

Design Review 0 Agenda

EEG Alarm Group

Dr. Schafer

Stinson-Remick 205

4:30 PM January 23, 2023

Leader: Jackson Bautch

Scribe: Alex Beck

Agenda

1. Comments from meeting with Professor Howard
2. Design Review 0
 - a. System Block Diagram
 - i. Major Subsystems
 - b. Subsystem Requirements
 - i. EEG
 - ii. Pulse Oximetry
 - iii. Alarm
 - iv. Internet of Things
 - c. Looking Ahead: Design Reviews 1 and 2
 - i. Subsystem Design
 - ii. Subsystem Hardware Demonstration
3. Comments and Questions

Going forward:

- Plan for testing devices. Establish body measurements
- Accelerometer to sense head movement and identify noise
- Eye mask vs headband

Design Review 0 Meeting Minutes

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Notes

1. Comments from meeting with Professor Howard
 - Prof. Howard agreed to be our unofficial advisor for the project.
 - We discussed numerous hardware designs for the EEG component of the bio-interface.
 - To start off with, we will just use 2 electrodes (1 lead) for brain-activity measurement and one lead near the temple to detect eye movement activity.
 - Instead of using a pre-created dev board, we will use an instrumentation amplifier such as the Analog Device 620.
 - The output of the amplifier circuit will go through an analog band-pass filter for 0.1-100 Hz.
 - The gain for the amplifier will need to be on the range of 1,000 to 10,000. Experimentation will be done to determine optimal gain.
 - To simulate EEG data, we will create a simulator using an ESP32 by outputting an analog signal on a D/A pin. The output will need to be a voltage divider with very large output impedance.
 - We will continue to meet with Prof. Howard throughout the semester.

2. Design Review 0
 - a. System Block Diagram
 - i. Major Subsystems
 1. No changes need to be made on the system block diagram.
 - b. Subsystem Requirements
 - i. EEG
 1. See above comments from our meeting with Prof. Howard
 - ii. Pulse Oximetry
 1. Due to the abundant availability of pulse ox sensors on the market, we will purchase a chip that does all the pulse ox measurements for us.
 2. Prof. Schafer gave us a dev board from a previous group's project to test out. We will need to ensure that the chip it uses is still available to purchase. If so, we will begin to interface the dev board with the ESP32.
 - iii. Alarm
 1. The alarm portion of our project is not something that we expect major challenges with, so we will hold off on working on it until we make good headway on the bio-interface portion of the project.
 - iv. Internet of Things

1. As with the alarm subsystem, connecting the ESP32 to a web server and creating a website to interact with the ESP32 is not a major challenge right now, so we will hold off on this portion until we have a better idea of how the bio-interface will work.

Keep a log of the previous month data

c. Looking Ahead: Design Reviews 1 and 2

i.Subsystem Design

ii.Subsystem Hardware Demonstration

3. Comments and Questions

- The designated spender will be Josh O'Brien
- We discussed various ideas for how the headband portion of the device will look like. Below are various ideas thrown around:
 - We will need Velcro on the headband to make it an adjustable size
 - How will we integrate the electrode on the temple into the headband.
 - Maybe we create an eye mask instead of just a headband? We could have infrared led/sensor to track eye movement instead of an EOG.
 - Look at sleep apnea head straps to see if that would be a good option.
 - The headband does not need to be something that is super fancy at this point. It is a prototype – not something that will be going on the market.
- The UI should be able to keep a month's worth of data to display to the user.
- Because there is variability in brain activity between each person, in an ideal world the device would have AI capabilities to adjust to different users.
- For the cost of the final boards, they are around \$50 after shipping.