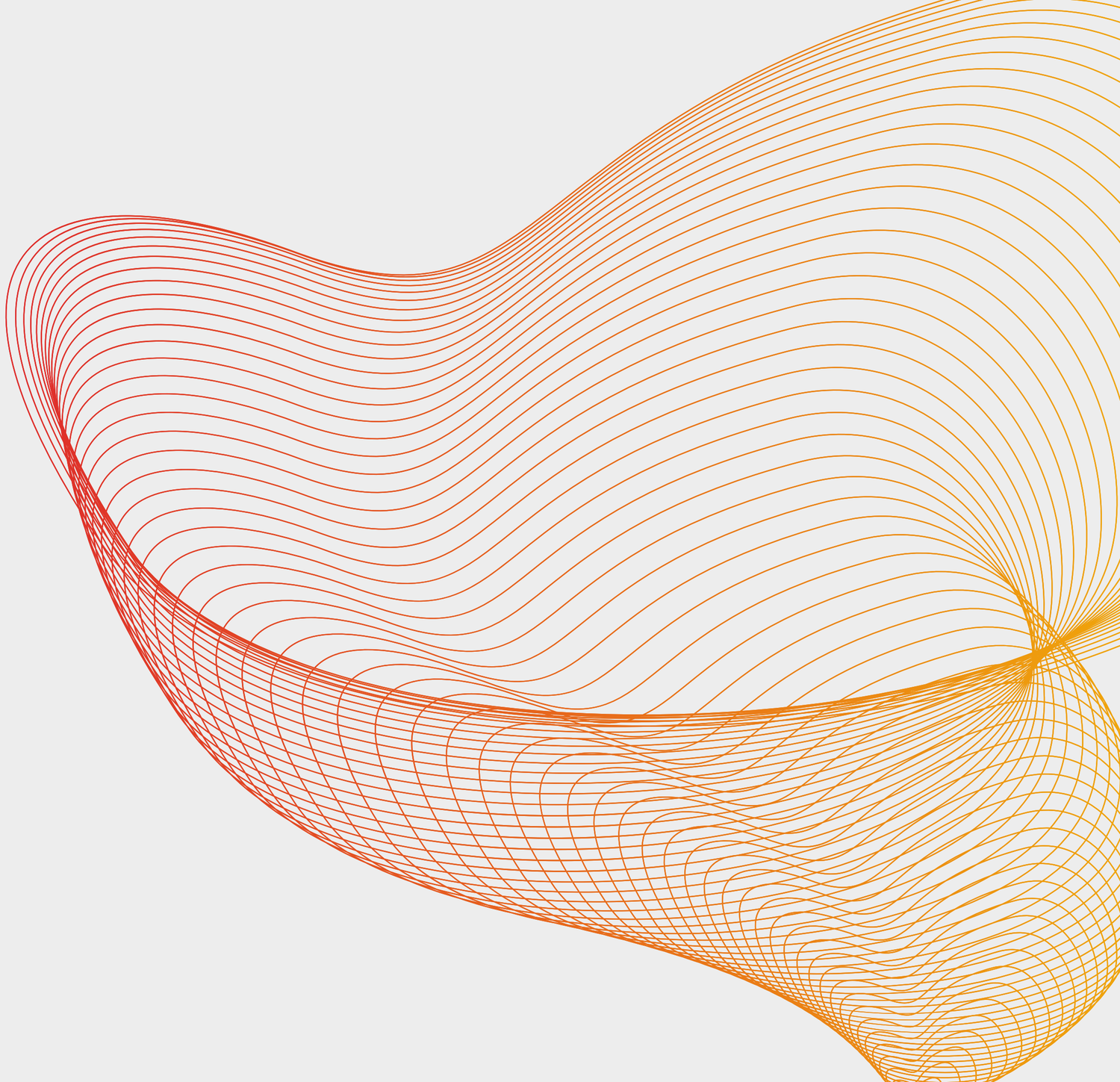
ECG Monitor

By
Team Leptons



Introduction

Our project aims to create a high-precision heart monitor that can faithfully capture and display ECG waveforms. Our main challenge is amplifying the ECG signal (0.1mV - 10mV) while reducing noise interference. We've utilized analog components and a combination of an instrumentation amplifier, filters, and a leg drive circuit to achieve this. Our target bandwidth is 160 Hz, and extensive testing, including simulation and breadboard trials, has been conducted to validate our circuit's functionality. Join us as we delve into the components and share our progress.

What is ECG?

ECG, or Electrocardiography, is a medical test that measures the electrical activity of the heart over a period of time. It is a widely used diagnostic tool to assess the electrical impulses that regulate the heart's rhythm. The test is typically performed by placing electrodes on the skin's surface, usually on the chest, arms, and legs, to record the heart's electrical signals.

ECG provides valuable information about the heart's health and function. It can help diagnose various heart conditions

Challenges in Acquiring ECG Signals

ECG monitoring has unveiled notable challenges that have come to the forefront of our project,

1. **Amplifying Weak Signals:** Amplifying ECG signals within the narrow voltage range of 0.1mV to 10mV is a formidable task.
2. **Noise Interference:** Noise interference, arising from external sources, including electromagnetic interference and muscle artifacts, poses a significant challenge in obtaining clear ECG waveforms.

Amplifying the ECG Signal

To amplify the ECG signal, we employ two components,

1. **The instrumentation amplifier:** plays a key role in increasing the amplitude of the ECG signals, making them more accessible for further processing and analysis.

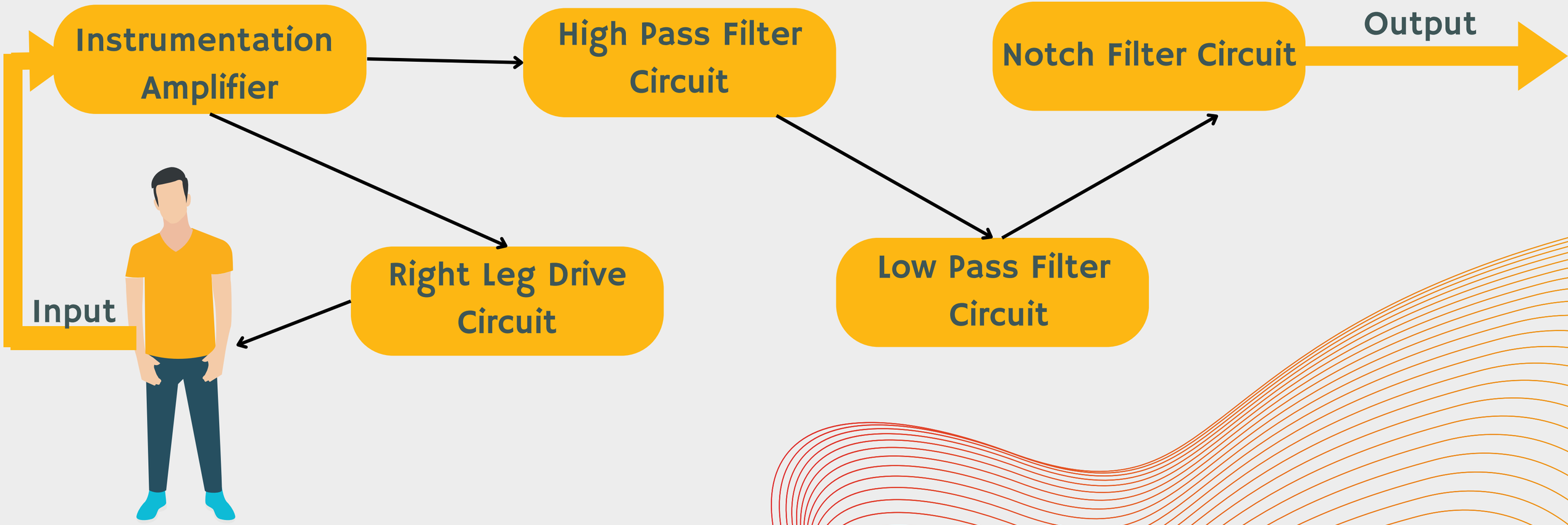
2. **The leg drive circuit :** to ensure good common-mode rejection ratio (CMRR) performance.

Noise Cancellation Circuits

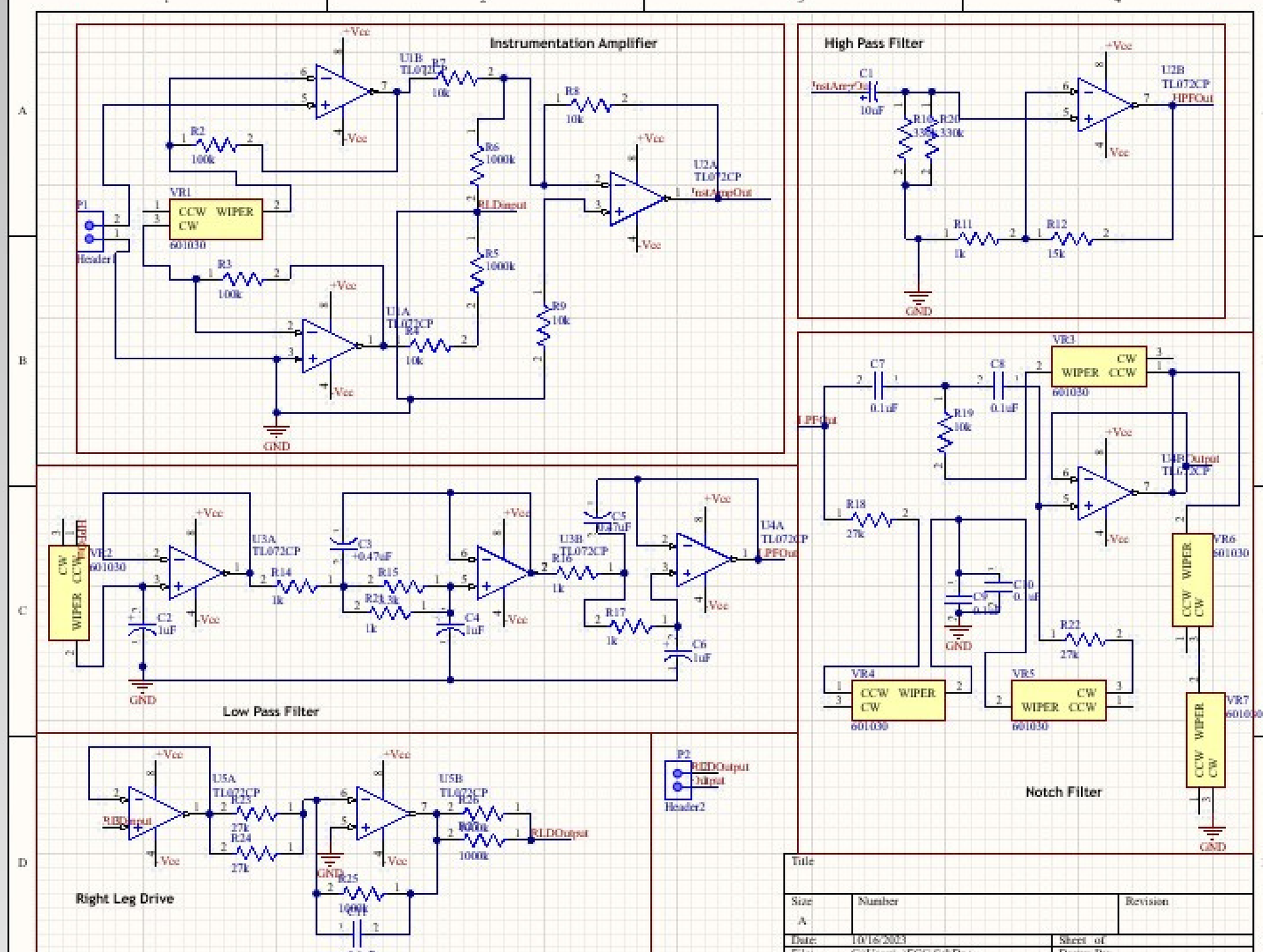
In our endeavor to provide precise ECG monitoring, we recognize the paramount significance of noise cancellation.

1. **High Pass filter :** Can effectively remove the low-frequency noise than 0.5Hz and DC shift ensuring a clearer and more focused ECG waveform.
2. **Low Pass filter :** Low-pass filters permit lower-frequency components than 160Hz of the ECG signal to pass while attenuating higher-frequency components.
3. **Notch filter :** To remove the power line interference frequency (50Hz)

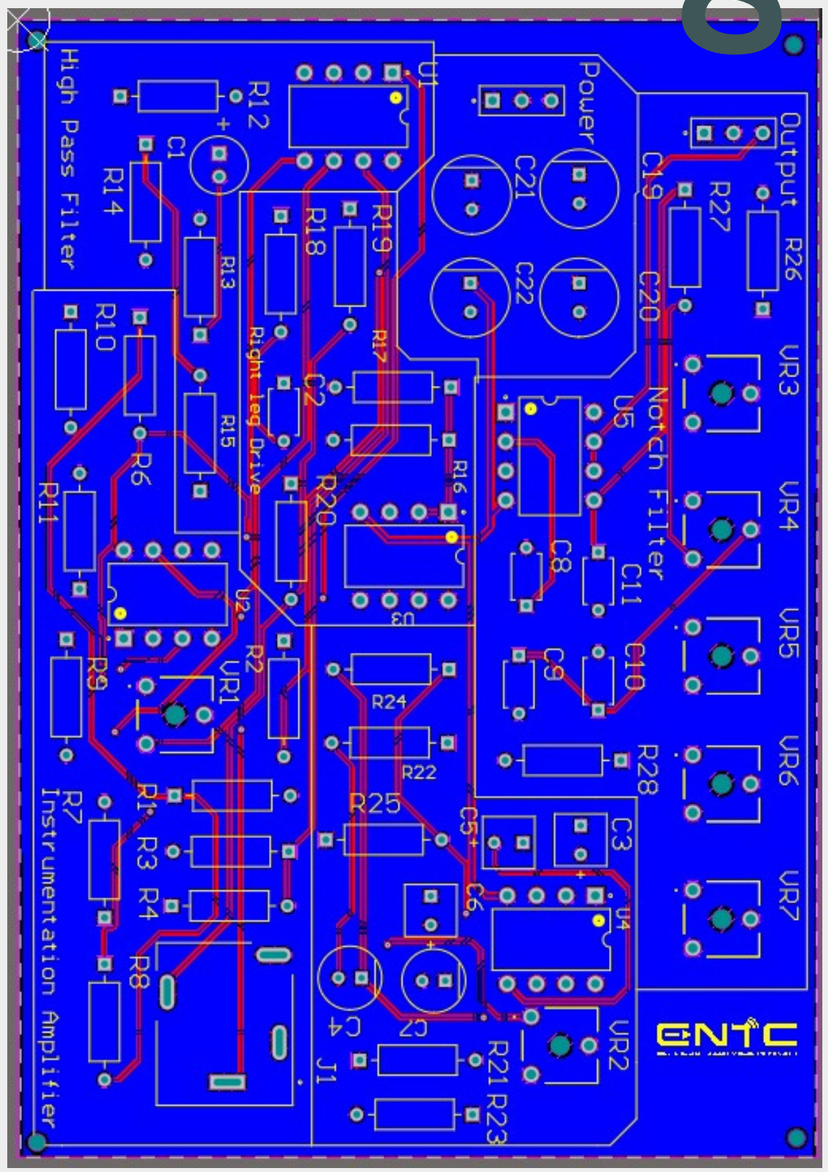
Device Architecture



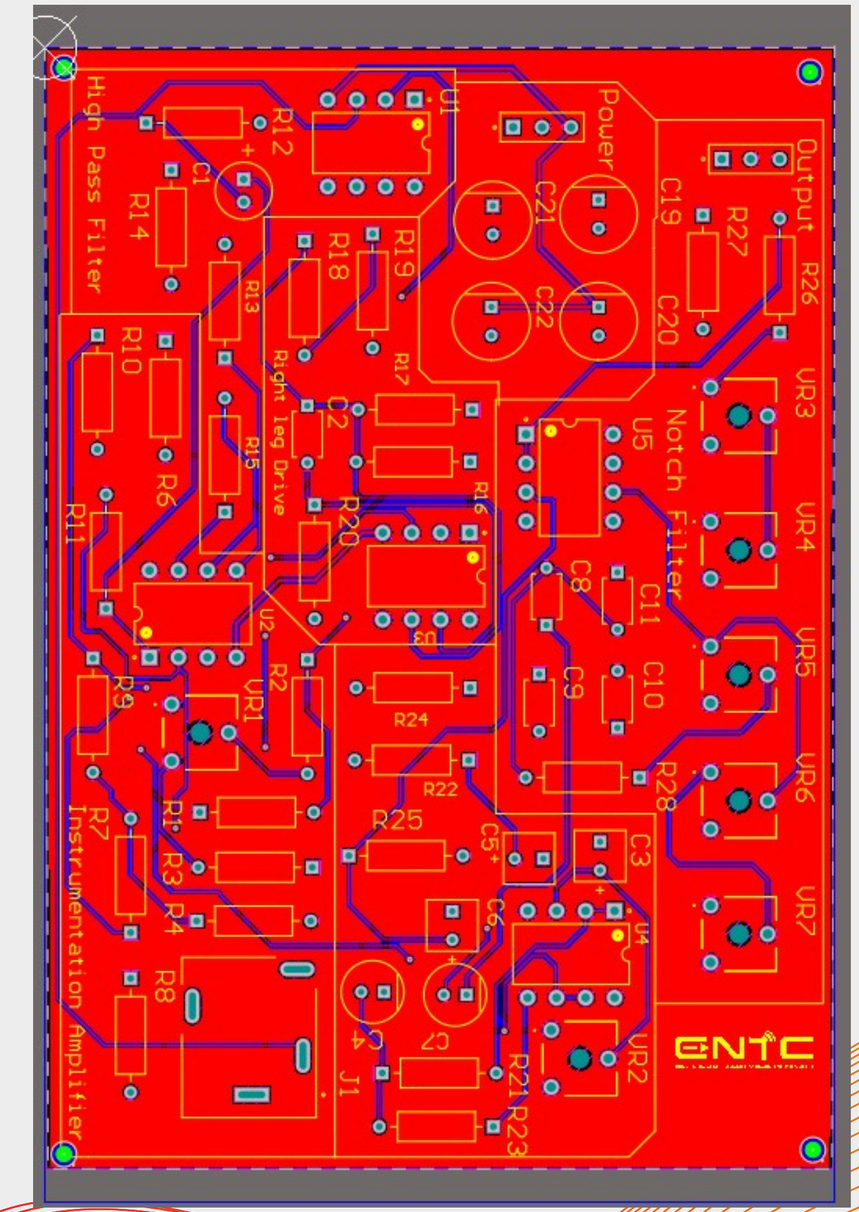
Schematic


Instrumentation Amplifier
High Pass Filter
Low Pass Filter
Notch Filter
Right Leg Drive
Header1
Header2
GND
+Vcc
-Vcc
Title
Size
A
Number
Revision
Date:
10/16/2023
Sheet of

PCB Design

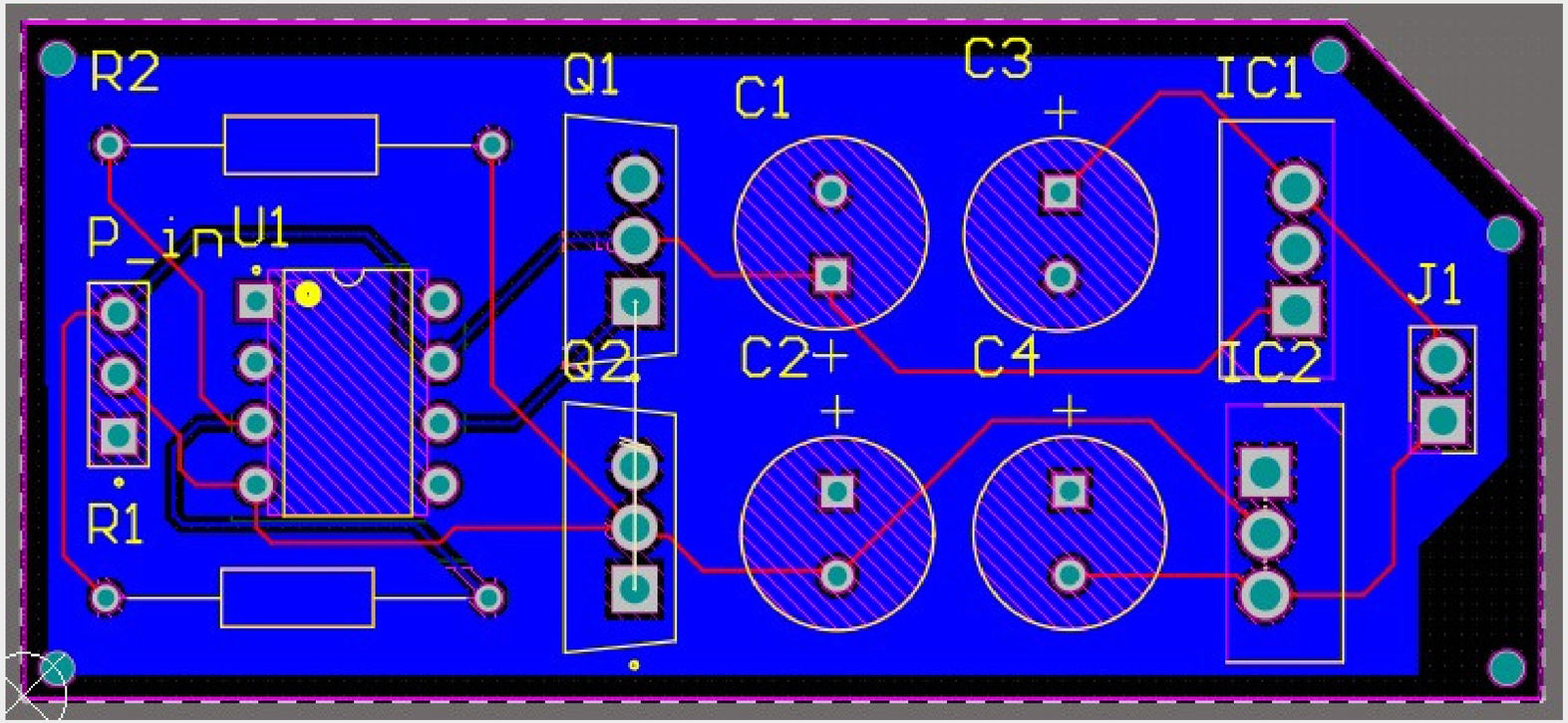


Top Layer

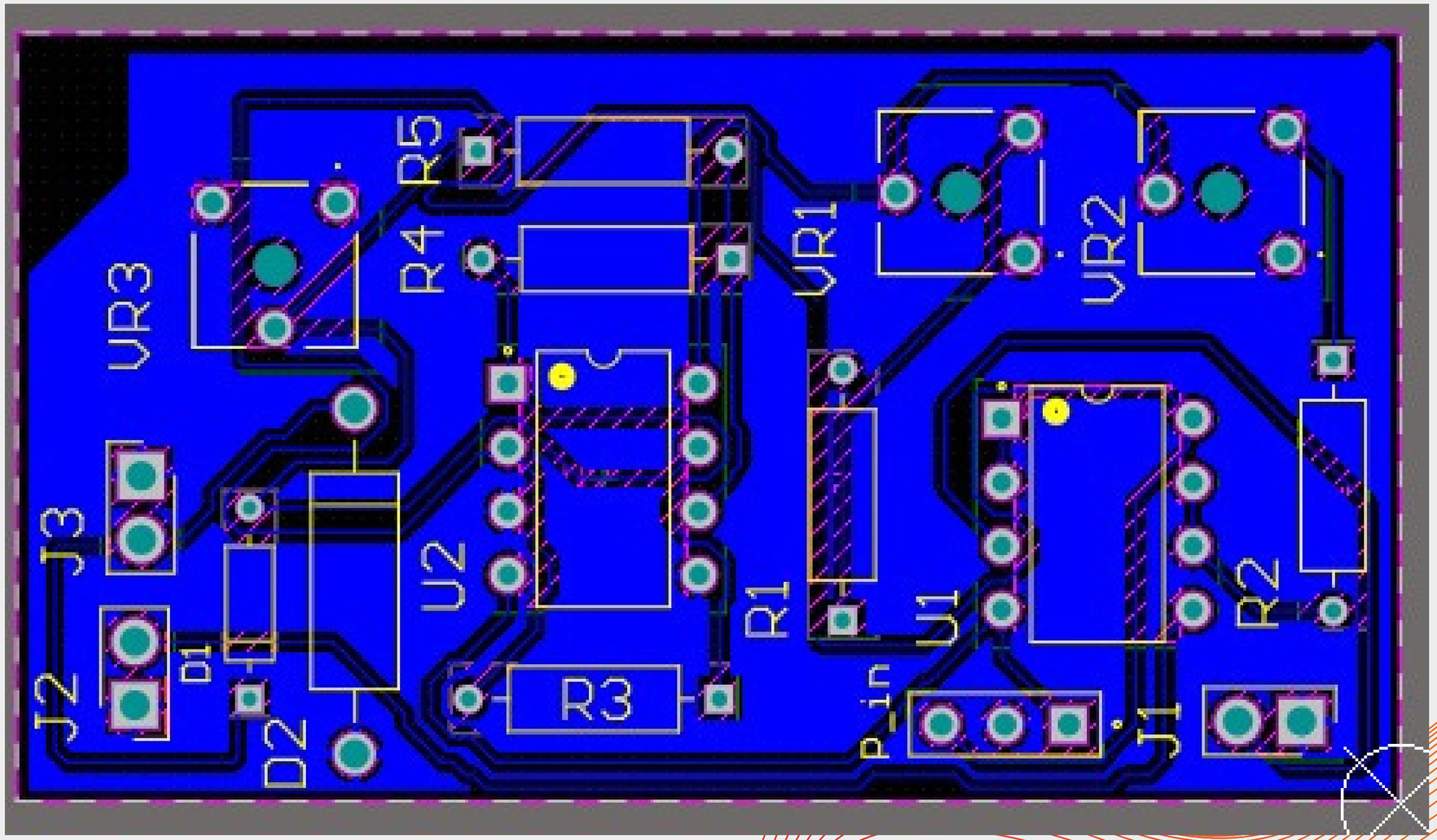


Bottom Layer

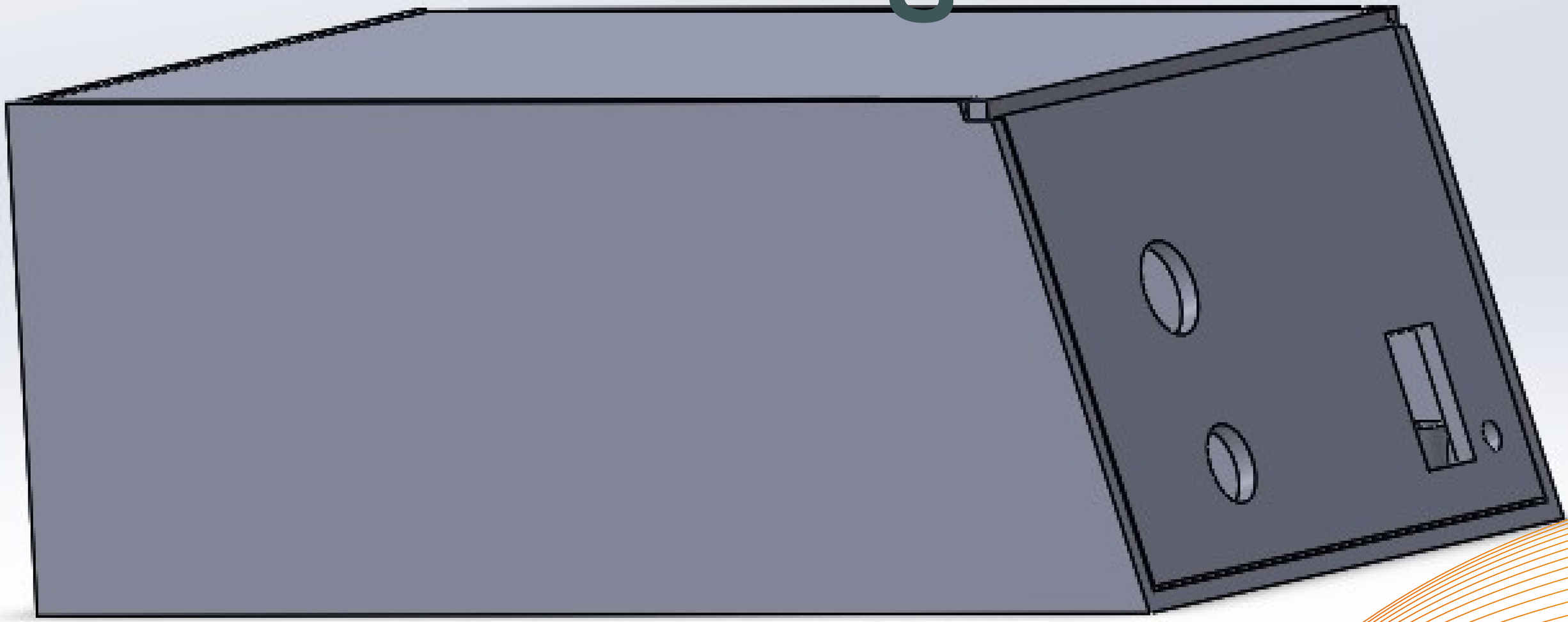
PCB of the power supply



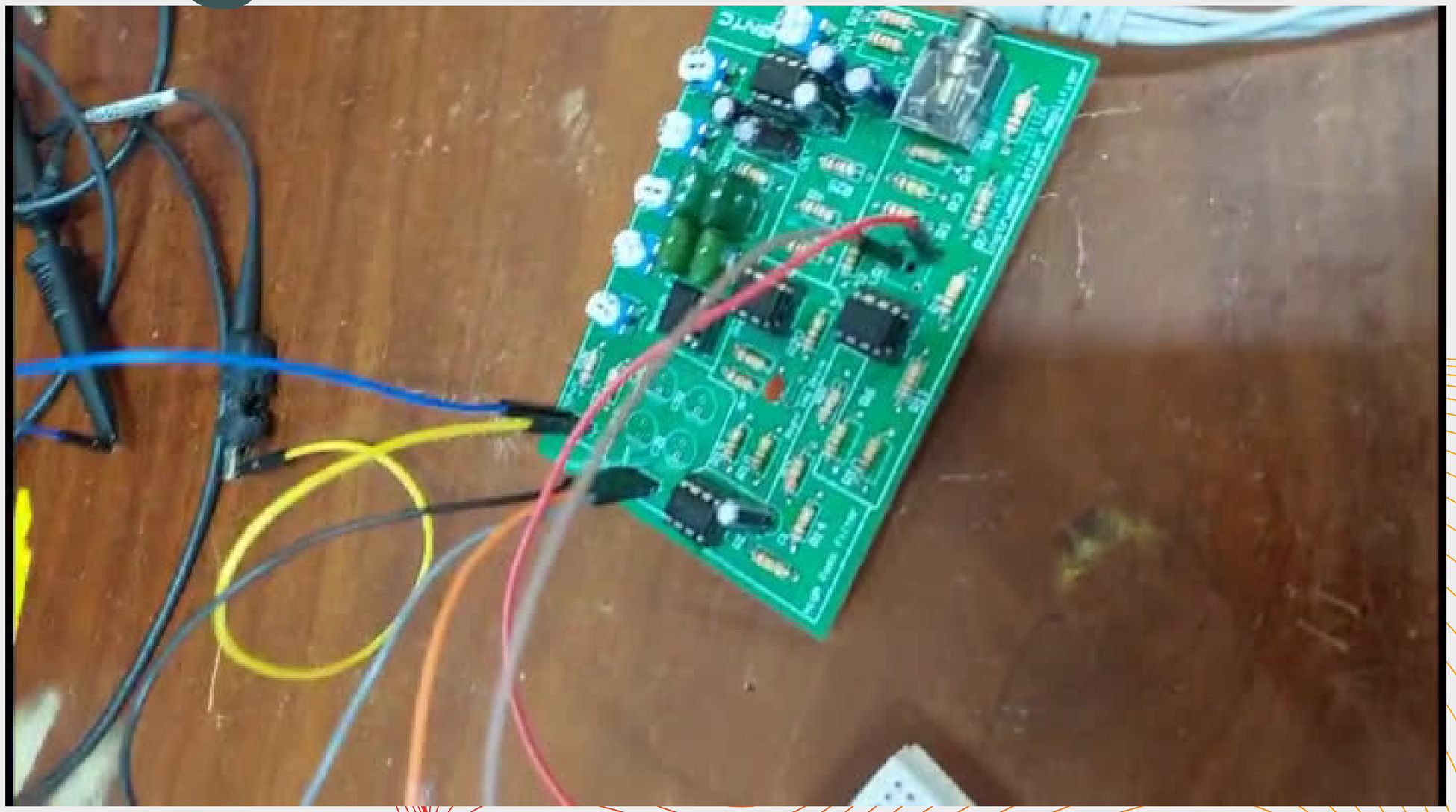
PCB of the display



Enclosure Design



Working Prototype



Task Allocation

210321X	Enclosure Designing Circuit Designing
210504L	Simulation Circuit Designing
210687X	Enclosure Designing Circuit Designing
210732H	PCB Design Simulation

Future Work

Our future work involves integrating a display for immediate visual feedback on the ECG waveform, enhancing user understanding and experience.

Thank You