Heart ECG monitor

1 Introduction

A heart ECG monitor is a device capable of displaying an electrical measurement of the human heart in real time. In this challenge, you are tasked to develop a device that can obtain 3-lead ECG signals using electrodes. The signal should be displayed using an appropriate mechanism. Since electrical signals produced by the human body are relatively weak in magnitude, you will have to use your knowledge in analog electronics to improve signal quality while amplifying the required signals. You are expected to build an analog front end which takes inputs from the ECG probes and outputs a clear ECG waveform.

2 Specification

Design an analog front end to amplify and display ECG signals with minimum distortion and superior signal quality.

- 3 lead ECG acquisition Use of analog electronics for implementation (transistors and operational amplifiers)

- Minimum 1 stage of amplification

- Use first-order active filter stages to remove noise signals.

- It is possible to use microcontrollers only for displaying the signal (using an OLED display or any similarly appropriate method).

- Required to design a suitable enclosure for the device Compatibility to plug ECG electrodes available in the market.

3 Additional Notes

- Any change of project specification is negotiable only before the mid review All circuits must be simulated using software (e.g., Multisim, LTspice,PLECs,...etc.)

- All circuits should be tested on the breadboard and reviewed by the assigned supervisor before moving further

- Circuits must be designed using professional EDA software (e.g., Altium Designer, OrCAD,...etc.)

- Schematics should be verified and evaluated by the assigned supervisor

- Design for manufacturability should be considered when designing the PCB Complete set of design and manufacturing documents Schematics, Layout, 3D file Gerber files, Assembly files BoM must be generated and properly documented.

- Students are encouraged to procure components from international component distributors (e.g., Mouser, DigiKey, Arrow Electronics, LCSC)

- Students are encouraged to get the PCBs manufactured from international PCB manufacturers (e.g., JLCPCB, PCBway)

- Main functionality of the project must be achieved with basic electronic components such as resistors, capacitors, inductors, diodes, transistors and other analog integrated circuits.

- Using any other pre-built programmable ICs are prohibited.

- Microcontrollers can be only used for user interface operation.

- Enclosure design must be done using a professional software (e.g., Solidworks)

- Enclosure and 3D model of the circuit must be assembled and inspected before manufacturing. 3D printing, Laser cutting and Sheet metal bending can be used to manufacture the enclosure.

- Student are encouraged to consider the 3D model and PCB co-design (design in parallel by taking their integration into consideration) when designing.

- Final implementation of the project need to done in a PCB.

- Follow provided "General guidelines".