Engineering Portfolio

Engineer Information:

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Portfolio Access on Github:

https://github.com/musherom/Engineering-Portfolio

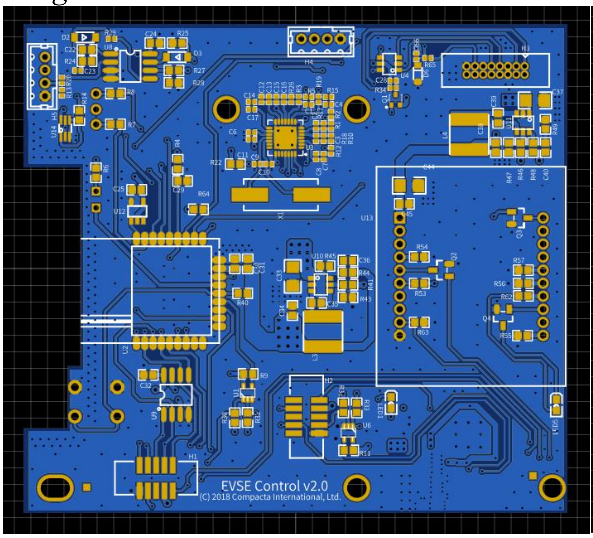
Project Lists:

Electric Vehicle Supply Equipment (EVSE)

Abstract:

This project is a smart EV car charging station not only for home automation but also for portable use. The device provide integrated cost and real-time consumption information to flexibly adapt to the needs of end users. I involved in the whole design flow including system functionality design, implement schematic,PCB layout, tuning components placement and signal trace to achieve UL2954,UL2231-1 and UL2231-2 equivalent certification.

Design Overview:



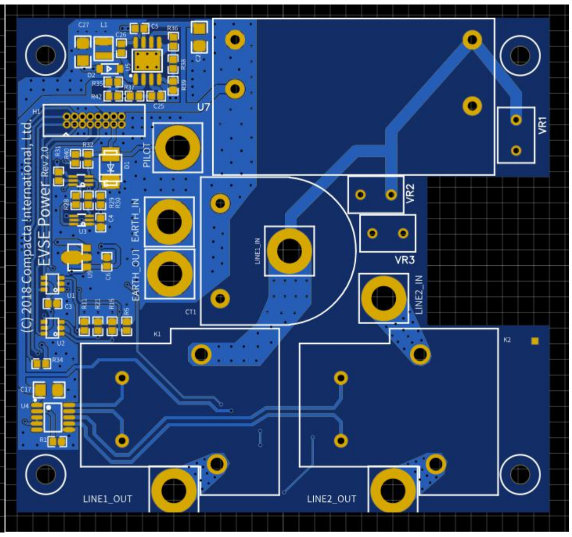


Figure 1.1. Control PCB(4-layer) Fig 1.2 Power PCB(2-layer) Design Overview

Figure 1.3. Control Board Prototype Overview

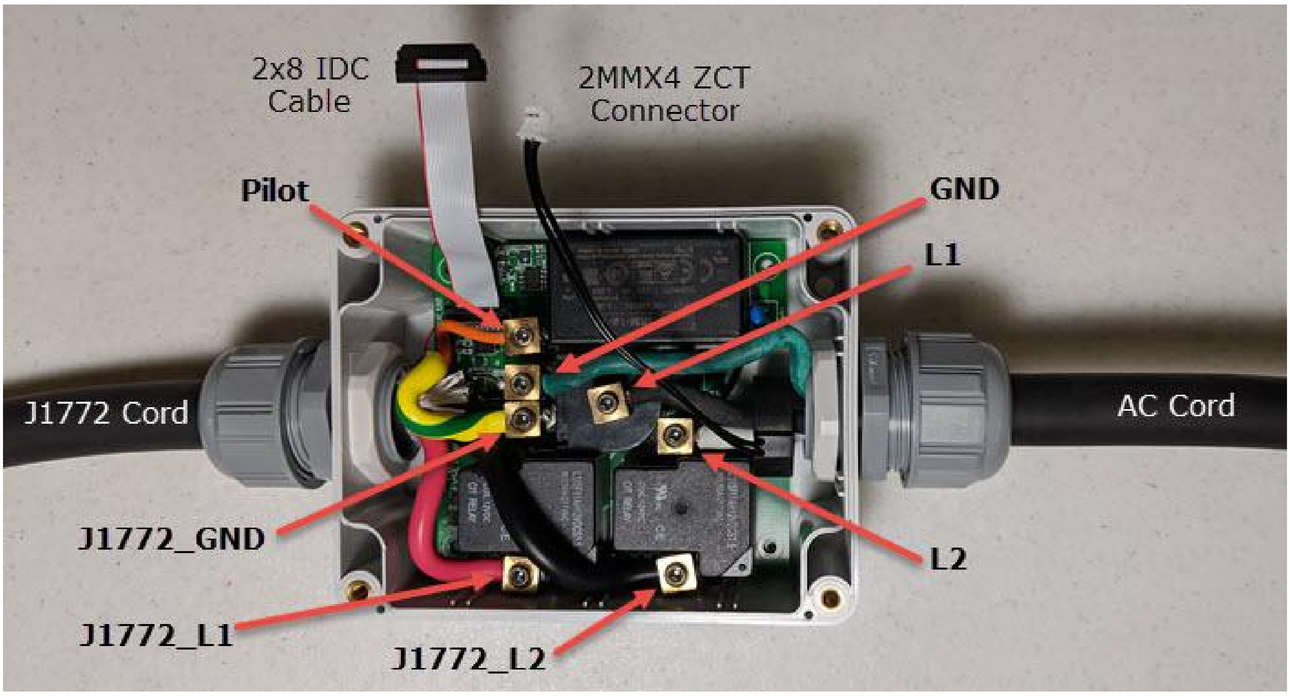


Figure 1.4. Power Board Prototype Overview

Figure 1.5. Full Assembly Prototype Overview

Electric Vehicle Supply Equipment Testing Platform(EVSE Testing Platform)

Abstract:

EVSE testing platform is a device that designed for doing automation test of EVSE in the production line. It includes automatic testing functions such a embedded energy meter calibration, Ground-Fault Circuit Interrupter(GFCI) test, and Ground Monitor Interrupter(GMI) test. The testing platform improve the speed of product testing, which reduce the total labor cost during production.

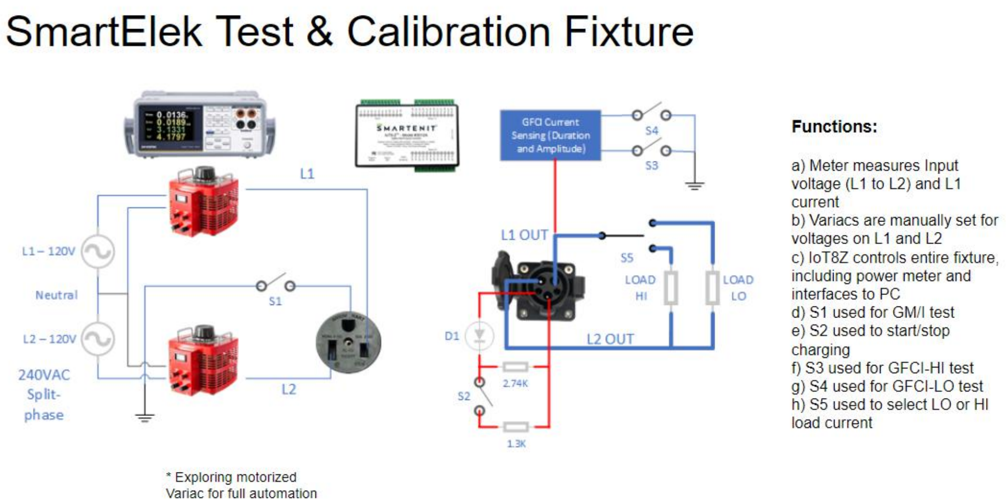


Fig 2.1 Testing platform functionality Design overview

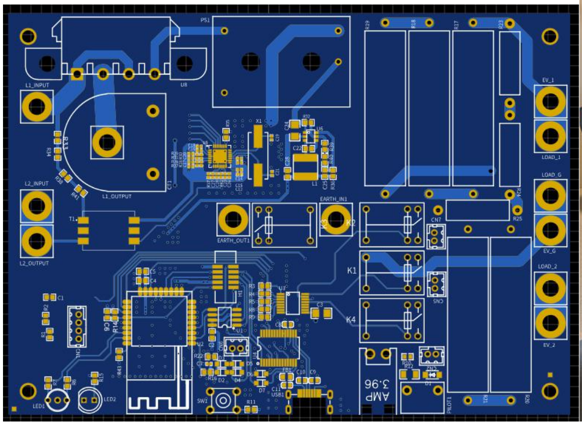


Fig 2.2 Testing platform PCB layout

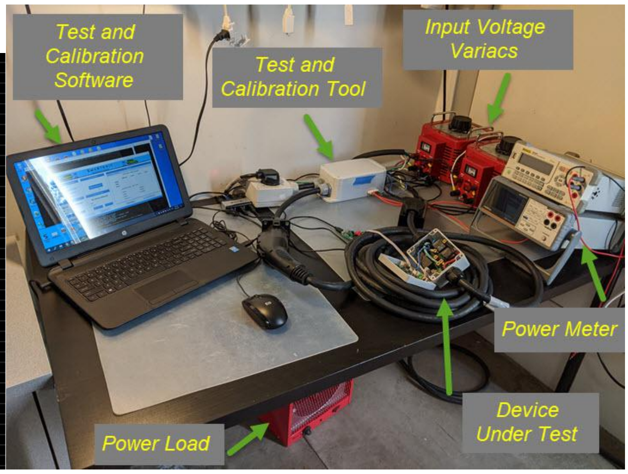


Fig 2.3Testing platform prototype setup

Continuous Blood Pressure Sensor

Continuous Blood Pressure Sensor is a wearable Internet-of-Things(IoT) device designed for continuously monitor a person's blood pressure in multiple points. This device use NRF52832 as main controller to communicate with other devices through Bluetooth Low Energy(BLE) protocol. The prototype achieved by using 4-layer layout design on a dimension of less than 10cm x 6cm.PCB.

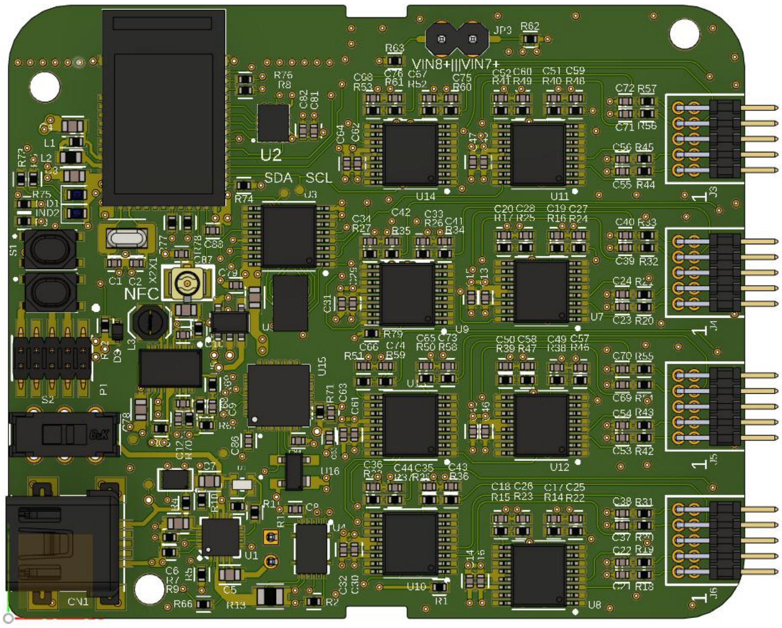


Fig 3.1 Main PCB in 2D overview

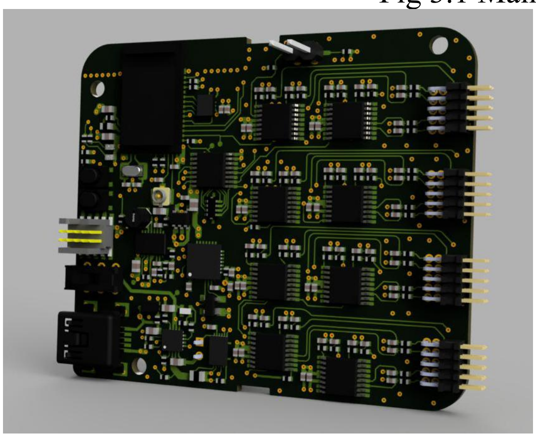


Fig 3.2 Main PCB in 3D overview

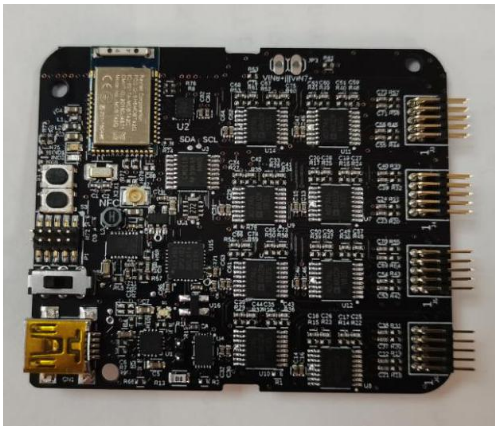


Fig 3.3 Main PCB finished prototype overview

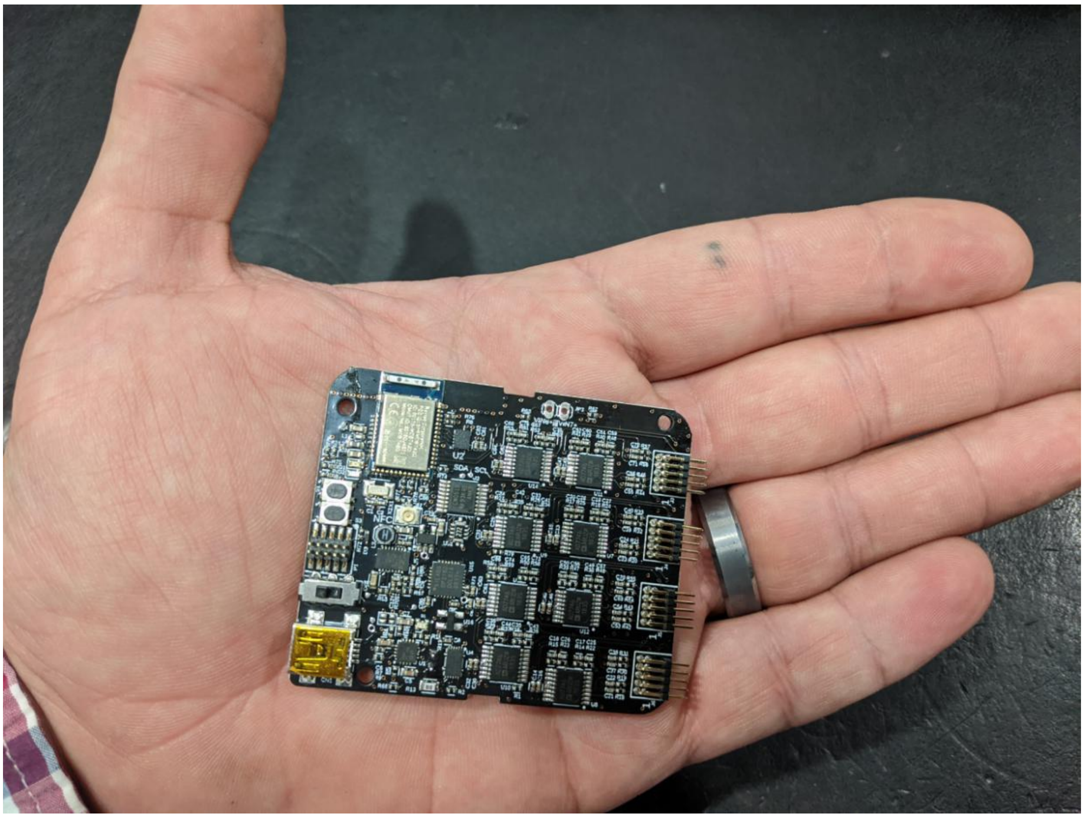


Fig 3.4 Actual PCB dimension compare with a hand

SafePassage 2

This is a surgical force sensing system used by doctors in UC Irvine Douglas Hospital. The is a device designed to measure the force applied by a surgeon inserting a catheter into the human body during urology procedure.The project also cooperated with UCI Department of Urology Clinical surgery.

The design use a ESP32 as main processor which allow collected data of pushing force and upstream the MQTT message to the host device though Bluetooth Low Energy communication. There are also an Android app designed for documenting the measured result.

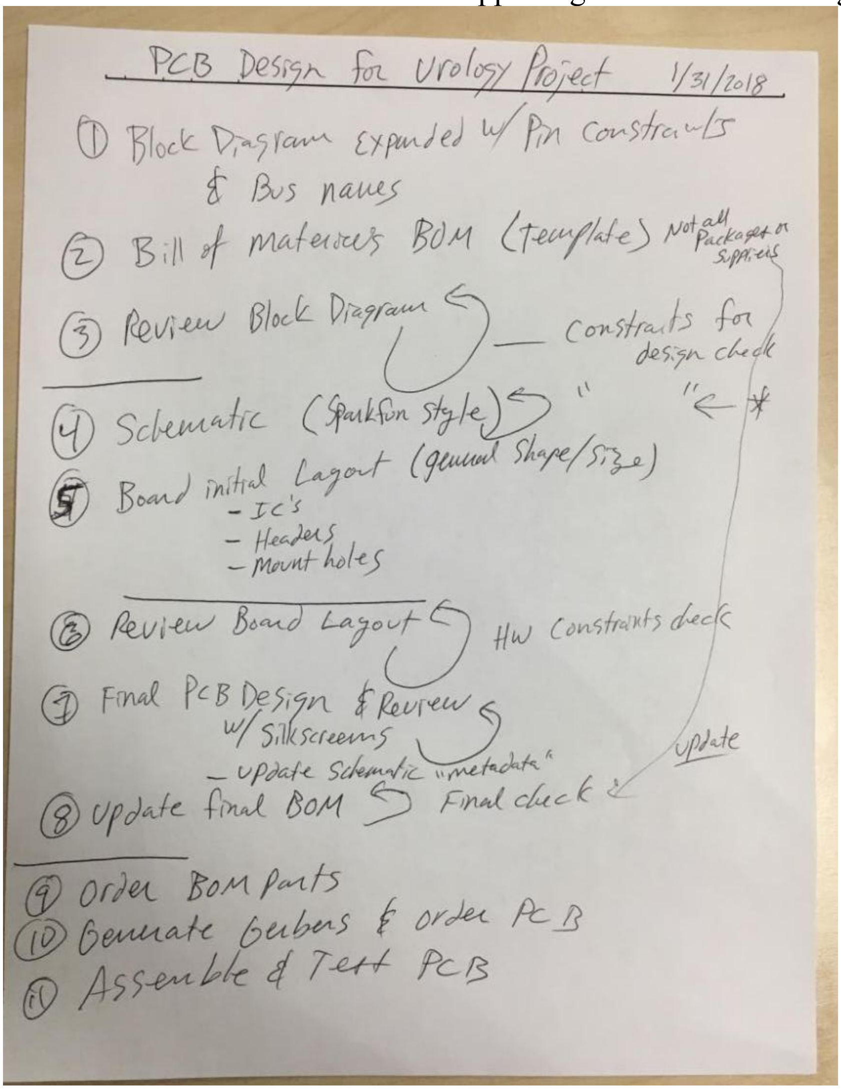


Fig 4.1 Design Project planning

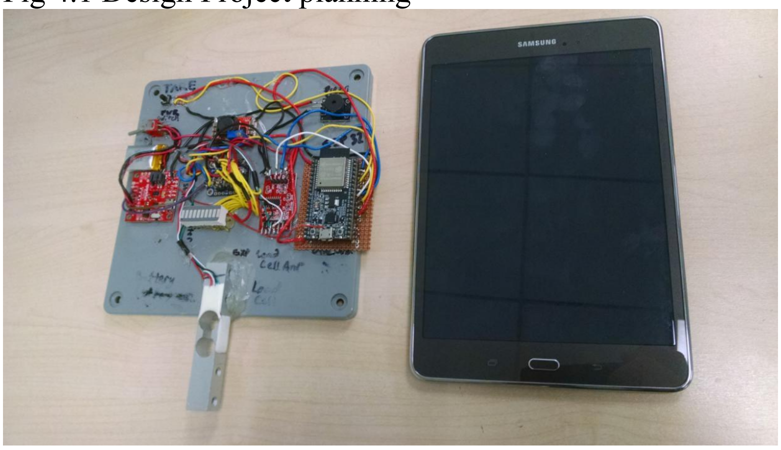
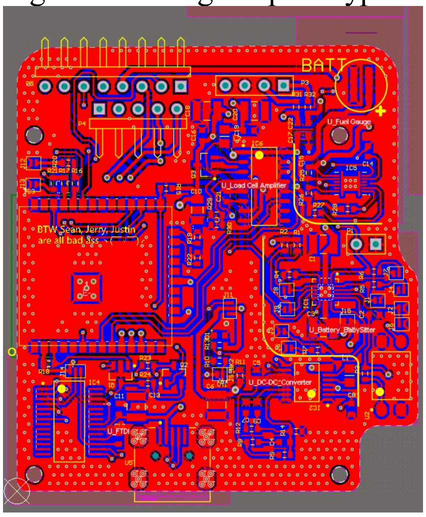


Fig 4.2 Building the prototype to verify functionality



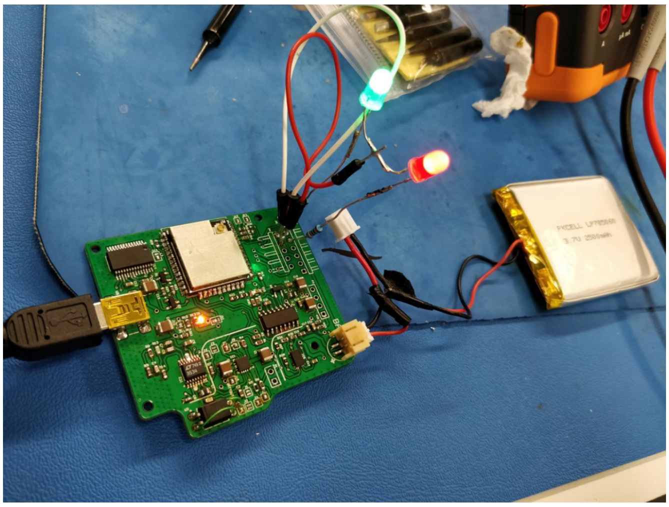
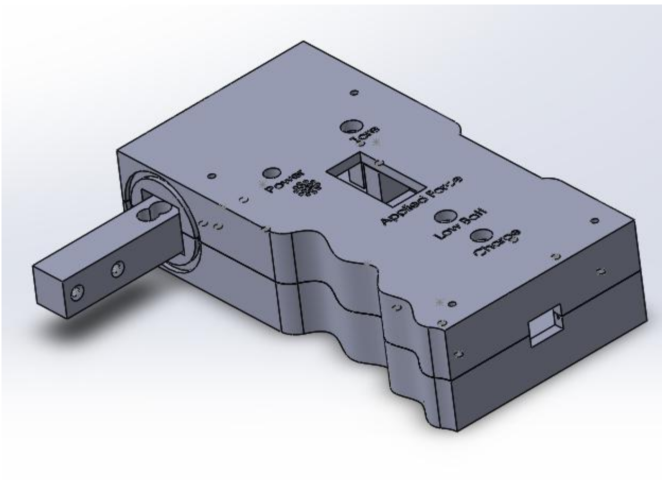


Fig 4.3 Integrate the design Fig 4.4 Test the functionality of circuit board



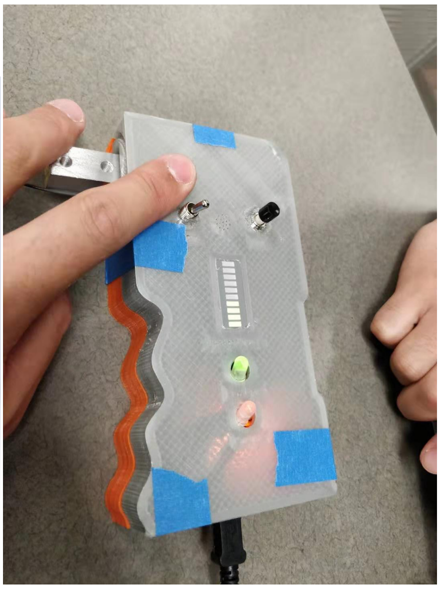


Fig 4.5 design the prototype enclosure Fig 4.6 3D printed encloure

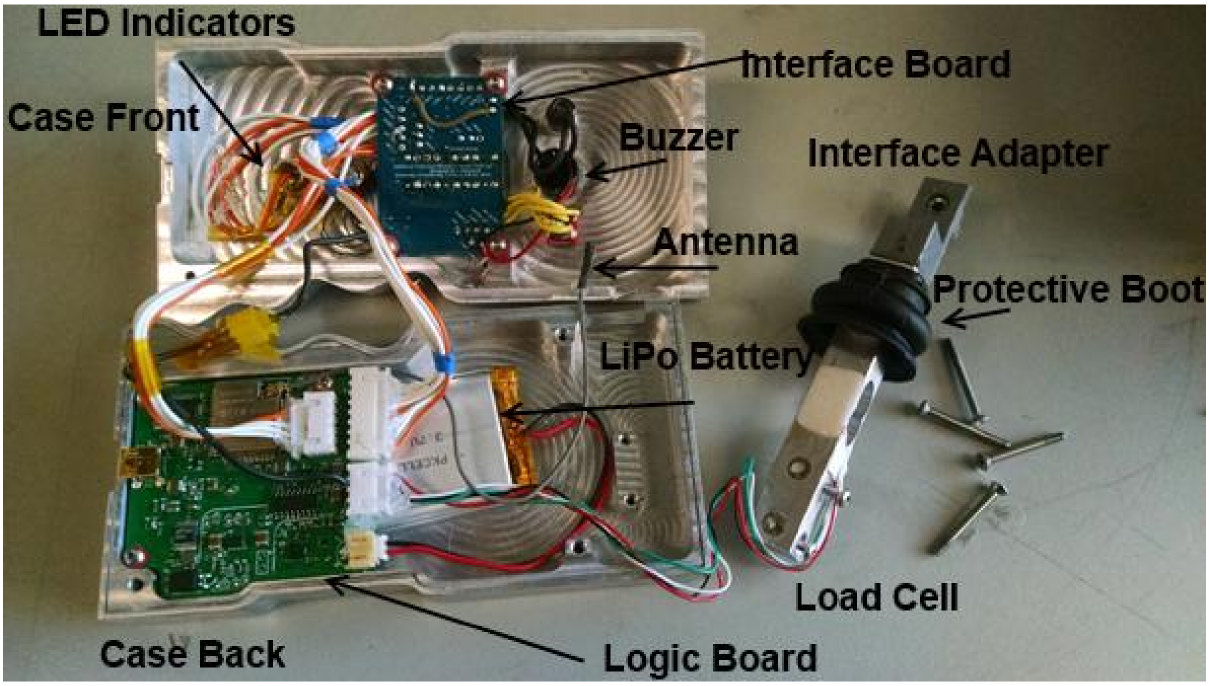


Fig 4.7 Device inner view

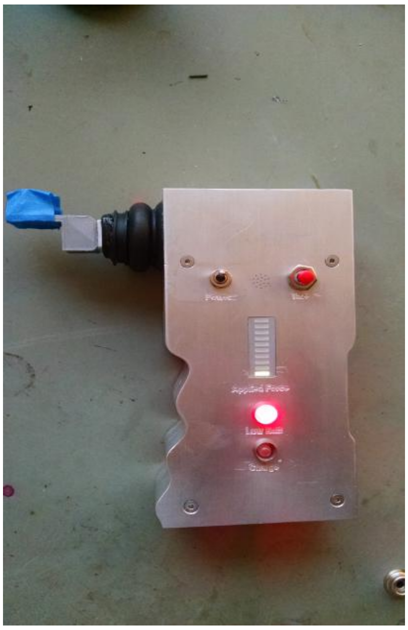


Fig 4.8 Final Device front view


Fig 4.9 Final Device demo communicate with Android App

PCB Schematics:

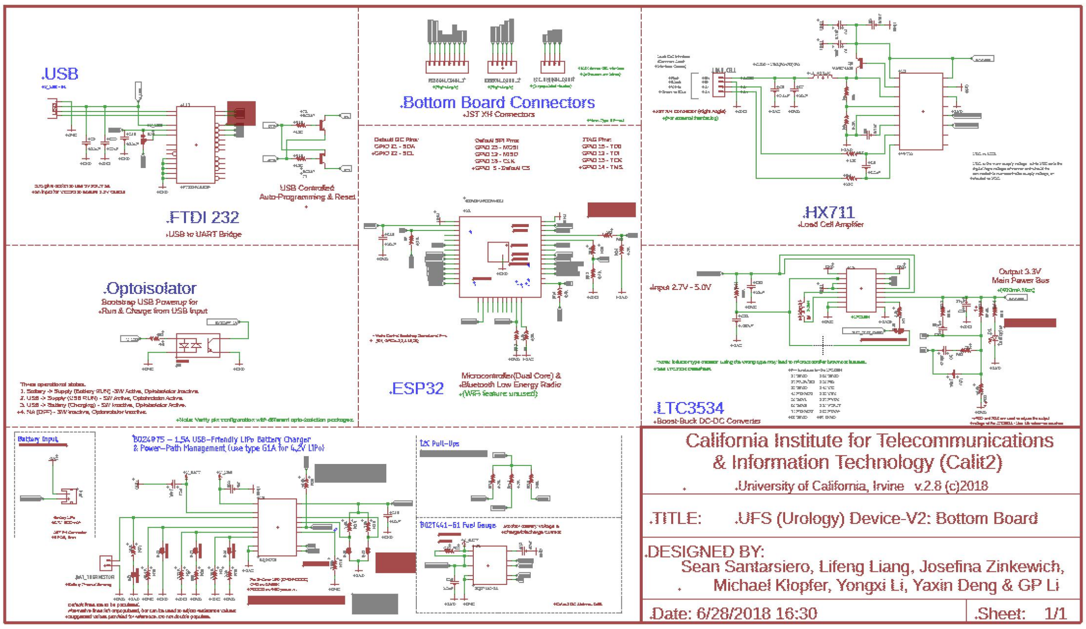


Fig 4.10 Main board schematics

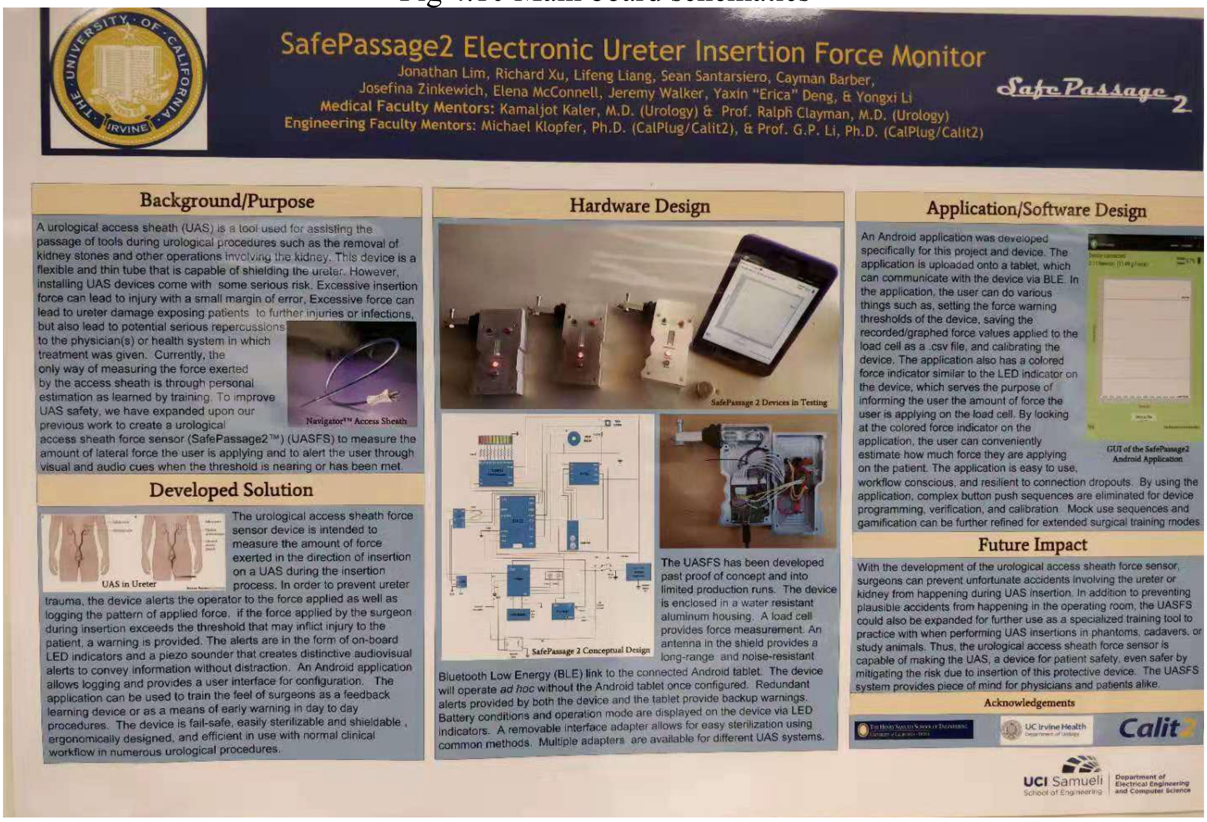


Fig 4.11 Top board schematics

Instruction for Users (IFU):

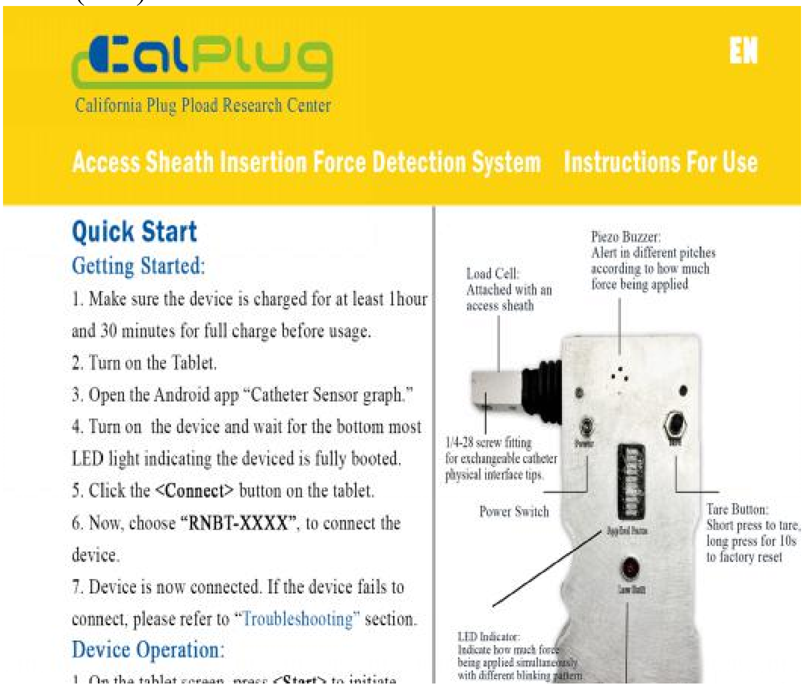


Fig 4.12 First page of IFU

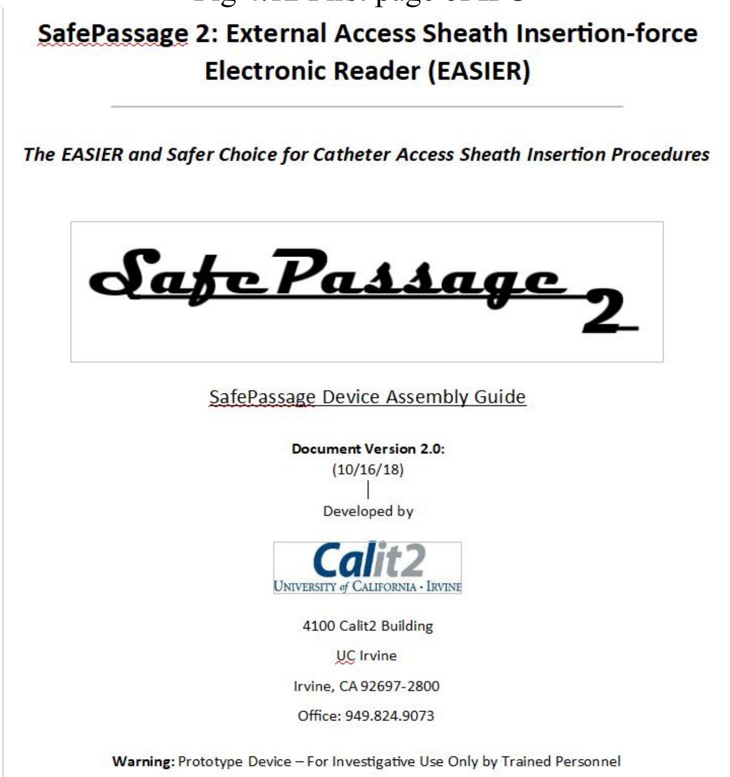


Fig 4.13 First page of Assembly Guide

Wattmeter(Open source Project)

Abstract:

Wattmeter is a small PCB module embedded with ADE7953 energy meter IC and necessarily isolation circuit which allow user to create their own energy metering device for different kind of purpose.

The module is capable to measure a single phase line power and can be communicated through I2C, UART and SPI interface. This is a open sourced project is public on (https://github.com/CalPlug/ADE7953-Wattmeter)

Schematic:

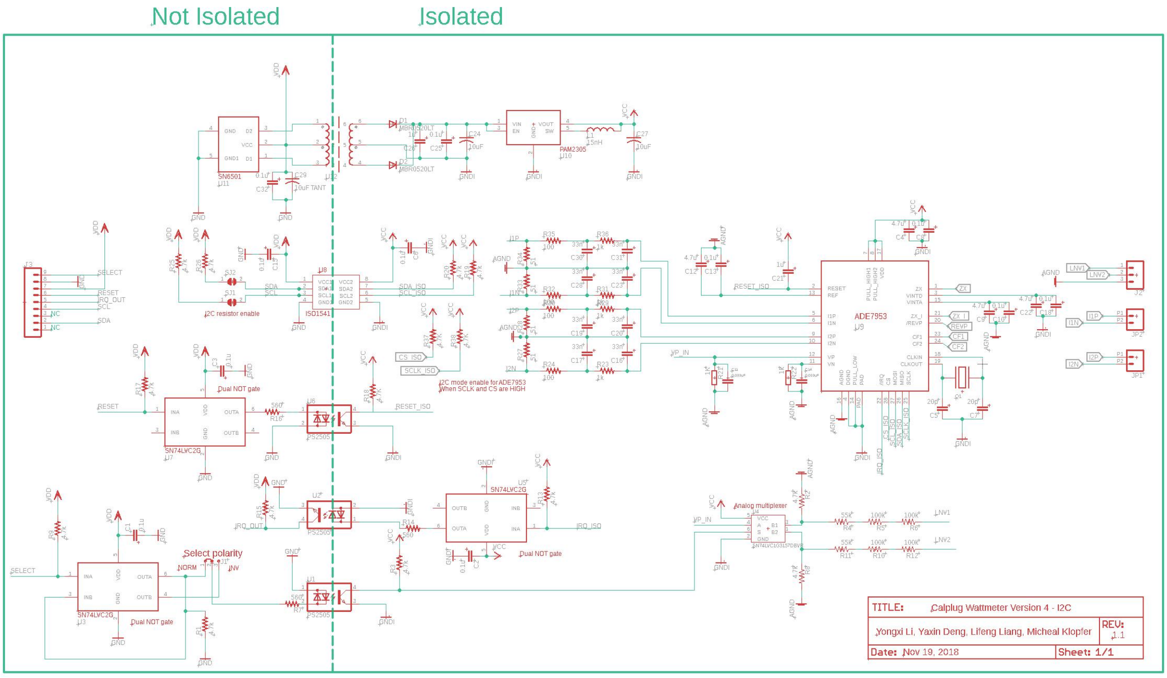


Fig 5.1 I2C Version PCB schematics

PCB Layout:

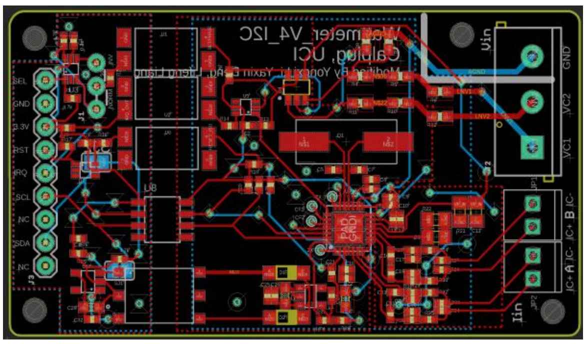


Fig 5.2. I2C Version PCB layout

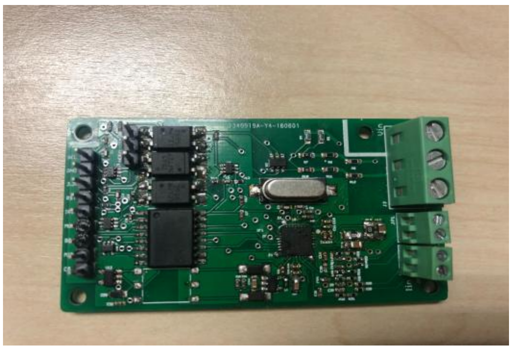


Fig 5.3. Prototype PCB overview

Micromouse 2019

Micromouse is an event where small robot mice solve a 16×16 maze. It began in the late 1970s. Events are held worldwide, and are most popular in the UK, U.S., Japan.

The maze is made up of a 16×16 grid of cells, each 180 mm square with walls 50 mm high. The mice are completely autonomous robots that must find their way from a predetermined starting position to the central area of the maze unaided. The mouse needs to keep track of where it is, discover walls as it explores, map out the maze and detect when it has reached the goal. Having reached the goal, the mouse will typically perform additional searches of the maze until it has found an optimal route from the start to the finish. Once the optimal route has been found, the mouse will run that route in the shortest possible time.

This mouse is fully designed and assembled by myself. It use a ESP32-PICO as main processor to achieve high speed sensing data processing, the ability to communicate with the micromouse through WIFI or BLE, while keep the whole system on a roughly 5x5 cm sized PCB board. The design layout in 6-layer for main circuit board, and 4-layer for the daughter board. The body of the mouse is printed out using SLA 3d printing technology.

PCB Layout:

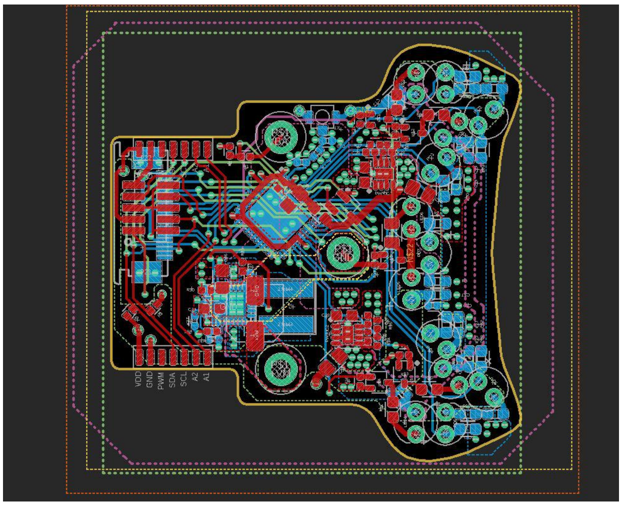


Fig 6.1 Main circuit board layout

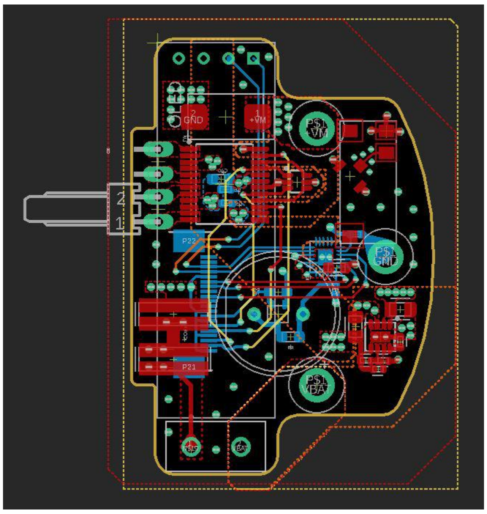


Fig 6.2 Daughter board layout

CAD Design:

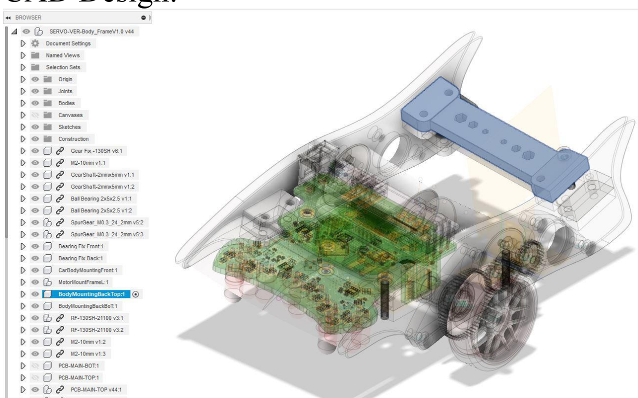


Fig 6.3 Perspective view of design

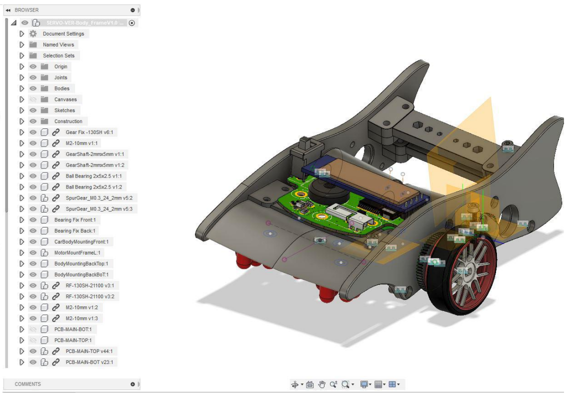


Fig 6.4 3D rendered view of design

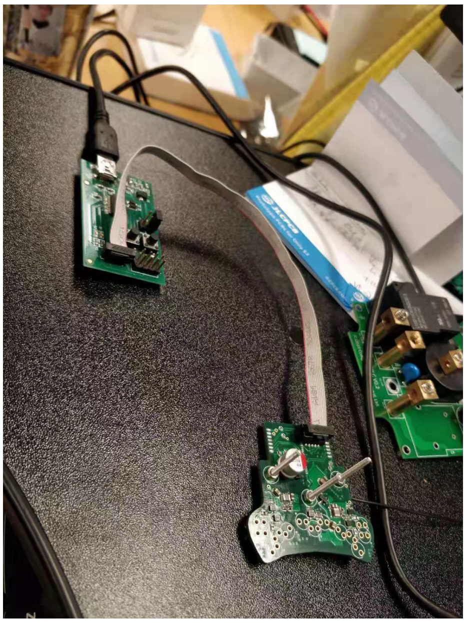


Fig 6.5 Main circuit board functionality test

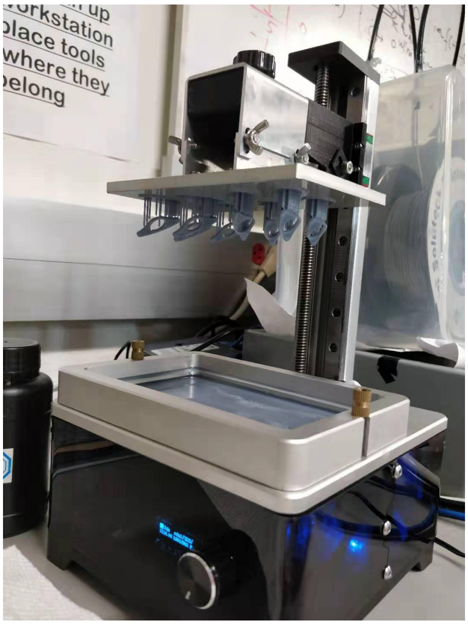


Fig 6.6 3D Printed Body structure using SLA 3D printing techonology

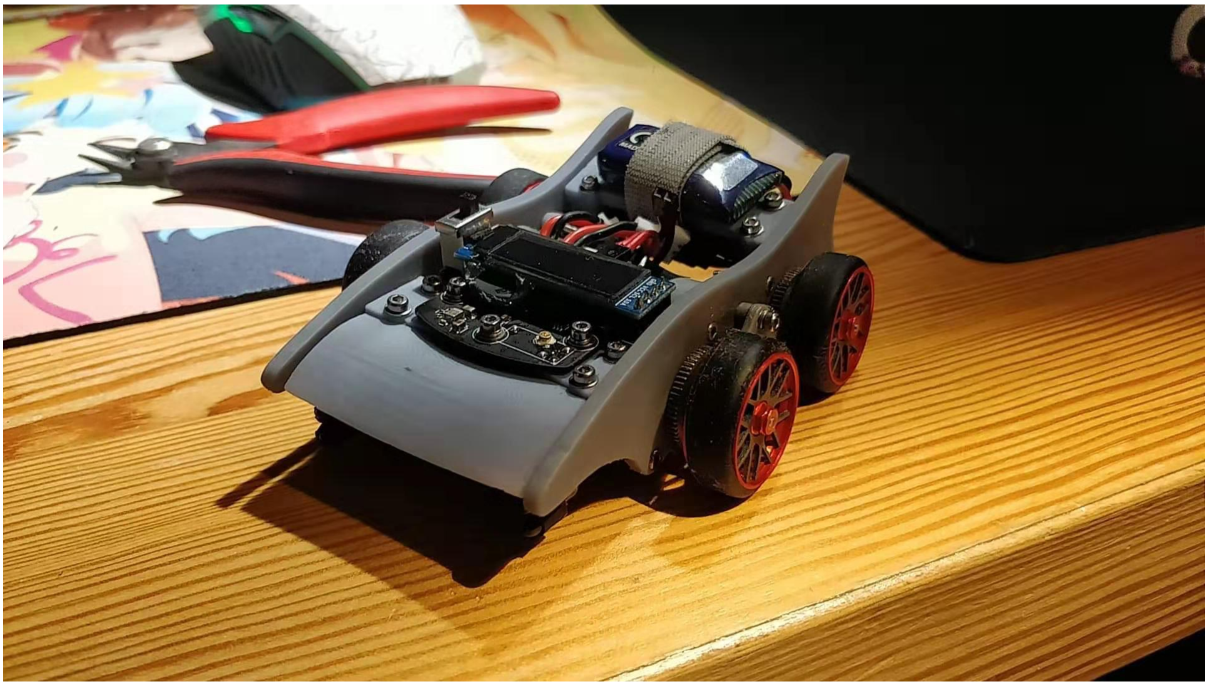


Figure 6.7 Final Assembled Micromouse

Figure 6.8: Group Photo of Micro Mouse 2019 Competition