LuigiMobil: A remote controlled smart rover

Embedded Systems Course

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Abstract

This embedded design project involves building a rover that is controlled by a webserver using a laptop and its arrow keys. The rover is equipped with an IR sensor that detects nearby objects and automatically stops the rover when it is reversing to prevent collisions. The webserver allows the rover to be controlled remotely using a laptop, providing a user-friendly interface for controlling the rover's movements. Overall, this project combines the use of embedded systems, web development, and sensor technology to create a functional and autonomous rover.

Introduction

This project delves into the realm of robotics and embedded systems by creating a rover that can be controlled remotely via a webserver and a laptop. A key feature of this rover is its ability to detect and avoid obstacles using an infrared sensor. By combining different technologies such as embedded systems, web development and sensor technology, this project aims to showcase the potential of these fields in the development of advanced and versatile machines. The rover will be able to move in different directions and stop when it is reversing and getting close to an object. The objective of this project is to demonstrate how these technologies can be utilized to create practical and efficient devices that can perform a wide range of tasks.

1.1 Hardware components

Components that were used in this project are:

-PIC Microcontroller(16f877a)

Figure (1.1) PIC 16f877a

-DUAL H-BRIDGE MOTOR DRIVER L298N

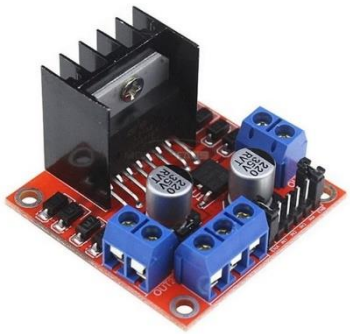


Figure (1.2) H-BRIDGE

-IR Infrared Sensor

Figure (1.3) IR Infrared Sensor

-NodeMCU ESP32.

Figure (1.4) NodeMCU ESP32

- **Dc motor**

Figure (1.5) Dc motor

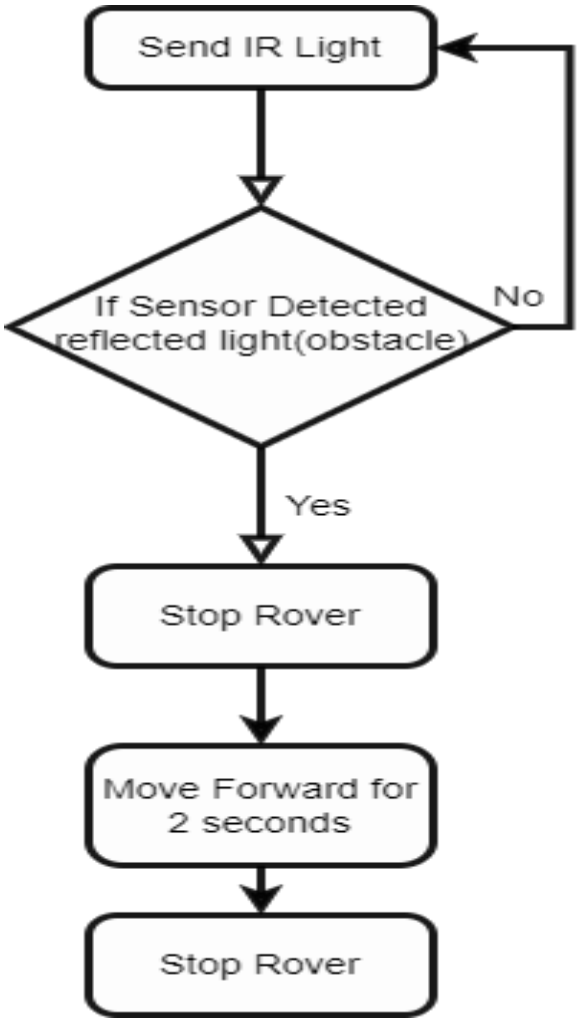
-Piezo Buzzer

Figure (1.6) Piezo Buzzer

2.1 Project Flow Chart & Design

-IR Sensor

During the Backward movement if there's an obstacle behind the rover, the IR sensor will make an interrupt and the rover will stop and move for 2 seconds then stop again to avoid collision**.**



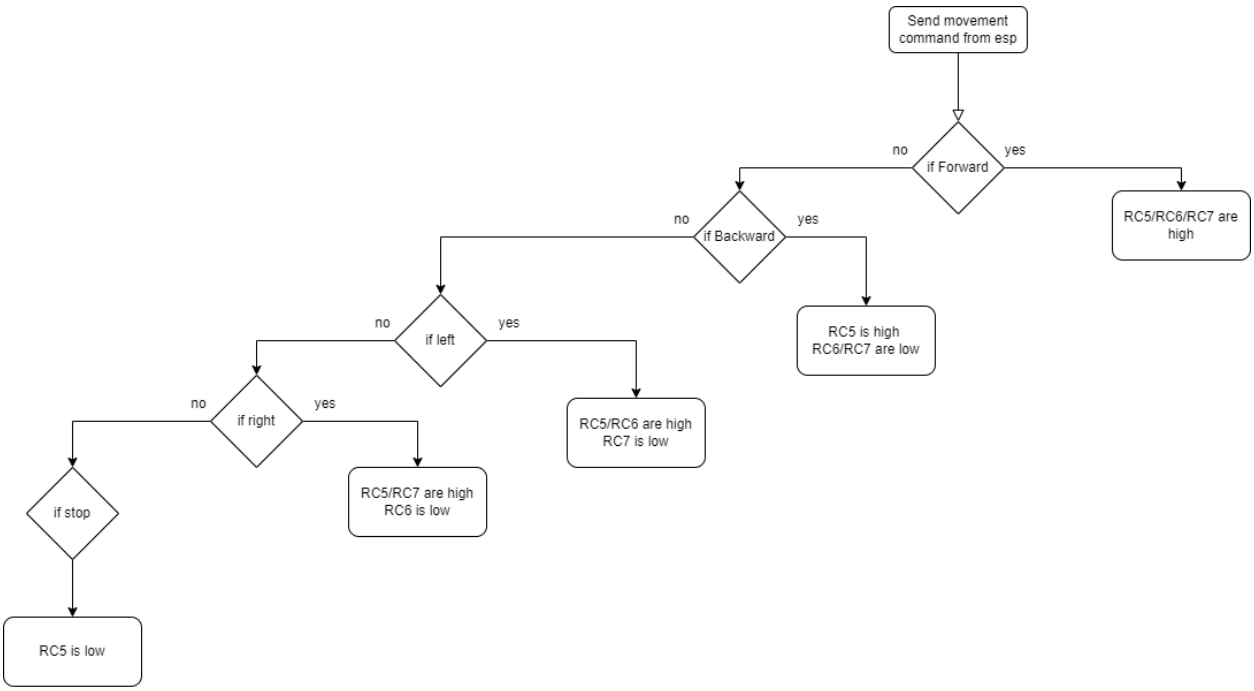
-NodeMCU with H-Bridge

when you press an arrow on the laptop connected to the web server the control pins take a digital signal that controls the motors and make them move, this goes for all the movement of the car.

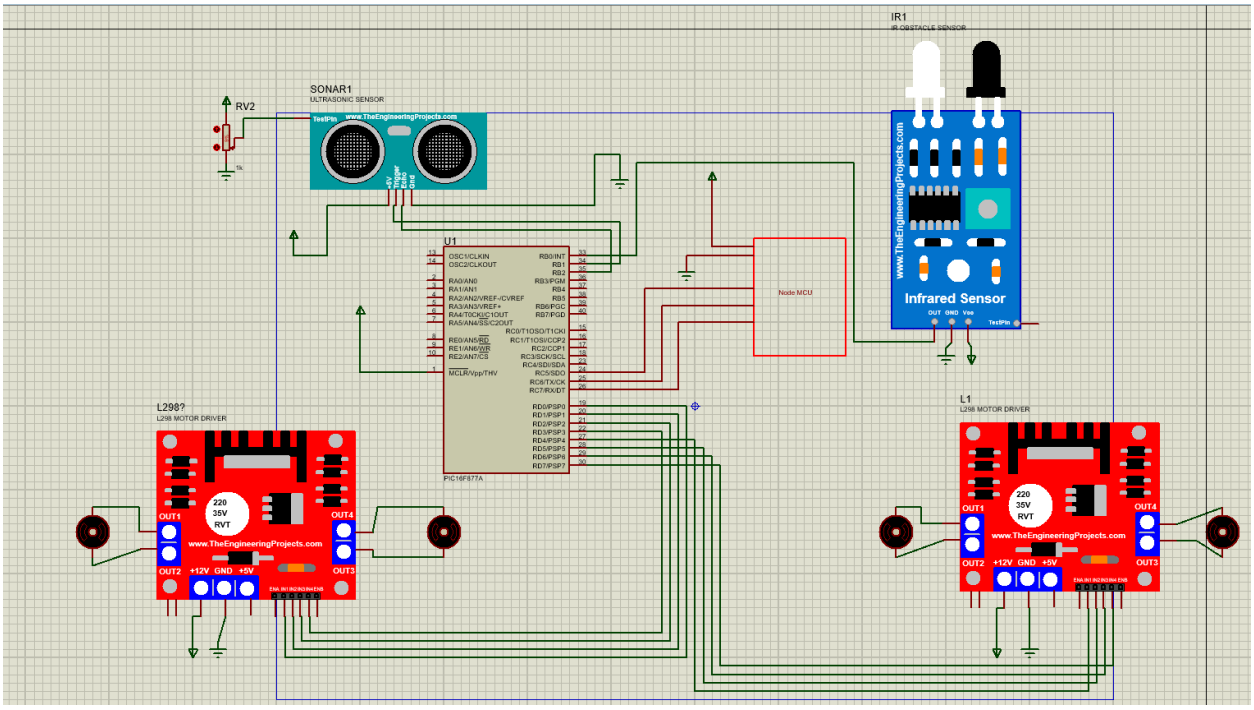
The Control pins will be controlled using Node MCU which will be connected to the pic16F877A, the Node MCU will be in communication with a web server on our laptops where we are going to control the movement of the car through the keyboard arrows.

The following truth table shows the controls received from the esp32

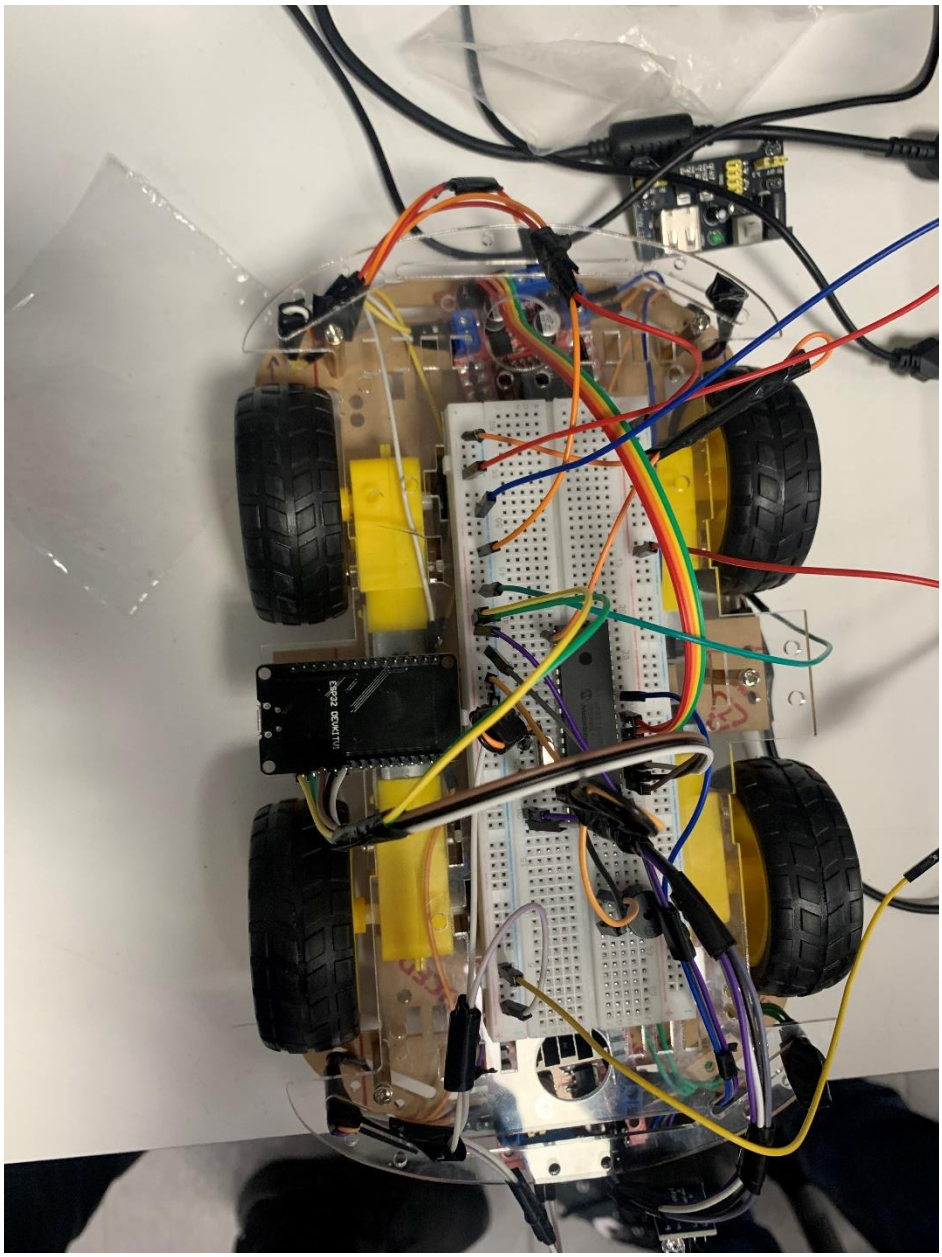
Movement/ port	RC5	RC6	RC7
Forward	1	1	1
Backward	1	0	0
Left	1	1	0
Right	1	0	1
Stop	0	X	X

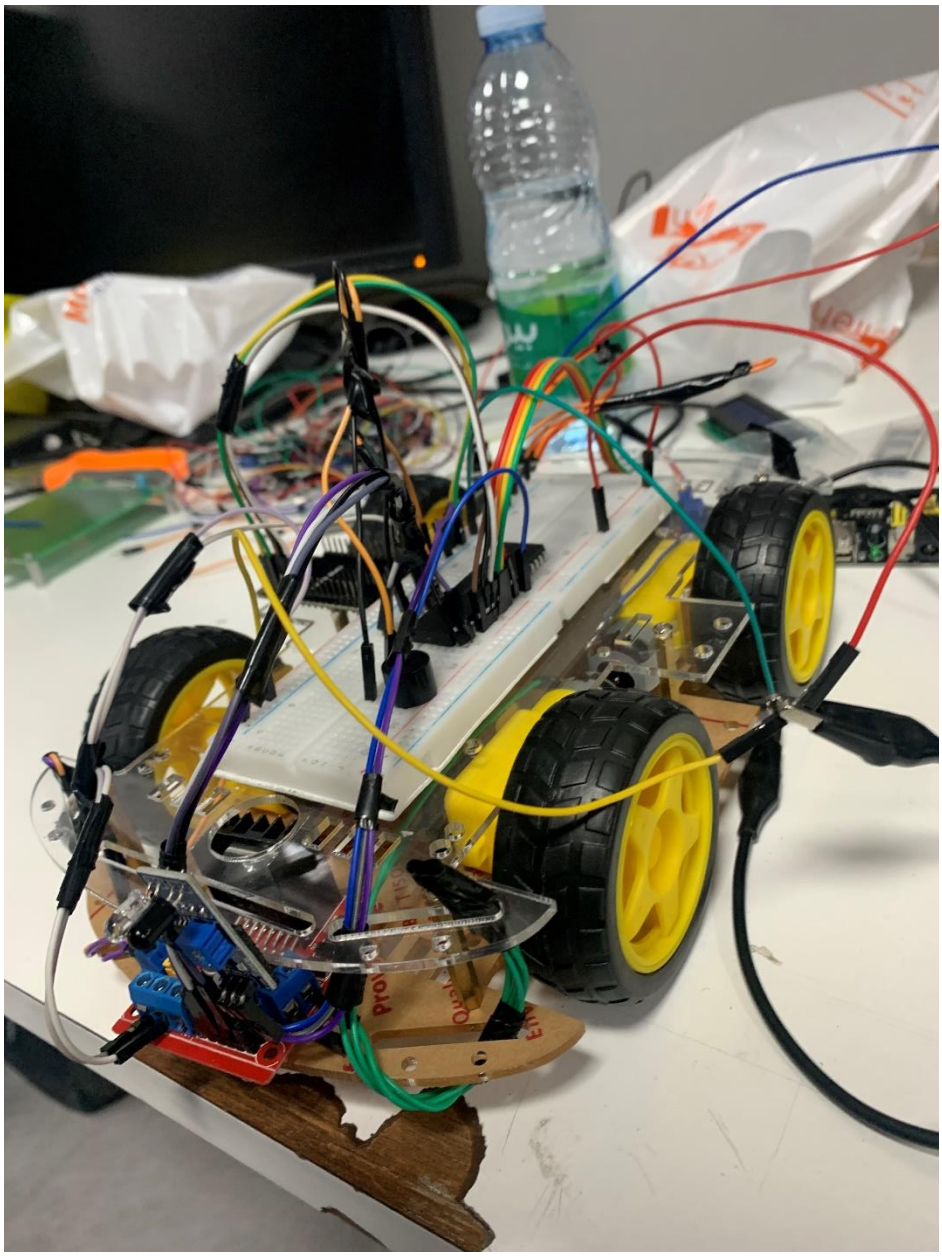


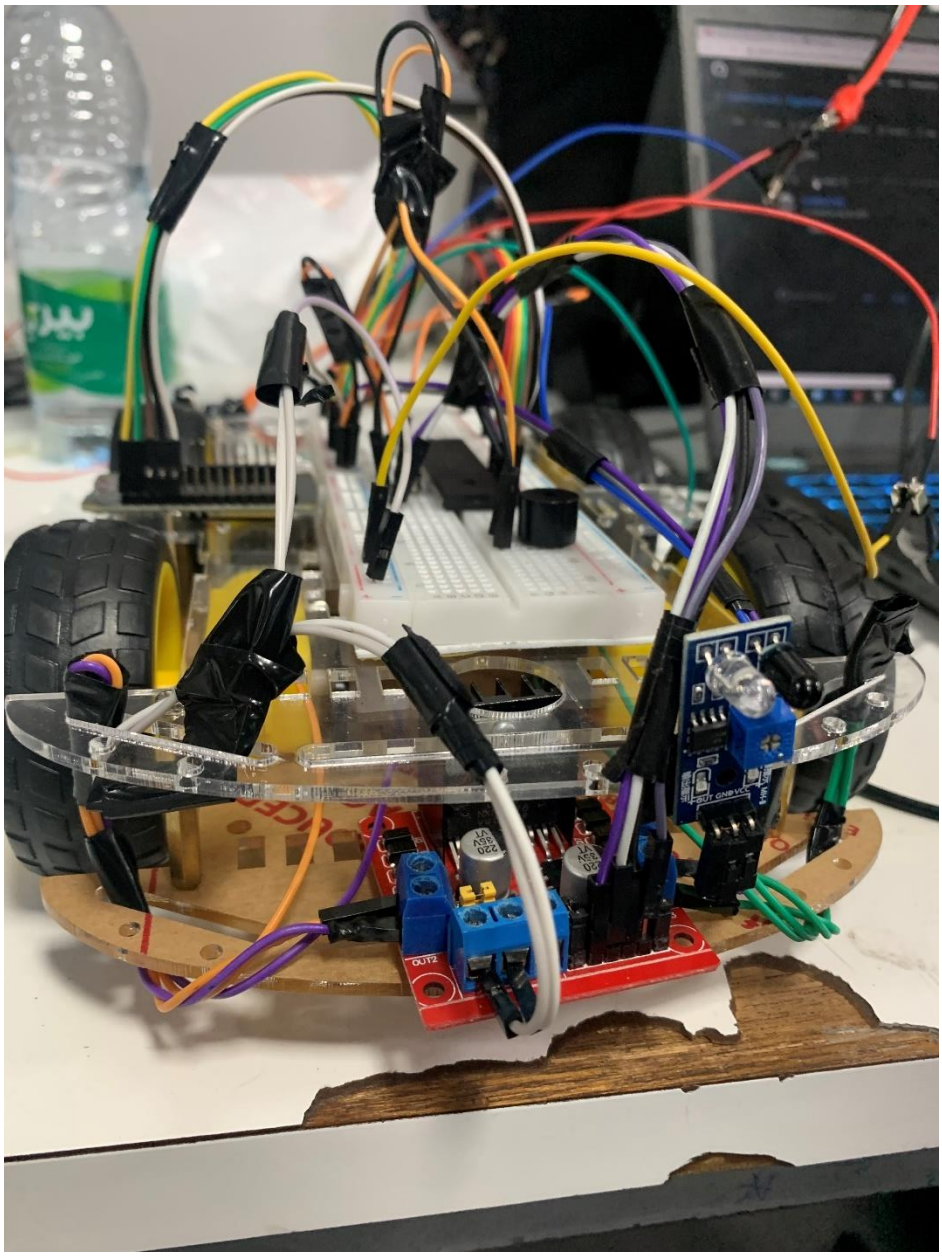
-Circuit Design

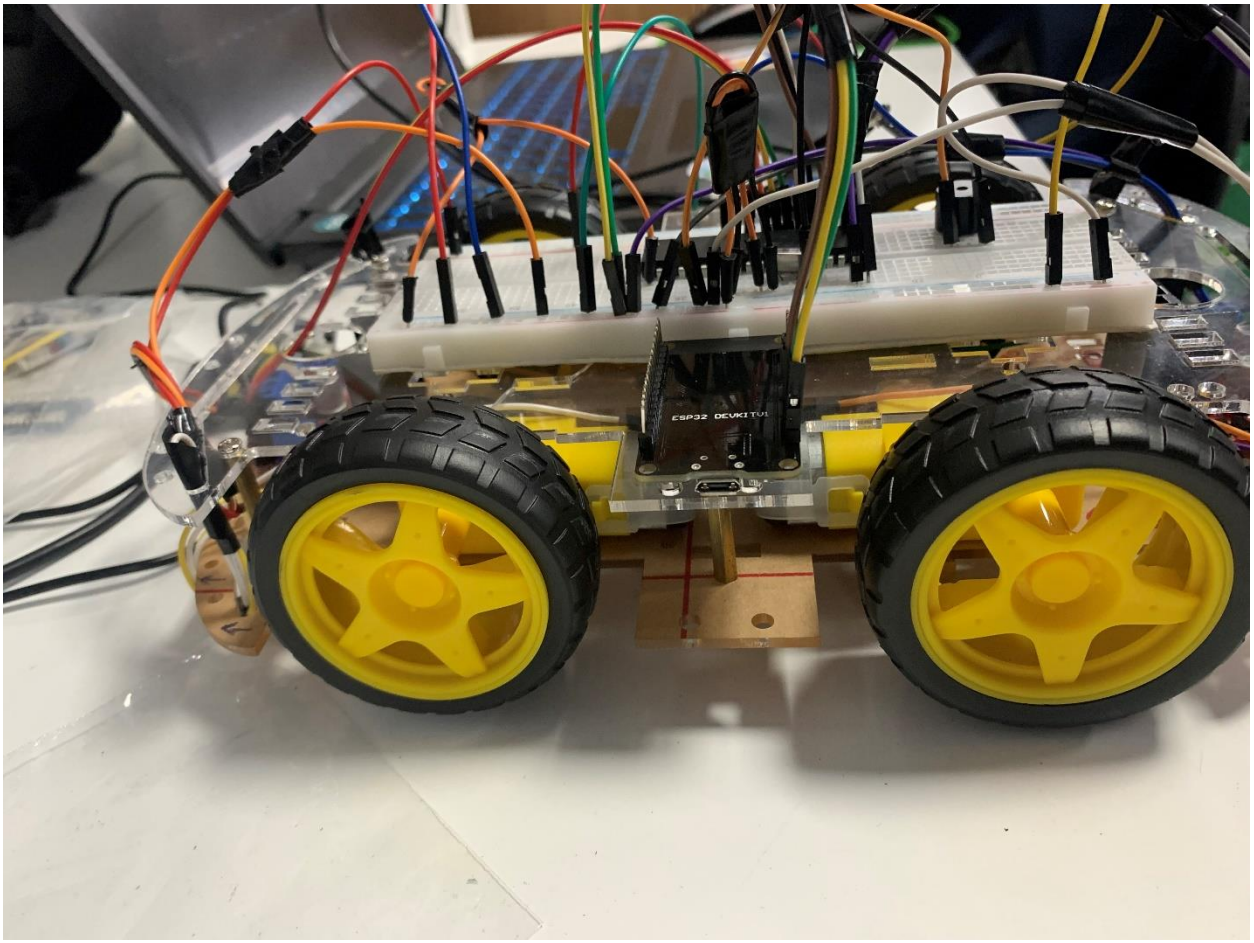


-Mechanical Design






OUT2
220
35V
GND VCC



Problems and Recommendations

While working on this project we faced few problems that we should mention:

- Trying to find the suitable power source that we can rely on during working on the hardware and testing.
- The continuous malfunction while working on the hardware parts, as they are cheap and non-reliable on the long term.
- Merging the code together and debugging it to make it work.

We as a group think that taking the following recommendation into consideration could help in the future work:

- Having a reliable power source ready when needed.
- Assuring the availability of the needed hardware parts in a very high quality, to use it for the long term

Conclusion

In conclusion, this project has highlighted the capabilities of various technologies when combined. The rover that was developed in this project, is a perfect example of how embedded systems, web development, and sensor technology can be integrated to create autonomous machines that can navigate and perform tasks independently. The ability to control the rover remotely through a webserver and a laptop, and the inclusion of an IR sensor that enables the rover to detect and avoid obstacles while reversing are prime examples of how these technologies can be used to make machines more efficient and useful. This project has successfully demonstrated the potential of these technologies in the field of robotics and embedded systems, and it has opened up new possibilities for future developments.

References and Datasheets

-IR Sensor

https://www.electronicsforu.com/technology-trends/learn-electronics/ir-led-infrared-sensor-basics

-Datasheets

-PIC Microcontroller (16f877a) Datasheet.

https://ww1.microchip.com/downloads/en/devicedoc/39582b.pdf

-L298N Dual H-Bridge.

https://www.smart-prototyping.com/image/data/9_Modules/101861%20LN298N%20dual%20H-bridge%20driver%20motor/L298DATASHEET.pdf