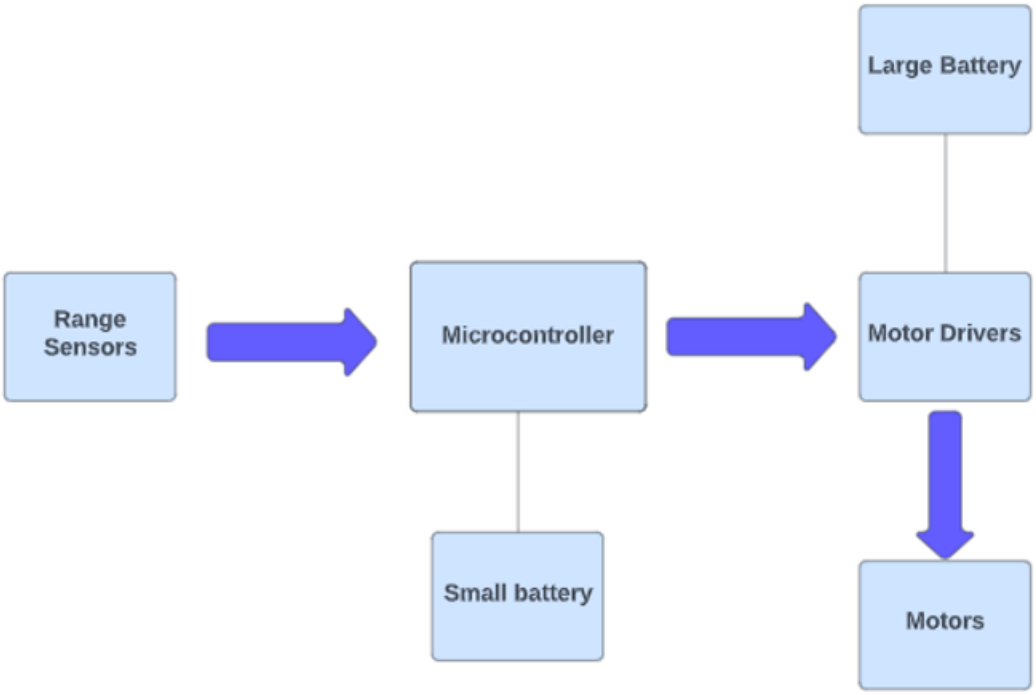
Working of Robot

Block Diagram



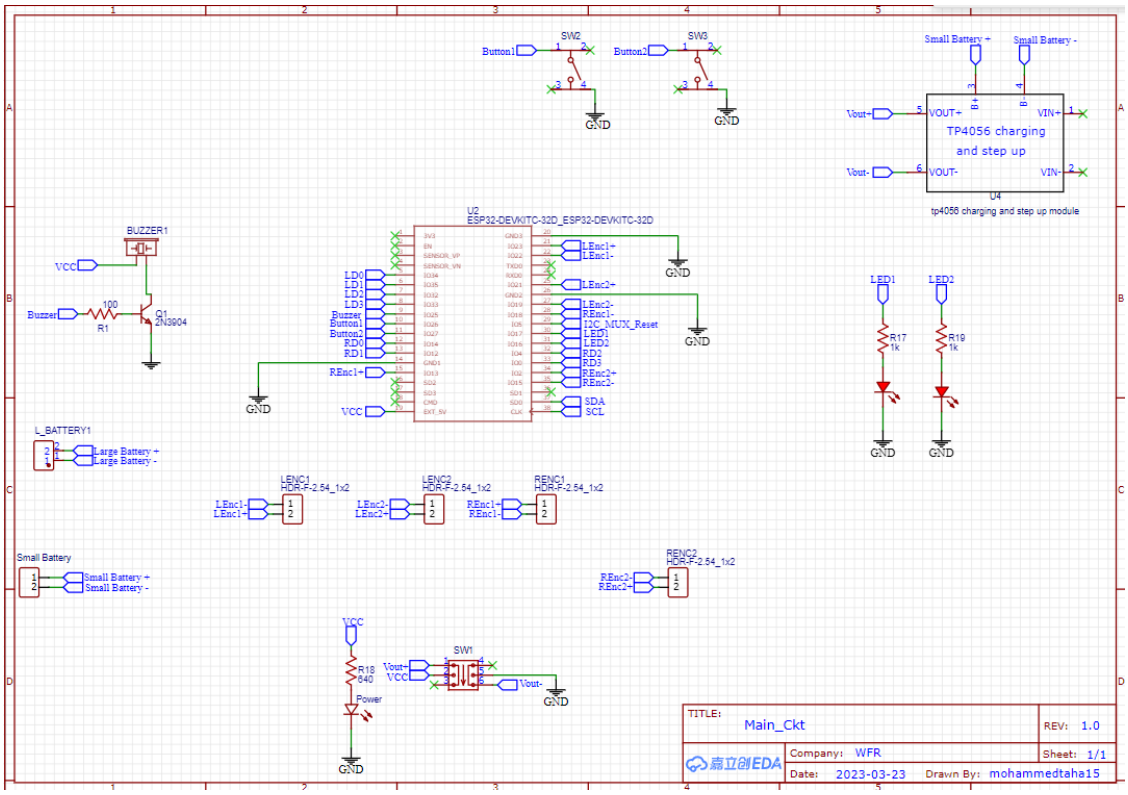
The brain of our robot is the microcontroller which is responsible of all the working of robot. This microcontroller is powered by a small battery. The input to MCU are readings from the range sensor. These sensors are ToF sensors which return the difference of time between rays sent and received. The MCU in turn gives signals to motor drivers accordingly. The motor driver is connected with a large battery and is responsible for driving the motors, controlling their speed and direction. The values from range sensors determine the direction and speed of motors. The MCU takes the values from range sensors, processes it, and outputs to the motor drivers to drive the motors accordingly.

Schematic

We've used EasyEDA online editor to create the schematic of our robot, as the software has large set of components and libraries to access and can be accessed anywhere at any device online. Schematic of a robot contains all the components of robot and connections between them.

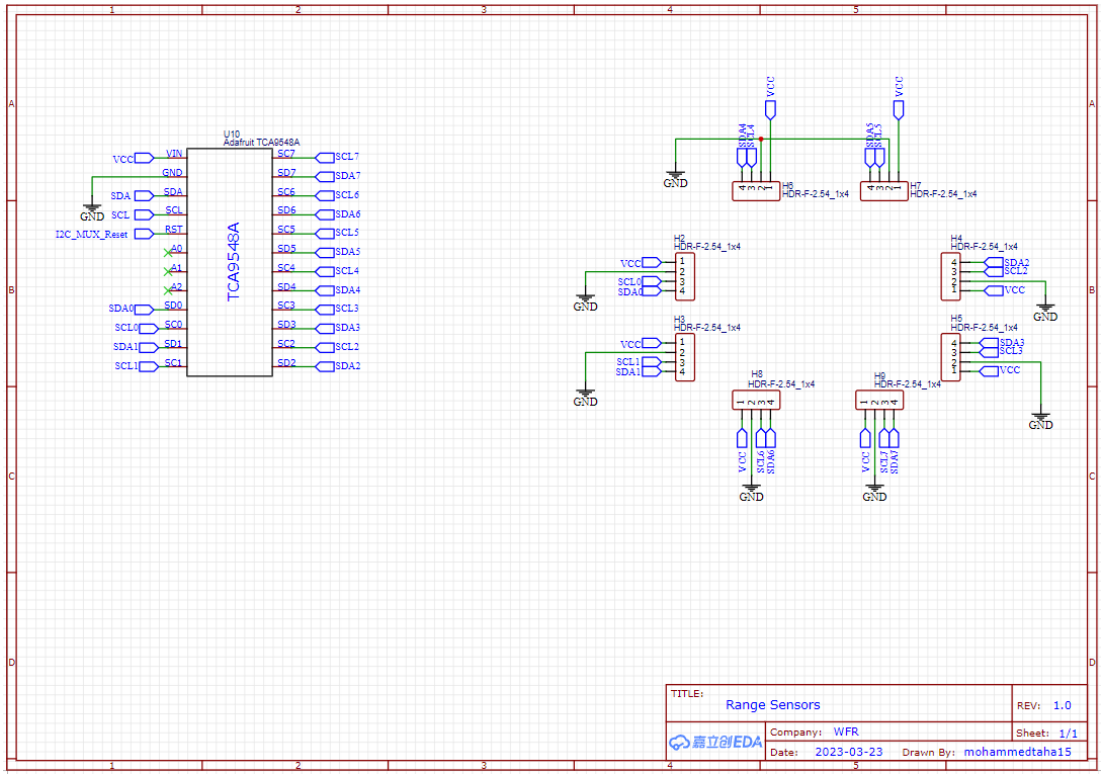
Main Circuit

The main circuit schematic consists of esp32 wrooom-32D and its connections, a step up or charging module for charging the small battery connected to esp32, two buttons for calibration of sensors, a buzzer and two LEDs for debugging and testing, a switch to turn esp32 on and off, connectors for encoder pins and batteries.



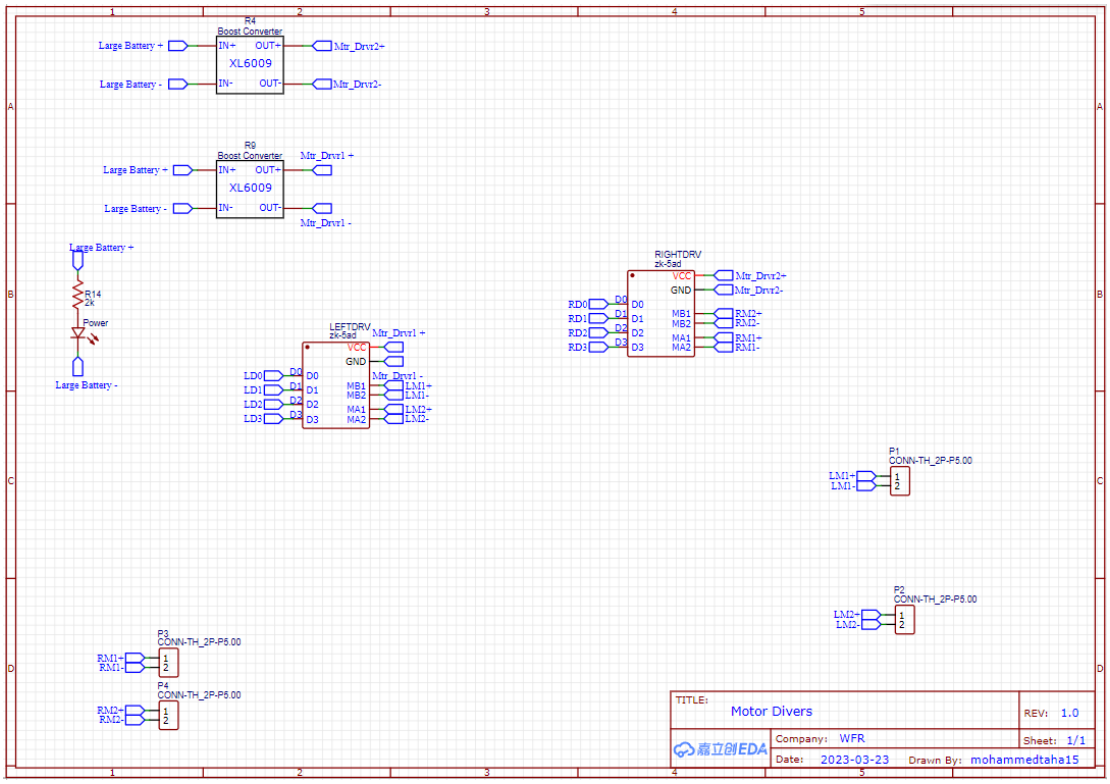
The Range Sensors

The second sheet contains the components and connections for sensors. In this part of schematic we have an I2C multiplexer(TCA9548A) for choosing between the values of range sensors to be read by the microcontroller i.e esp32. Apart from the mux, we have six headers for connecting the range sensors. These sensors are connected to SDA and SCL pins of multiplexer which in turn is connected to esp32.



The Motor Drivers

The third sheet is of motor drivers. This contains two ZK-5AD motor drivers, on which four pins; D0 through D3 are connected to esp32, four pins to two motors and two are connected with the converter. There are two boost converter modules(XL6009) which provide connection between the large battery and the ZK-5AD drivers.

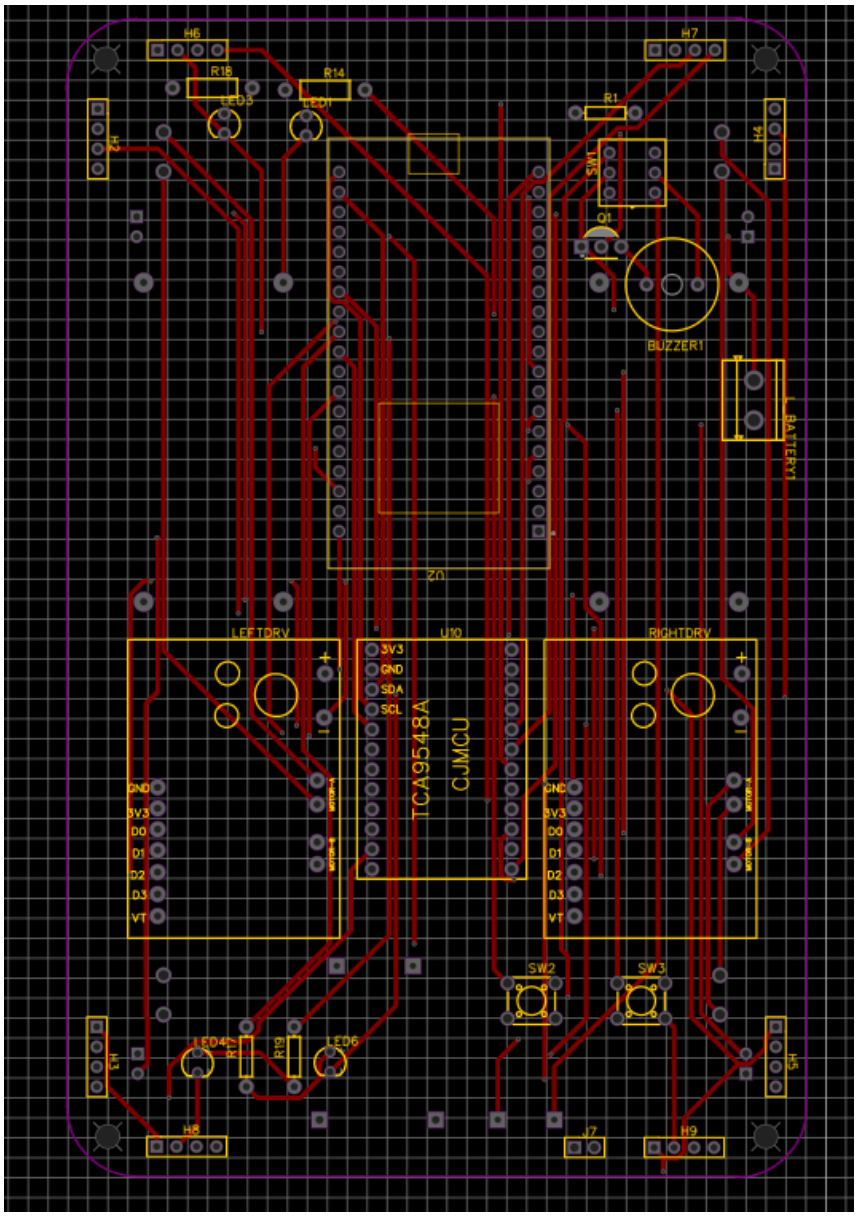


PCB Layout

Once the schematic was designed, we proceeded towards building a PCB layout of the schematic. We used the same EasyEDA online editor to create one. The PCB consists of two layers, top and bottom. The board is 94.3mm wide and 147.6mm long.

The Top Layer

The top layer consists of ESP32, the ZK-5AD motor drivers, TCA9548A I2C multiplexer, buzzer, buttons, switches, LEDs and eight range sensors. The range sensors are equally displaced from the board outline and are placed two on each side of PCB, so that they get accurate sense of walls around it. Apart from the components we have four holes, one on each corner, for mounting PCB to the robot chassis.



The Bottom Layer

The bottom layer is much simpler and less complicated as compared to the top layer. This layer is designed to accommodate components without having the issue of dealing with a large board, making the board more compact. This layer contains the two XL6009 modules and a step up charging module (TP4056). This layer also contains two connectors for each motor, one of which is for the motor itself and one connector is for the encoder pins emerging from the motor. These are integrated on the bottom layer because the motors will be placed beneath the PCB so the wires emerging from motors will not create a mess and will be attached to bottom layer.