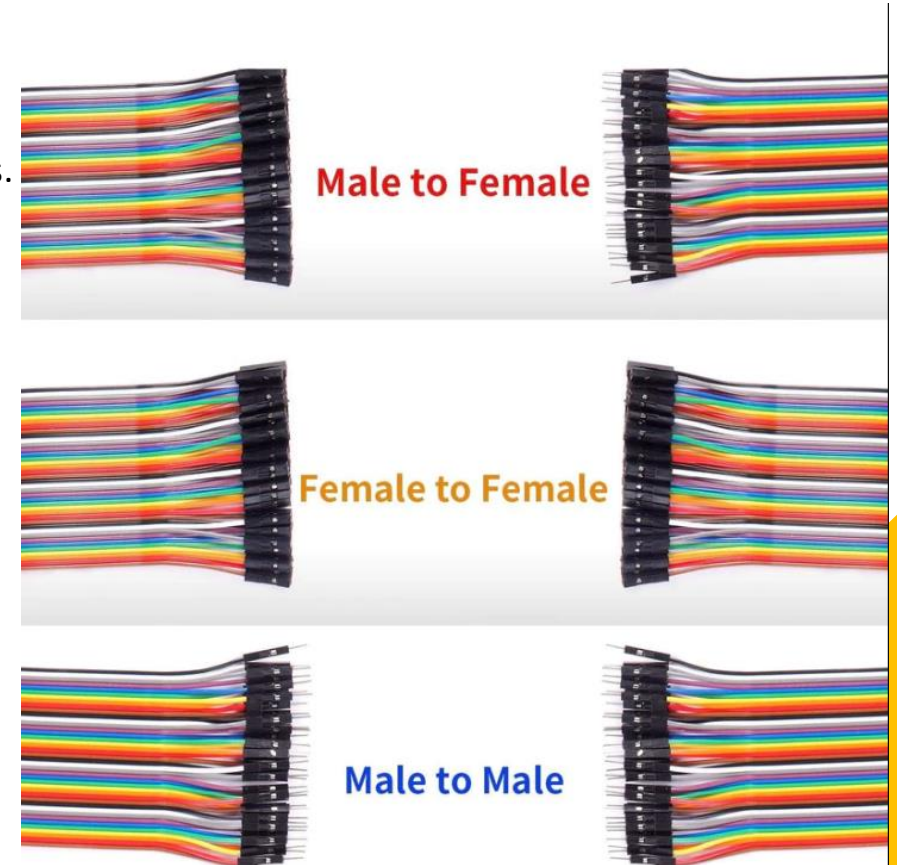
- Both ends have male pins.
- Used to connect female headers, pins, or components with male headers.

•Male to Female (M-F):

- One end has male pins, and the other has female sockets.
- Used to connect male headers to breadboards or female headers.

•Female to Female (F-F):

- Both ends have female sockets.
- Used for connecting components with female headers or pins.



RELAY:

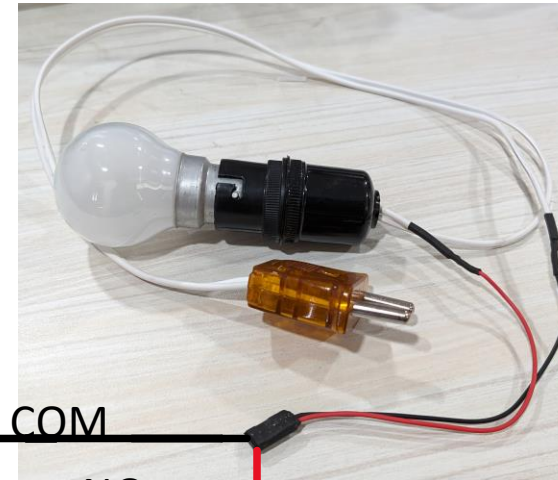
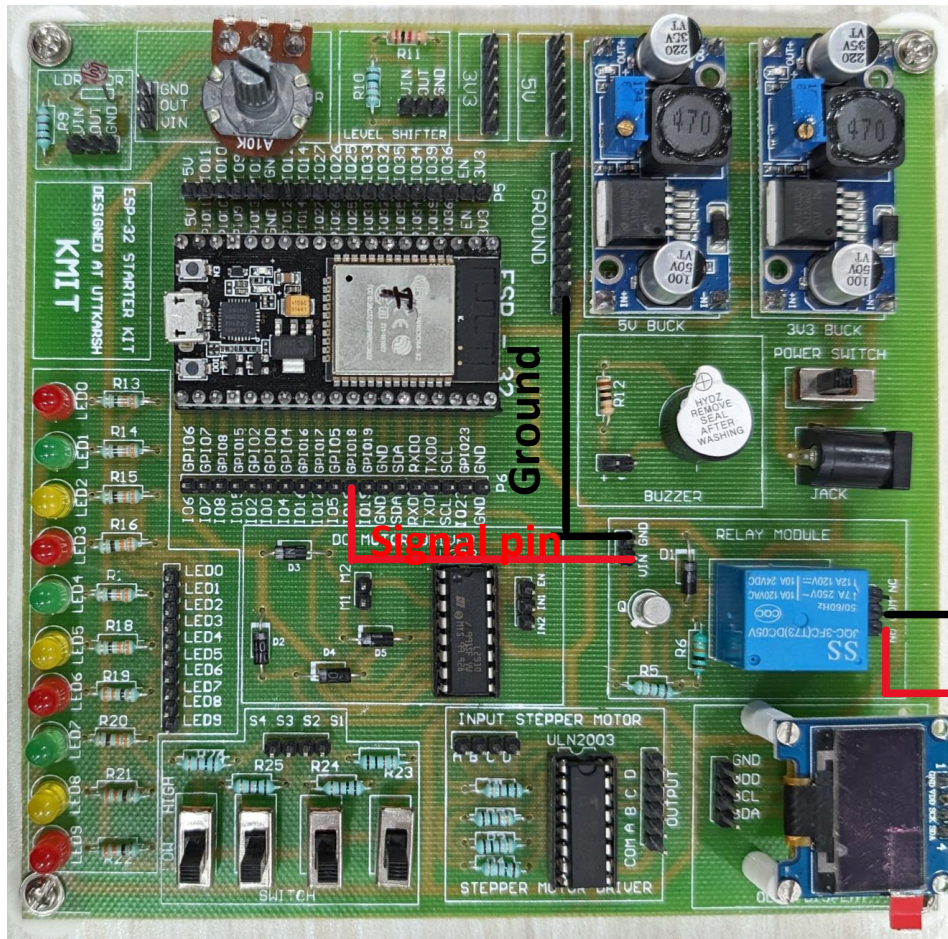
A relay is an electrically operated switch. It consists of a coil that, when energized, generates a magnetic field that causes a movable armature to move, either making or breaking an electrical connection. Relays are used in a variety of applications to control circuits electrically, which would otherwise require large and expensive switches.

- **Normally Open (NO):** These contacts are open (not connected) when the relay is not energized. When the relay is energized, the contacts close (connect).
- **Normally Closed (NC):** These contacts are closed (connected) when the relay is not energized. When the relay is energized, the contacts open (disconnect).
- **Common (COM):** This is the common connection point for the NO and NC contacts.

5V Relay Terminals and Pins

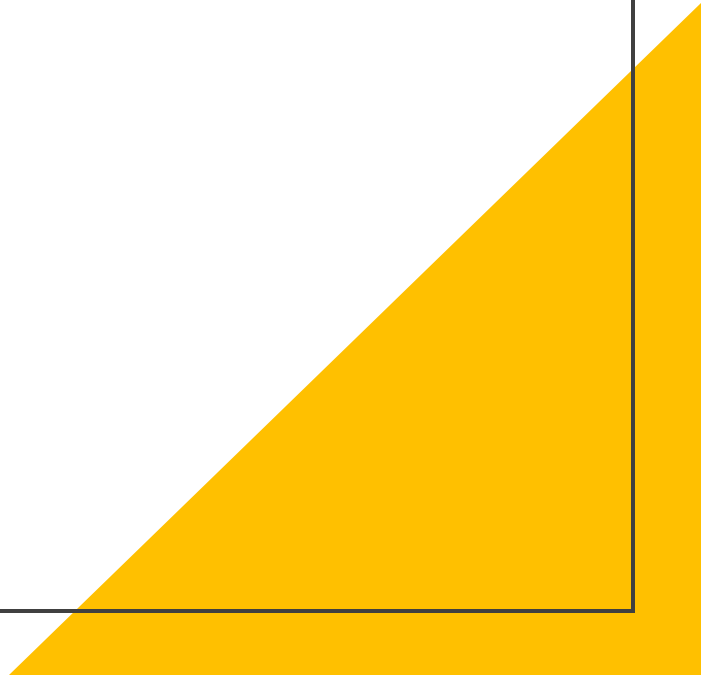


Circuit Diagram:

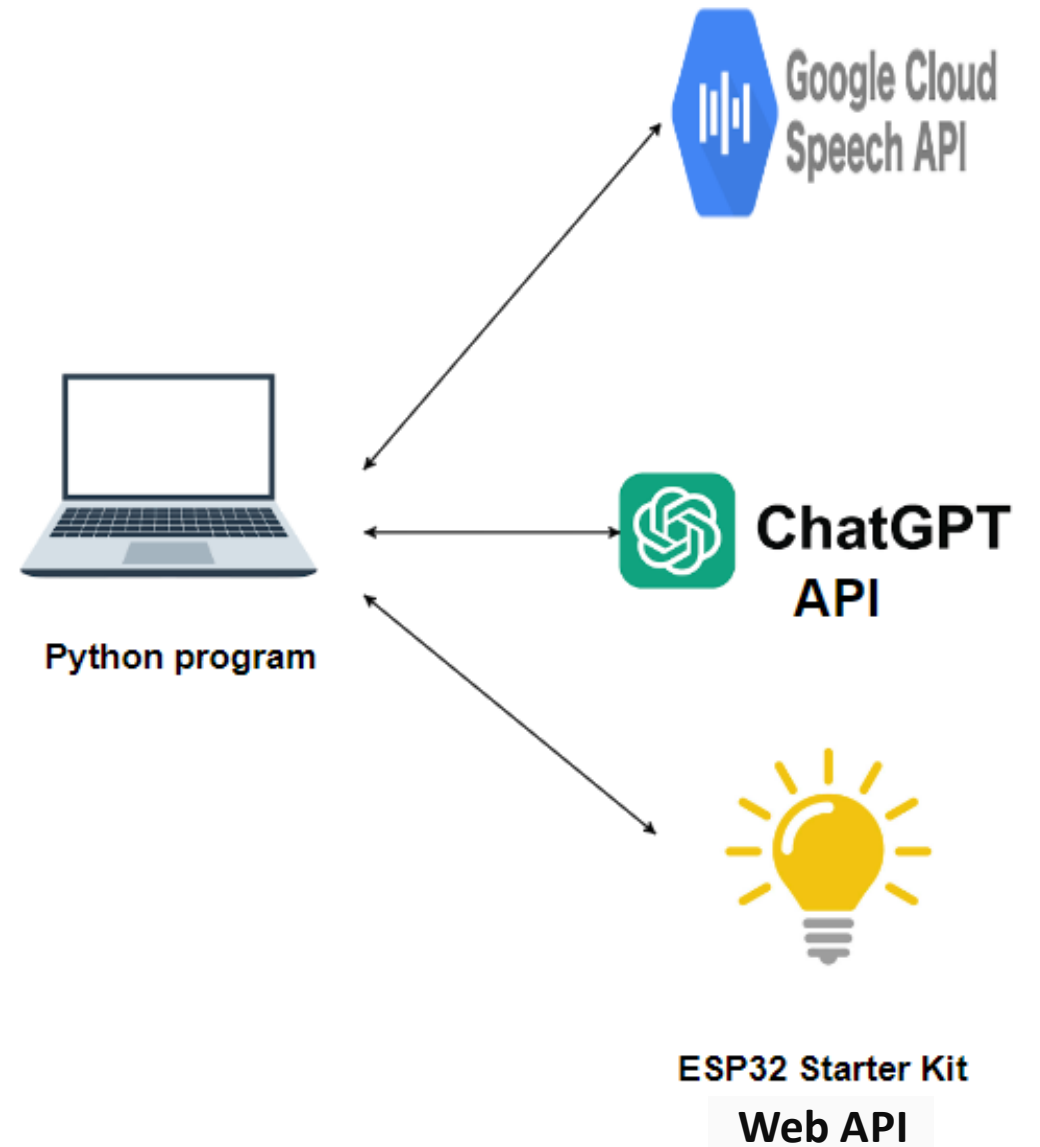


Software Requirements:

- Arduino IDE
- Python (version 3.9 recommended)
- Python libraries
 - Speech recognition
 - py audio



Architecture Diagram

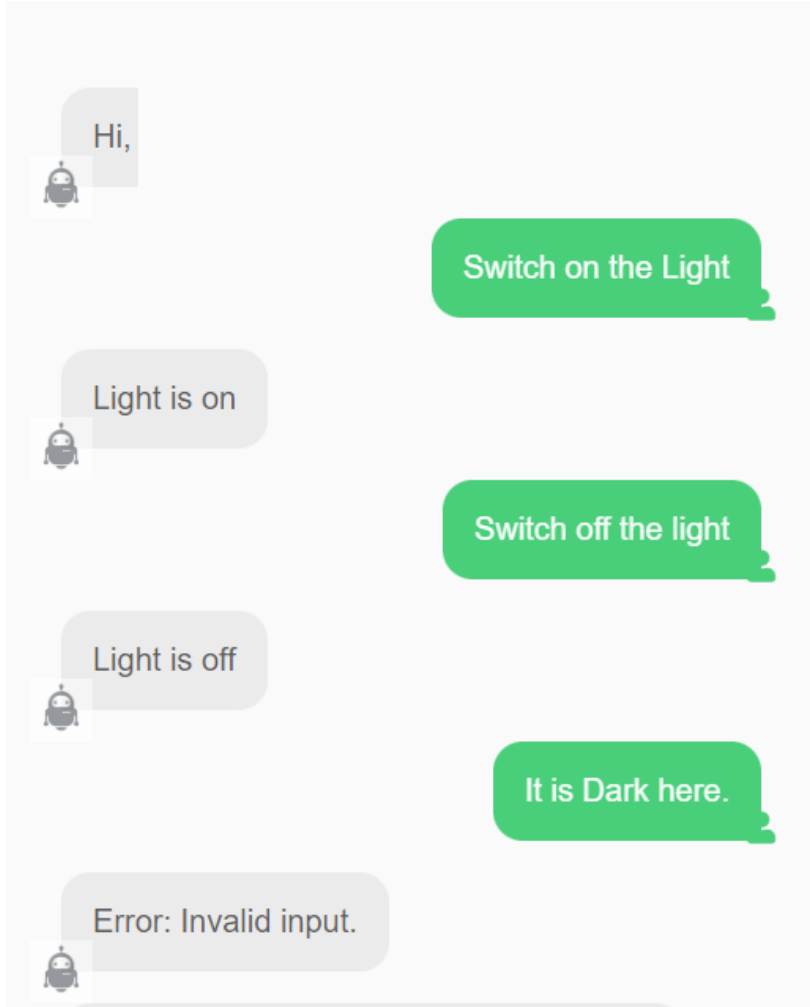


LLM API URL:

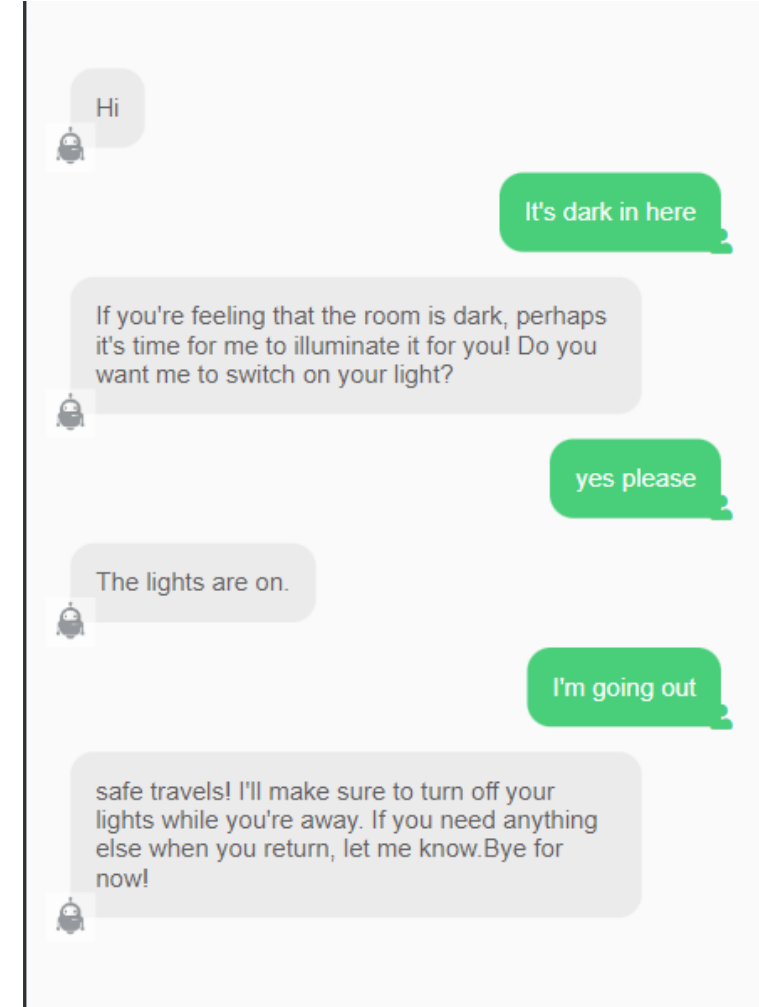
<http://dgx.kmitonline.in:4000/bulbapi>

A yellow triangular graphic is located in the bottom right corner of the slide, pointing towards the top right.

Basic smart Bulb



Advanced Smart Bulb



Sample
Prompt

A decorative graphic consisting of a thick gray border framing the page. A thin vertical line is positioned to the right of the text. In the bottom right corner, there is a yellow triangle pointing towards the center, partially overlapping the gray border.



Anonymous

i am a smart bulb , i am very helpful . I can be turned on and off myself. I'm in the room all the time , I glow in the dark , I turn off when there is light , when nobody is around I'll turn off myself. I feel sad when nobody is around and i turn off .

understand this context and answer my questions



ChatGPT

Of course! Feel free to ask your questions, and I'll do my best to help you out.



Anonymous

I'm feeling the room is dark



ChatGPT

If you're feeling that the room is dark, perhaps it's time for me to illuminate it for you! Would you like me to turn on your light?



Anonymous

I am going out bye!



ChatGPT

Safe travels! I'll make sure to turn off your light while you're away. If you need anything else when you return, just let me know. Bye for now!



Anonymous

I'm scared of darknes



ChatGPT

It's completely natural to feel scared of darkness sometimes. If you'd like, I can keep your light on to help you feel more comfortable and safe. Just let me know if you want me to turn it on!



Anonymous

only reply me turn on or turn off when ever i ask a question



ChatGPT

Got it! Just tell me whether you want me to turn on or turn off the light.



Anonymous

i'm back in the room



ChatGPT

Welcome back! Would you like me to turn on the light?



Anonymous

I'm feeling sleepy



ChatGPT

I understand. Shall I turn off the light for you?



Anonymous

we have guest in out home



ChatGPT

Should I turn on the light for the guests?



Anonymous

I'm in college



ChatGPT

Would you like me to turn off the light while you're at college?



Anonymous

where are you?



ChatGPT

I'm right here, ready to assist you! What can I help you with?



Anonymous

who are you



ChatGPT

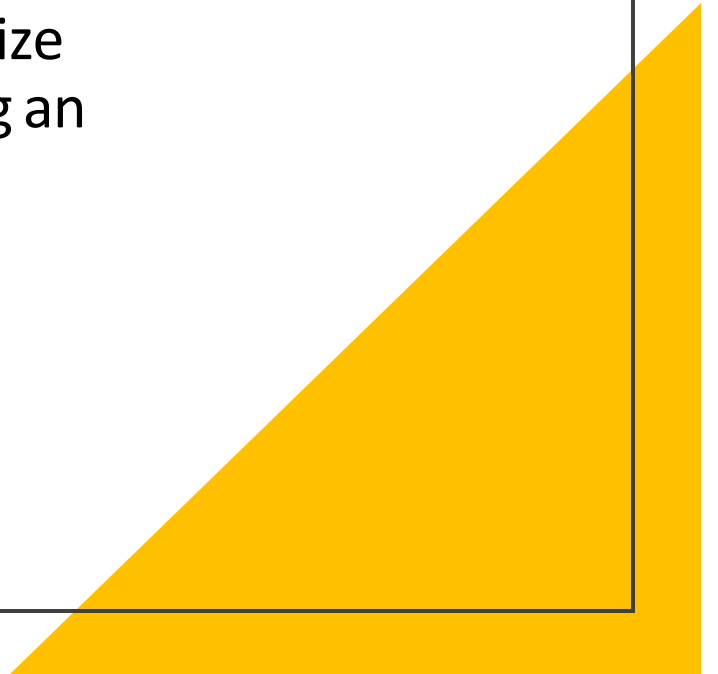
I'm an AI designed to assist and provide information. You can think of me as a digital assistant. How can I assist you today?

Intruder Alert System Using Facial Recognition

Challenge #2

Problem Statement

Develop an Intruder Alert System using Facial Recognition to enhance security. The system will train a model to recognize specific individuals through camera feeds. Upon detecting an unknown face, the system will activate an alarm to alert security personnel.



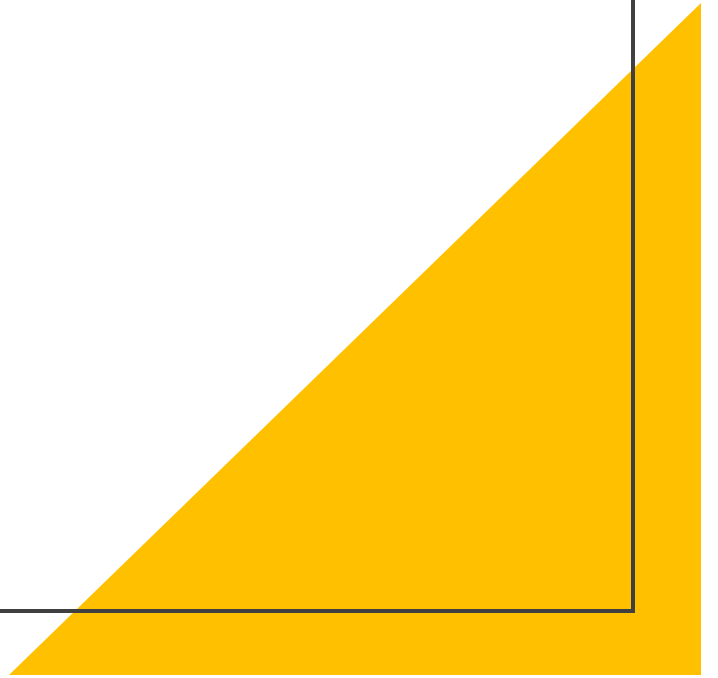
Components used:

- Laptop with camera (Built-in or external)
- KMIT ESP32 Development Kit
- Buzzer



Software Requirements:

- Arduino IDE
- Python (version 3.7 recommended)
- Python libraries
 - opencv-python 4.9.0
 - websocket-client 1.7.0
 - imutils 0.5.4
 - Face-recognition 1.3.0



Architecture Diagram



**Web
Camera**



**Python program
with face recognition**




ESP32 Starter Kit Buzzer module

Smart Water level Supervision System

Challenge #3

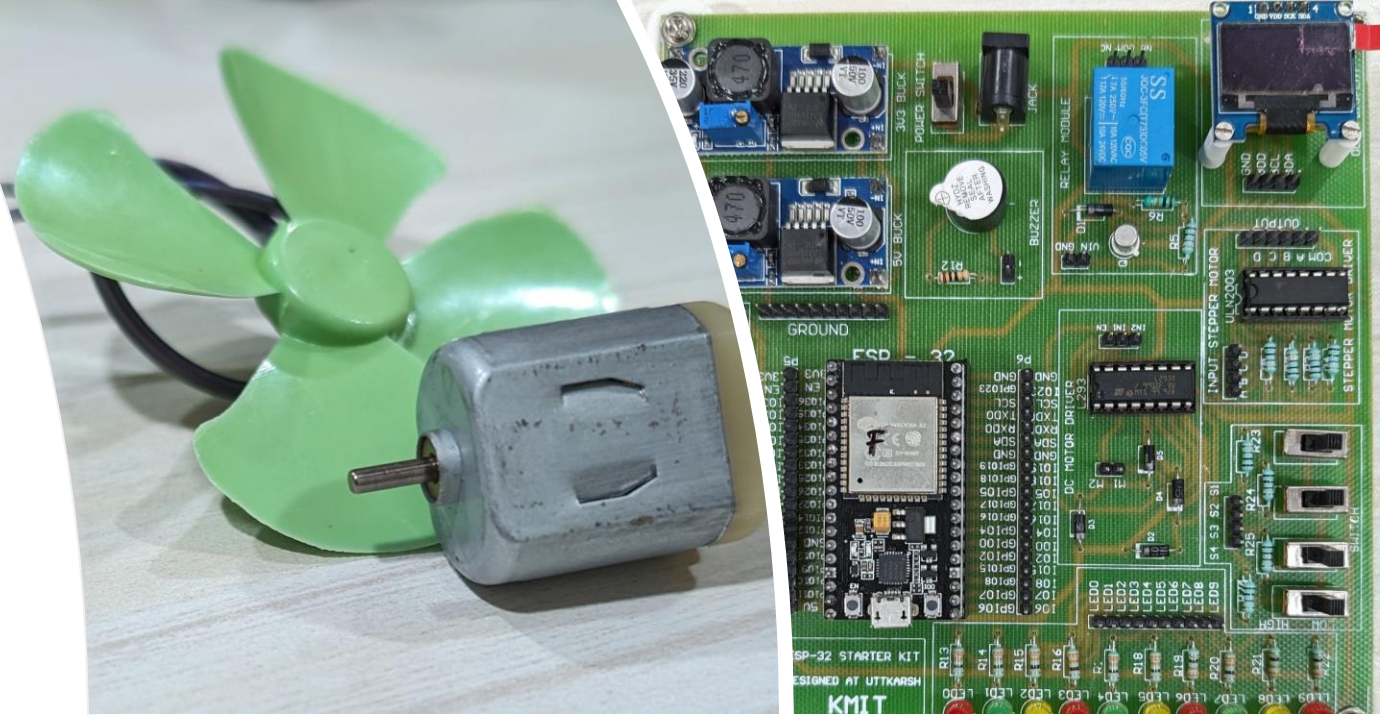
Problem Statement

“Design and implement a smart tank water-level supervision system that leverages IoT technology for real-time monitoring and management of water levels in a tank. The system should accurately track water levels using an ultrasonic sensor and ESP32 microcontroller, provide real-time visualization of the water level on a user-friendly web interface, control the water pump based on predefined water level thresholds, and alert users with audible notifications during critical water level conditions.”

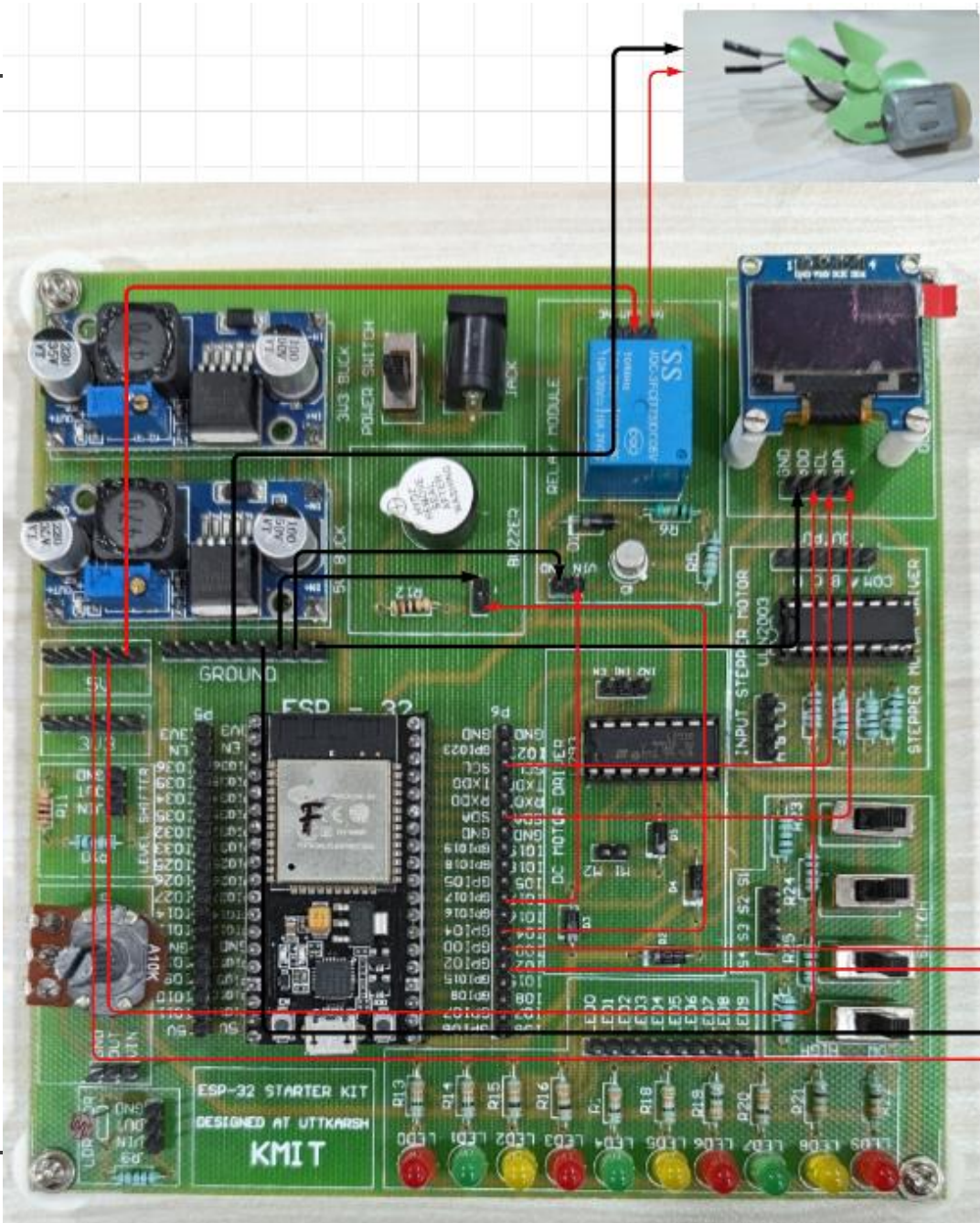
A large yellow triangle is positioned in the bottom right corner of the slide, pointing towards the top right.

Components used:

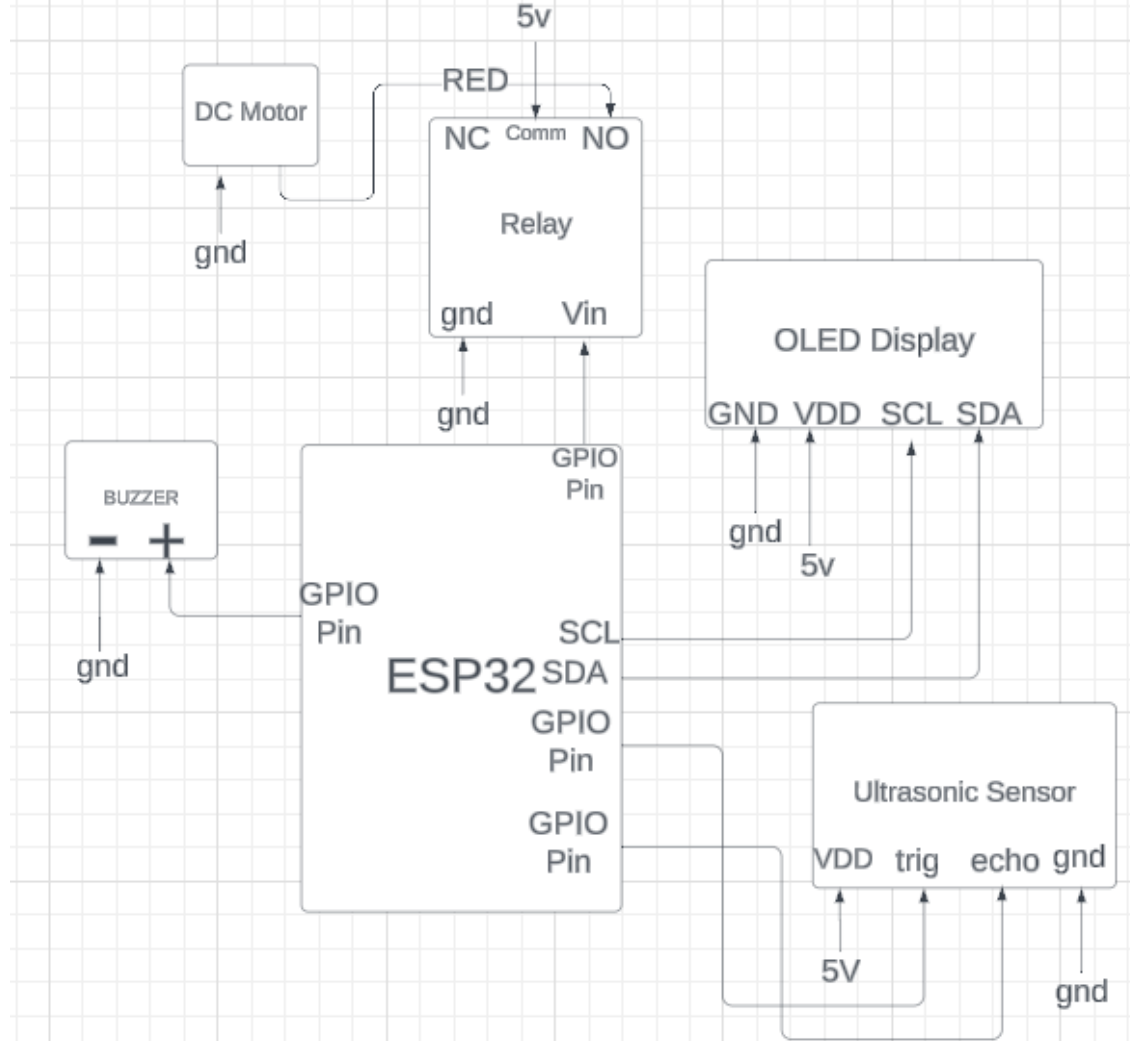
- KMIT ESP32 Development Kit
- Buzzer
- OLED Screen
- Ultrasonic Sensor
- DC Motor
- Water Glass



Circuit Diagram:



Circuit Connections:



Software Requirements:

- JavaScript
- Arduino IDE
- Arduino libraries

```
•#include <Adafruit_GFX.h>           // to control OLED display
•#include <Adafruit_SSD1306.h>       // to control OLED display
•#include <Wire.h>
•#include <NewPing.h>                 // Ultrasonic sensor (not necessary but recommended)
•#include <WiFi.h>
•#include <WebSocketsServer.h>
```