EE445L: Lab11. Final Embedded System

Hyejun Im(hi956)
Sarthak Gupta (sg38368)

1. Objectives

1. Overview

1.1. Objectives: Why are we doing this project? What is the purpose?

There is a bigger purpose for us choosing this project. Non-invasive biomedical devices can help people with so many different medical conditions. They will act as aide for someone when help isn't readily available. More importantly, some of these devices can be used for rehabilitation purposes or completely removing the problem. We hope that our device can help people who have experienced nerve loss in their feet to regain their balance. We, at Imta Tech, are very passionate about helping people. Our purpose with this project is simple: educate, innovate, and change the world "one step at a time."

1.2. Roles and Responsibilities: Who will do what? Who are the clients?

Imta Tech will be engineering this device and the instructors of EE445L will be our clients. We will create the product and demonstrate it to our clients and our general audience. Specifically, our senior software engineer, Hyejun Im, will be designing the modularity of the code to set it up in the initial stages. Also, our lead embedded design engineer, Sarthak Gupta, will be testing the hardware components and will design a schematic. After both of these tasks are complete, the two engineers will join forces the rest of the way to complete the final product.

1.3. Interactions with Existing Systems: Include this if you are connecting to another board

We are not connecting to any other boards.

2. Function Description

2.1. Functionality: What will the system do precisely?

The system will measure plantar pressure distributions using force sensitive resistors(FSR) attached to the sock of a client. We will have the client do different tasks such as balancing on one leg, walking in a straight line, sitting down, etc. We will use the data from the resistors to analyze the client's balance while doing these tasks. This is where the main functionality of our biofeedback device comes in. The software will use the data to analyze if the client is leaning too much in one direction. The client will have earphones connected to the device. If the client is leaning too much to the right, they will hear a sound in their right ear. If they are leaning too much to the left, they will hear a sound in their left ear. This is the same for the forward and backward directions as well.

The system can be improved by sending the progress of the patient to the doctor. It will send data to the server, and doctor will be able to give some feedback to the patient. Hopefully, with time, the client will learn to walk and hear a minimal amount of sound, meaning their balance has improved.

2.4. Performance: Define the measures and describe how they will be determined.

The system will be judged by several measures. First, the software modules must be easy to understand and well-organized. Second, the analysis of the pressure distribution on the client's foot should be correct enough to maintain the balance. Third, the appropriate feedback should be send to the user. This feedback will be sent through the earphone.

2.5. Usability: Describe the interfaces. Be quantitative if possible.

There will be 4 resistors, 2 buttons to toggle between test modes, ST7735 to give user visual feedback, and headphones for audio feedback. The device itself will be able to be clipped on the users waist or to be used as a handheld.

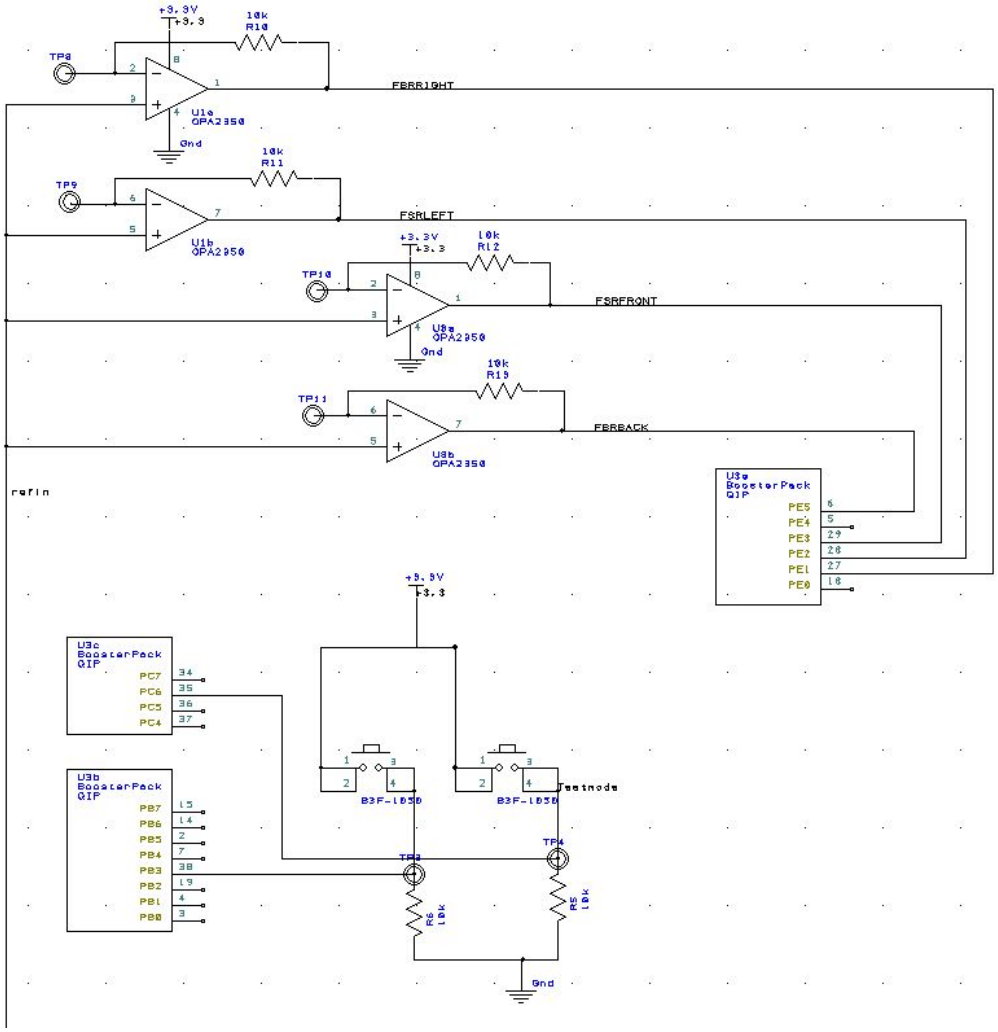
3. Deliverables

3.1. Reports: How will the system be described?

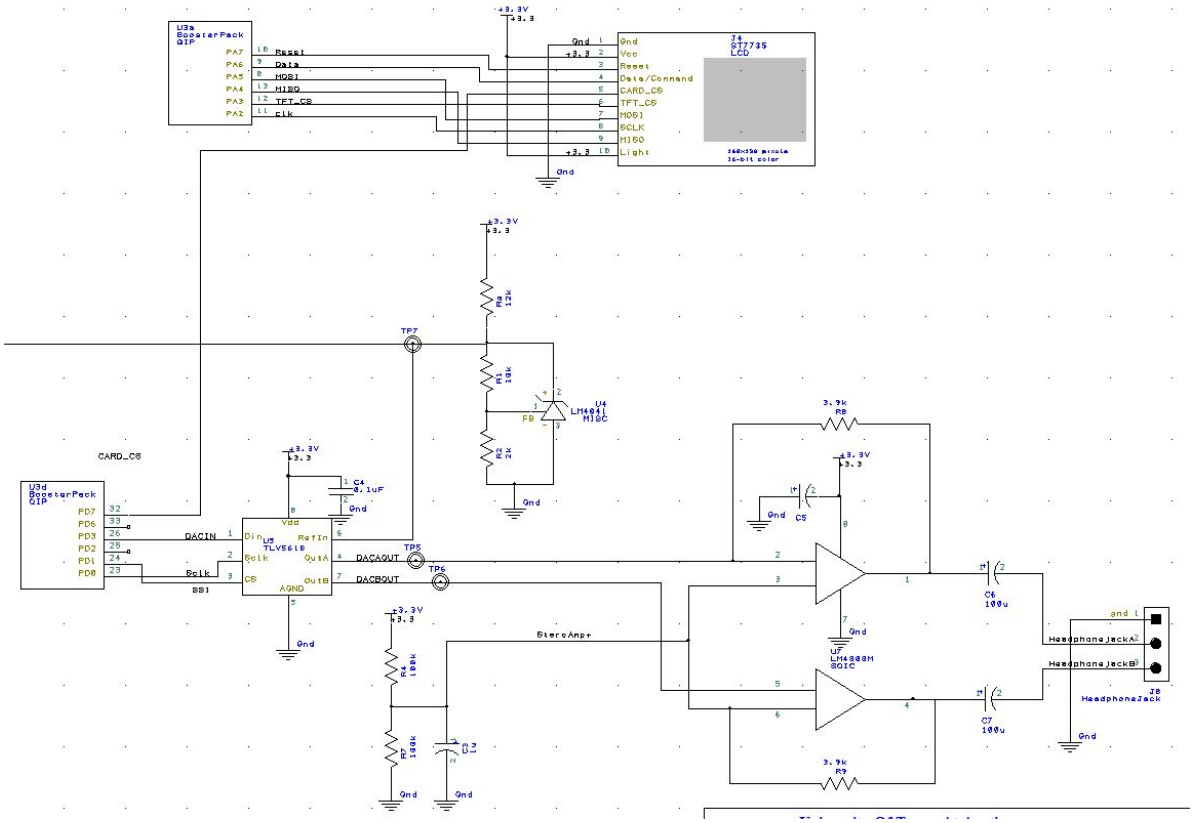
This system will be described through the report by the due date listed in the syllabus. We will write reports for lab 7 and lab 11. This report includes the final requirements document.

2. Hardware Design

2.1. The schematic

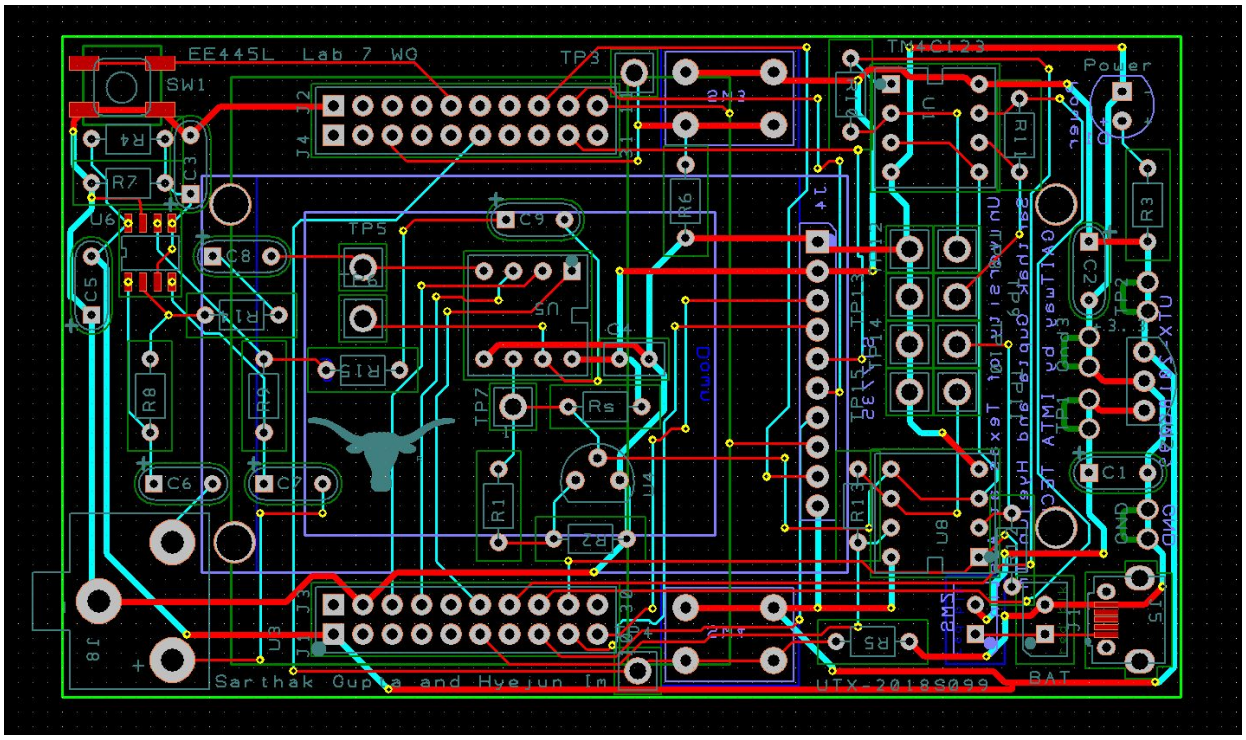


< Schematic of FSRs and buttons>

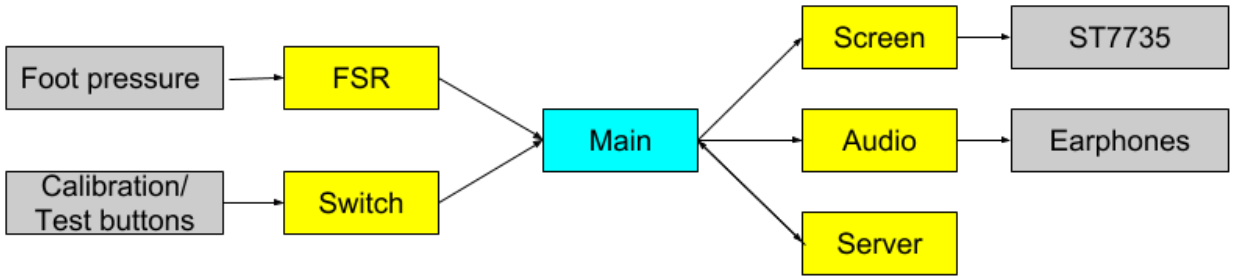


<Schematic of a screen and earphones>

2.2. PCB design

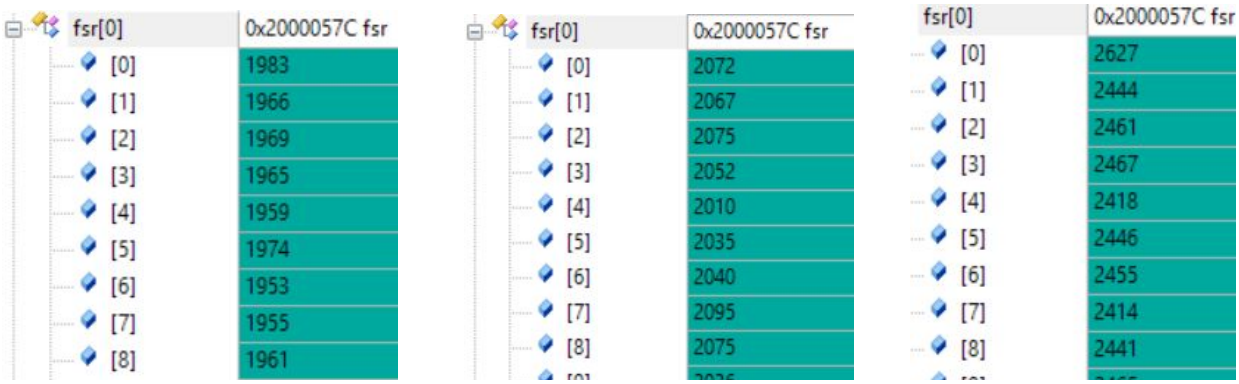


3. Software Design



FSRs will measure the data from the patient's foot. It will calibrate depending on the patient's weight. Also, switches decide which mode the device will be at. The device will output sound and visual effects.

4. Measurements Data



fsr[0]	0x2000057C fsr
[0]	1983
[1]	1966
[2]	1969
[3]	1965
[4]	1959
[5]	1974
[6]	1953
[7]	1955
[8]	1961

fsr[0]	0x2000057C fsr
[0]	2072
[1]	2067
[2]	2075
[3]	2052
[4]	2010
[5]	2035
[6]	2040
[7]	2095
[8]	2075

fsr[0]	0x2000057C fsr
[0]	2627
[1]	2444
[2]	2461
[3]	2467
[4]	2418
[5]	2446
[6]	2455
[7]	2414
[8]	2441

<A FSR ADC value with no pressure, two feet standing and one foot standing>

Our measurement values will vary from 1700 to 4095.

5. Analysis and Discussion

https://youtu.be/12vWELYHfh0