CV PRO
COMPETITION KIT

Figure 1 Fully assembled kit

HARDWARE SETUP

Mechanical Parts

Figure 2 Mechanical Parts

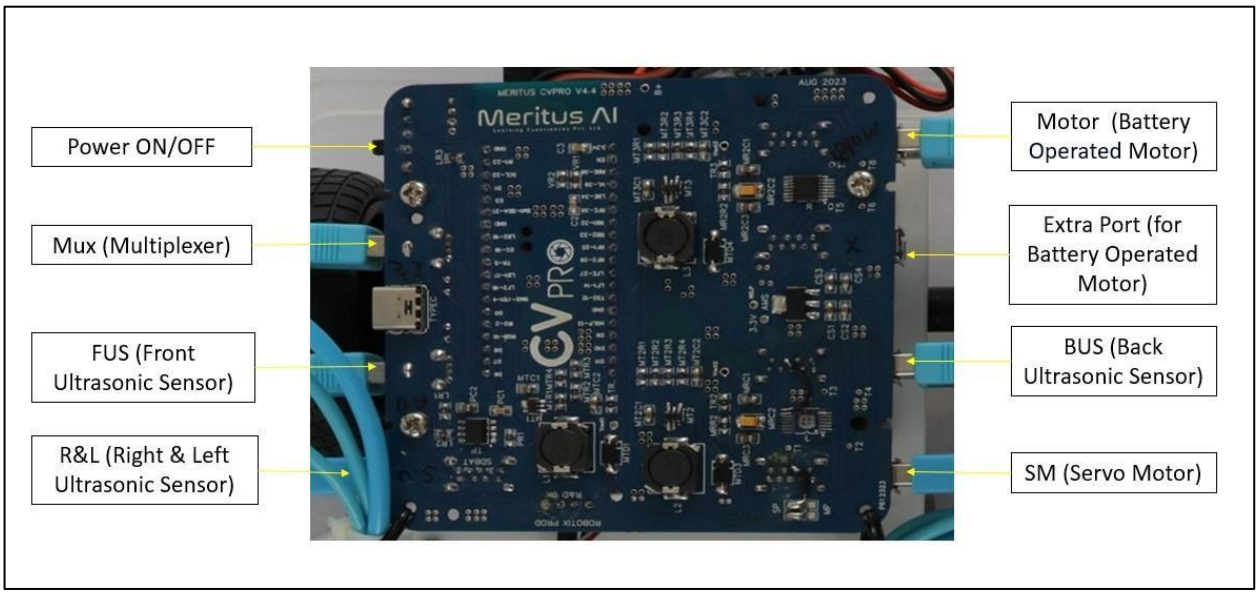


Figure 3 PCB Port and Usages (Top view)

Software Required:

The software applications required for working with 'Competition kit' - Arduino IDE. Since we are using ESP32 board manager has to be installed. Refer to the link, for the installation steps.

Modules and Components:

1. ESP32 Board:

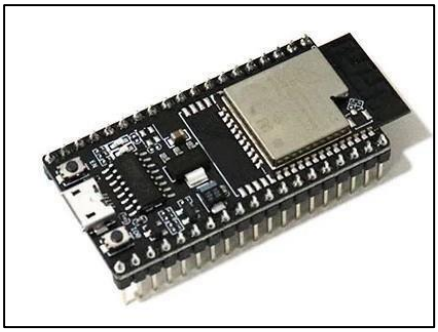


Figure 4 ESP32 Development board

The PCB contains an ESP32 as a controller. It is a versatile microcontroller, combining a dual-core processor with built-in Wi-Fi and Bluetooth capabilities. It's highly efficient and ideal for various IoT applications. Its dual-core architecture supports multitasking, making it efficient for both processing and communication tasks. With a wide range of GPIO pins, it's flexible for interfacing with sensors, motors, and other devices. Additionally, its low power consumption and compatibility with numerous development platforms make it a popular choice for IoT projects and beyond.

Important Note: To install the ESP32 board in your Arduino IDE, follow the link.

2. TCA9548A I2C 8 Channel Multiplexer Board:

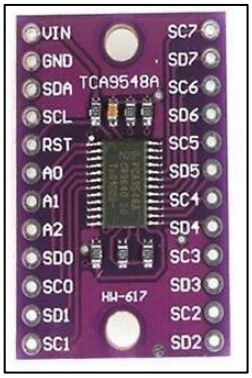


Figure 5 TCA9548A I2C 8 Channel Multiplexer

The TCA9548A is an I2C (Inter-Integrated Circuit) 8-channel multiplexer board. It is designed to expand the capability of I2C communication by allowing multiple I2C devices with the same address to be used on a single I2C bus.

Utilizing the TCA9548A will help resolve the issue of having two I2C color sensors with the same address. By using the multiplexer to direct the communication to the correct sensor via the designated channel, you can effectively work with both sensors in your project without address conflicts.

3. I2C Color Sensor:

Figure 6 Color Sensor

An I2C color sensor is a device that detects and measures colors using the I2C communication protocol. It typically integrates various photodiodes, filters, and electronics to accurately perceive and differentiate different colors. By utilizing an I2C color sensor in this project, you can detect and measure colors accurately, enabling a wide range of applications that require color analysis and processing.

Applications: I2C color sensors find applications in a variety of fields, including industrial automation, consumer electronics, robotics, healthcare, automotive, and more. They are used for color sorting, color matching, display calibration, and various other color-related applications.

4. HC - SR04 Ultrasonic Sensor

Figure 7 Ultrasonic Sensor

The HC-SR04 Ultrasonic Sensor is a widely used device for measuring distances based on the time it takes for ultrasonic waves to bounce back from an object. It consists of a transmitter that emits ultrasonic waves and a receiver that detects the waves. By calculating the time between emission and reception, the sensor determines the distance from the object. With a measurement range of 2 cm to 400 cm, Easy to interface with microcontrollers, the HC-SR04 sensor offers reliable and accurate distance measurements, making it a popular choice in the electronics and robotics communities.

PCB inbuilt functions

1. Charging and discharging - *Charging will only be enabled if the bot is in **OFF** state*.
2. ***Green LED*** will indicate when the bot is fully charge in off state. (Ensure that bot runs for 50 minutes from time of full charge condition).
3. Li-ion **3.7V** single cell **3200mAh**.
4. Power module for powering the board, sensors and motors.
5. Motor driver for controlling the motor.
6. ESP32 micro controller for executing both wired and wireless communications and algorithms. The programming can be done through the given **Type-C port**.

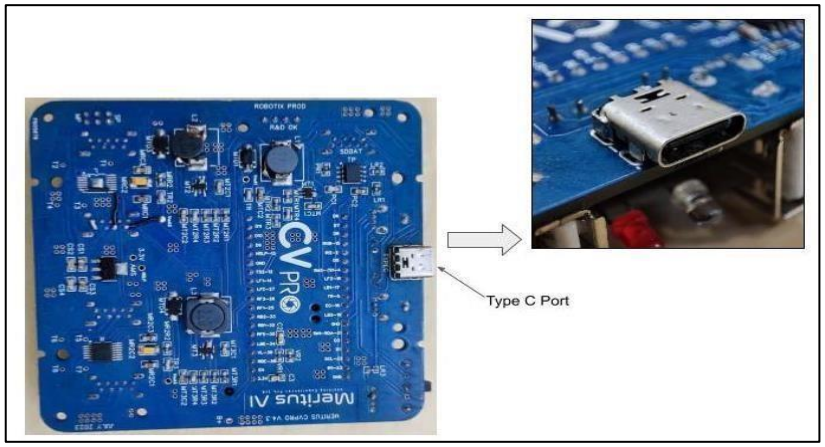


Figure 8 PCB (Bottom view) & Type C port

Port and Pin details:

Function	Port type	Port No	Pin
Motor (Battery Operated Motor)	USB 3.0	**1**	**32, 33**
Extra Port (for Battery Operated Motor)	USB 3.0	**2**	**25, 26**
BUS (Back Ultrasonic Sensor)	USB 3.0	**3**	**17,19**
SM (Servo Motor)	USB 3.0	**4**	**27**
R & L (Right & Left Ultrasonic Sensors)	USB 3.0	**5**	**Right- 2,23 and Left-5,18**
FUS (Front Ultrasonic Sensor)	USB 2.0	**6**	**12,4**
MUX (Multiplexer)	USB 2.0	**7**	**22,21**
RGB LED	-	**-**	**15**
NSLEEP FOR MOTOR	-	**-**	**13**
Battery Voltage Reading	-	**-**	**39**

- Kindly refer to the pins provided in the above table for programming firmware.

The competition kit will be capable of:

- Detecting colour on the floor using color sensor
- Avoiding obstacle using ultrasonic sensors
- Accomplishing any of the user-defined tasks

Follow the steps given below to operate the competition kit provided to you:

1. Create the Arduino program to upload in Arduino IDE.
2. Open the firmware in IDE.
3. Select the respective communication (COM) port and select the board as (Do it yourself devkit).
4. Switch on the kit.
5. Click 'Upload' button to upload the created program into the kit.
6. Turn on to accomplish the programmed task.

Maximizing performance of kit:

1. USB cables must be connected to their designated ports.
2. The kit's servo angle is fixed at **100 degrees**.
3. The PCB lacks protective covering; avoid placing conductive materials on it.
4. When adjusting the angle, stay within a **25-degree** range to the ***left and right of the center angle (100 degrees)***, which allows movement between **75** and **125 degrees**. Deviating beyond these limits may result in damage to the product.
5. Handle with care to avoid wire wear.

Key Library files required:

The following library files are crucial for proper functioning of the bot:

- #include <ESP32Servo.h> - This library allows to control servo motors with precision and ease, enabling precise movements in our system.

- #include <NewPing.h> - NewPing is used for accurate and efficient distance sensing, particularly useful when working with ultrasonic sensors. It simplifies the task of measuring distances.

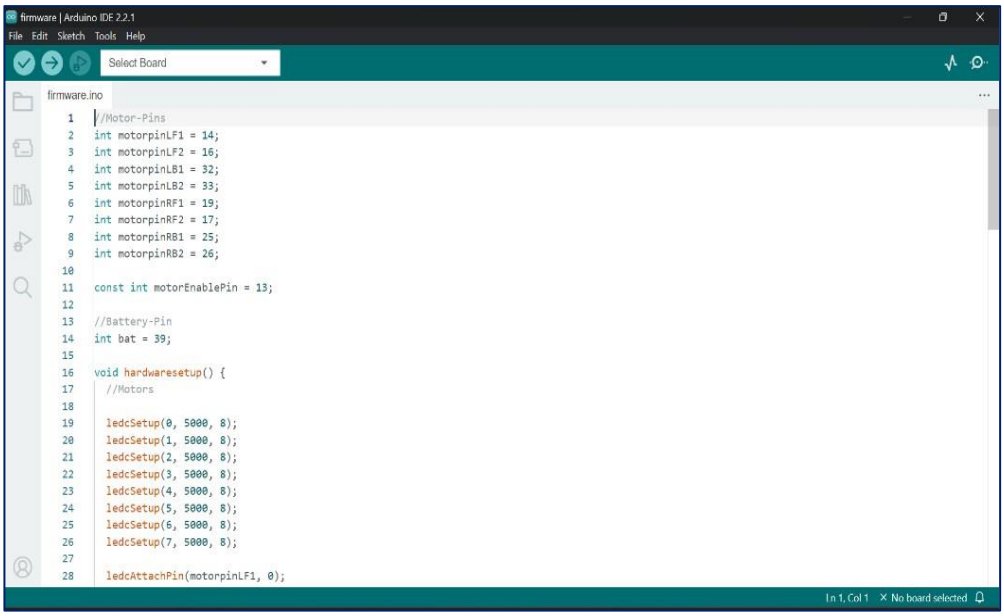
- #include <Wire.h> - The Wire library facilitates communication on the I2C bus, which is commonly used for connecting multiple devices in our setup.

- #include "Adafruit_TCS34725.h" - This library is essential for working with Adafruit TCS34725 color sensor, enabling us to capture and process color data effectively.

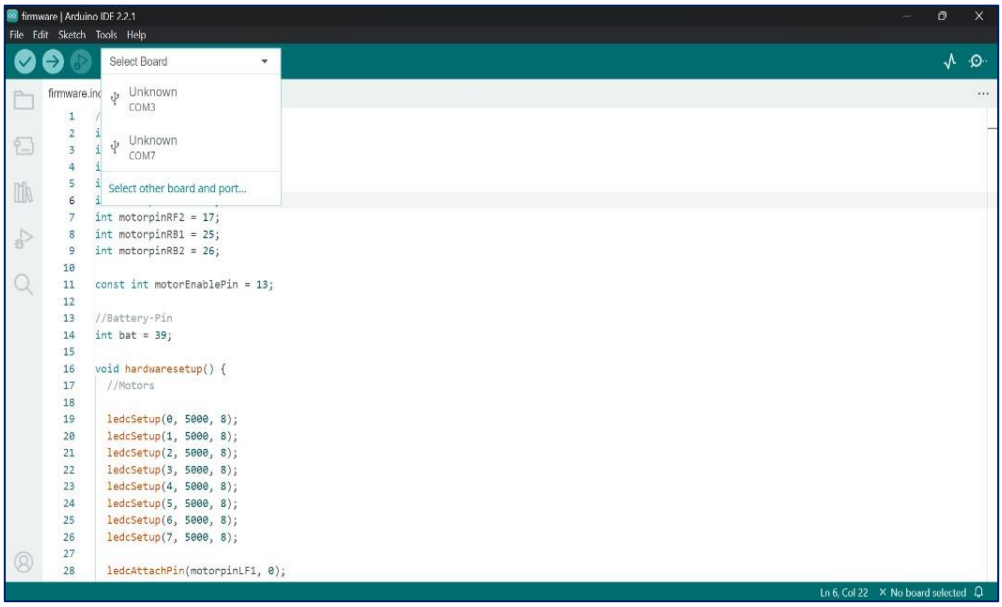
Note: **Consider exploring additional compatible libraries as well.**

It is imperative to test the bot for its functionality. For testing the test codes available in the downloaded GitHub repository can be used. It is available in the path – **'Firmware/Bot-TestCodes'.**

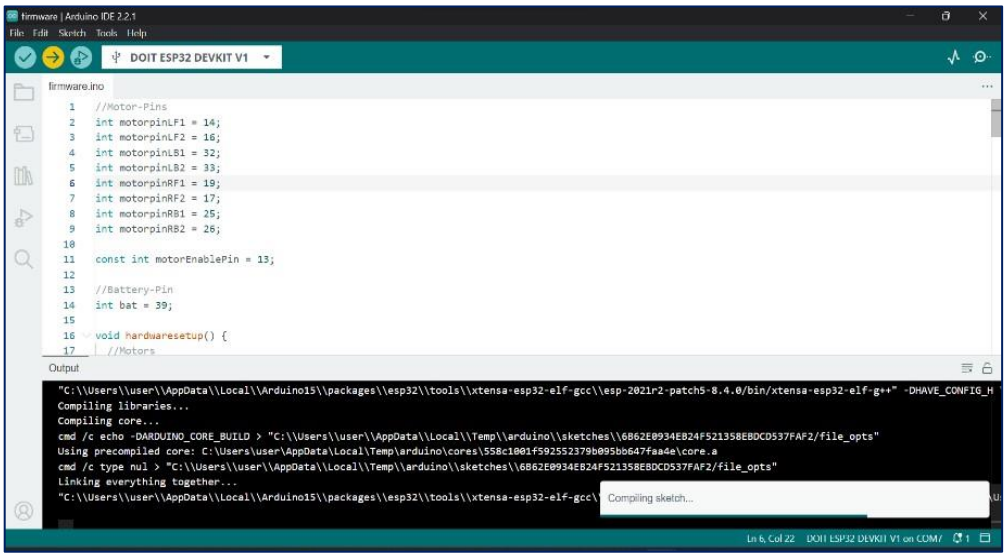
1. Launch the Arduino IDE on your computer and open your '.ino' file. A sample is shown below.



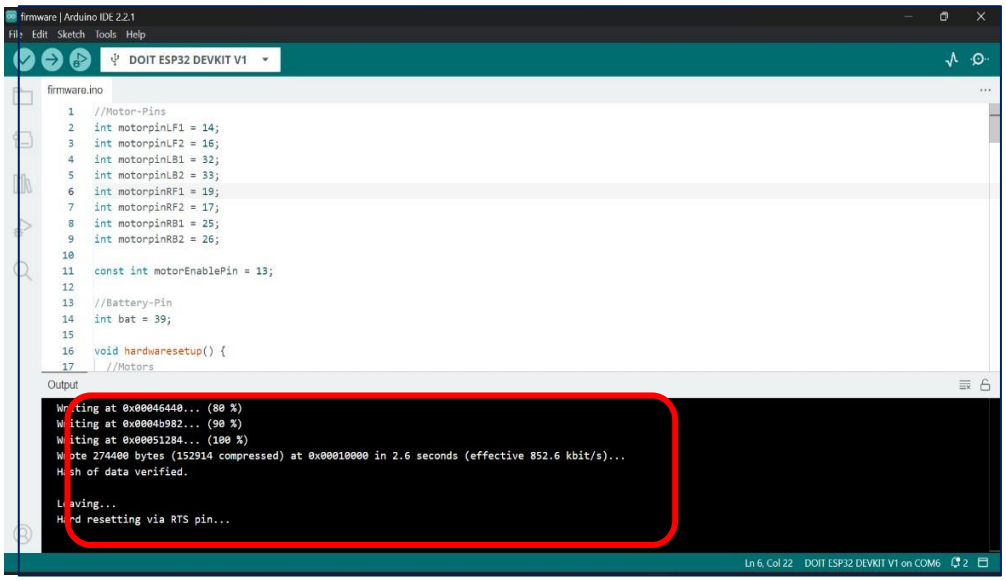
2. Select the respective board and COM port as shown below.



3. Click on ‘Upload’ button, and upload the test code file, ‘Bot_ColorSensor_Test’ to start the testing. You may try with each of the test codes provided. The IDE first compiles the code and then upload the code to the ‘Esp32’ board.



4. The following message (highlighted) will be displayed when the uploading is complete.



Uploading - CV Pro Competition Kit Firmware:

When testing of the kit is complete, upload the firmware provided to ensure a smooth and seamless integration between hardware and software. Upload the **‘CVPRO-Competition-Firmware.ino**’ file from the path – **‘…Firmware/CVPRO-Competition-Firmware’**.