



UNIVERSITY OF
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EEL 4914 Senior Design
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Preliminary Design Report

**Cognitive Electroencephalography
Acquisition Laboratory System**

Team 10 : MindView

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Project Abstract

Electroencephalography (EEG) is the acquisition and recording of brain signals from the scalp by means of electrodes placed on the head. Many curious electronics hobbyists have shown keen interest in EEG, although the steep cost of these apparatus usually places a barrier from exploiting their interest. The goal of our project is to build a Cognitive Electroencephalography Acquisition Laboratory System (CEEGALS) providing the end-users an affordable way to view and analyze their brainwaves. CEEGALS will allow the user to view these waveforms on a handheld LCD. The user will benefit from a beautiful separation of acquisition hardware and feedback hardware, since CEEGALS features wireless data transmission from the electrodes board to the display board.

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CEEGALS Features

Our EEG acquisition system will provide a new portable way to acquire and view brainwave signals. The system aims at reducing the amount of hardware that is to be attached to a subject, liberating them of the display module. The features of this system are as follows:

- Electrode data acquisition and filtering
- Wireless transmission of digitized waveforms
- Receive and process data on display module
- Output visual waveform on graphical LCD
- Allow for user input to choose among electrode channels
- Allow for PC interface to display module via USB protocol

Figure 1 below shows a system-level design of the CEEGALS product.

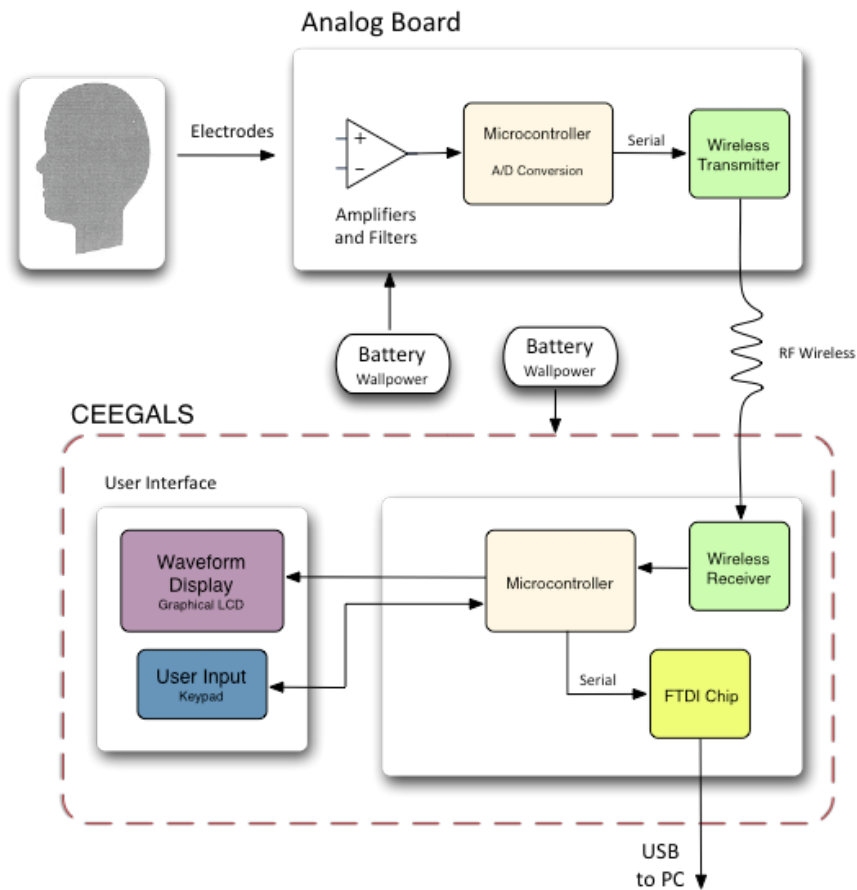


Figure 1 - CEEGALS System Level Design

Selection of Technology

In EEG one of the most important objectives of the system is to provide clean signals. For this reason we chose to sample the analog data and immediately transmit to another location for further processing and display. By doing the processing in this way we can reduce the amount of components and clutter on the analog acquisition board (headstage) and allow freedom of movement to the subject. The headstage will consist of the following components:

Electrodes (used for acquiring the raw analog signals)

OPENEEG designed amplifier/filter circuit

Microprocessor for digitizing and relaying waveforms to wireless transmitter

Xbee wireless module for wireless transmission

A handheld system will receive the digitized EEG data from the Xbee transmitter and prompt the user if they wish to view the waveform on the graphical LCD, or route to PC via USB. If the user decides to send the data to the PC we hope to interface this data with a number of open-source EEG programs that already exist. Both modules will be battery powered to allow for portability and comfort. The display handheld unit will consist of the following components:

One or two Microprocessors for data handling and user interface

Graphical LCD for waveform display

Xbee wireless module for data reception

FTDI controller to emulate USB PC interface

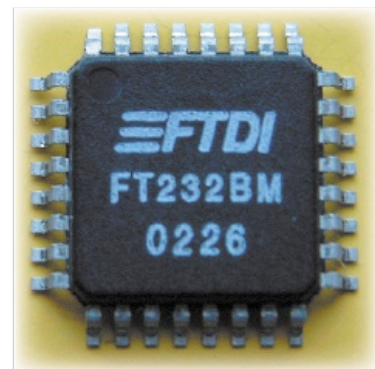


Figure 2 - FTDI Serial to USB Controller

The graphical LCD will be interfaced using a parallel communication to allow for better frame rates than the serial alternative. As of now testing is being done on the following LCD:



Figure 3 - Graphical LCD

Division of Labor

Danny:

- Analog Data Acquisition
- Finalizing Headstage package
- Graphical LCD Interface
- User Interface programming
- Final product testing

Jose:

- FTDI controller interface
- Xbee module testing and interfacing
- User interface programming
- Design display module PCB
- Display module packaging
- Final product Testing

It is evident that the programming in this project will be extensive and will require both designers' efforts. Division of labor is stated very loosely and it can be understood that most things will be a collaborative effort.

CEEGALS Gantt Chart

Table 1 - CEEGALS Gantt Chart Data

Task Name	Begin Week	Danny	Jose	Both	Total Weeks
Idea brain storming	0	0	0	2	2
Abstract	2	0	0	1	4
Part research, selection, & purchase	1	0	0	6	7
Preliminary design report	3	0	0	1	4
FTDI Breakout Board and Coding	4	0	3	0	7
Analog Data Acquisition	4	1	0	0	5
Xbee Module Testing	4	0	2	0	6
Finalize Headstage Module	5	4	0	0	9
Graphical LCD Interface	5	4	0	2	11
User Interface Programming	6	1	2	0	9
Design Display Module Package	10	0	2	1	13
Design Display Module PCB	10	0	3	0	13
Final Product Testing	13	0	0	1	14
Final Design Report	14	0	0	1	15
Demo	15	0	0	1	16

CEEGALS Design Project - Spring 2008

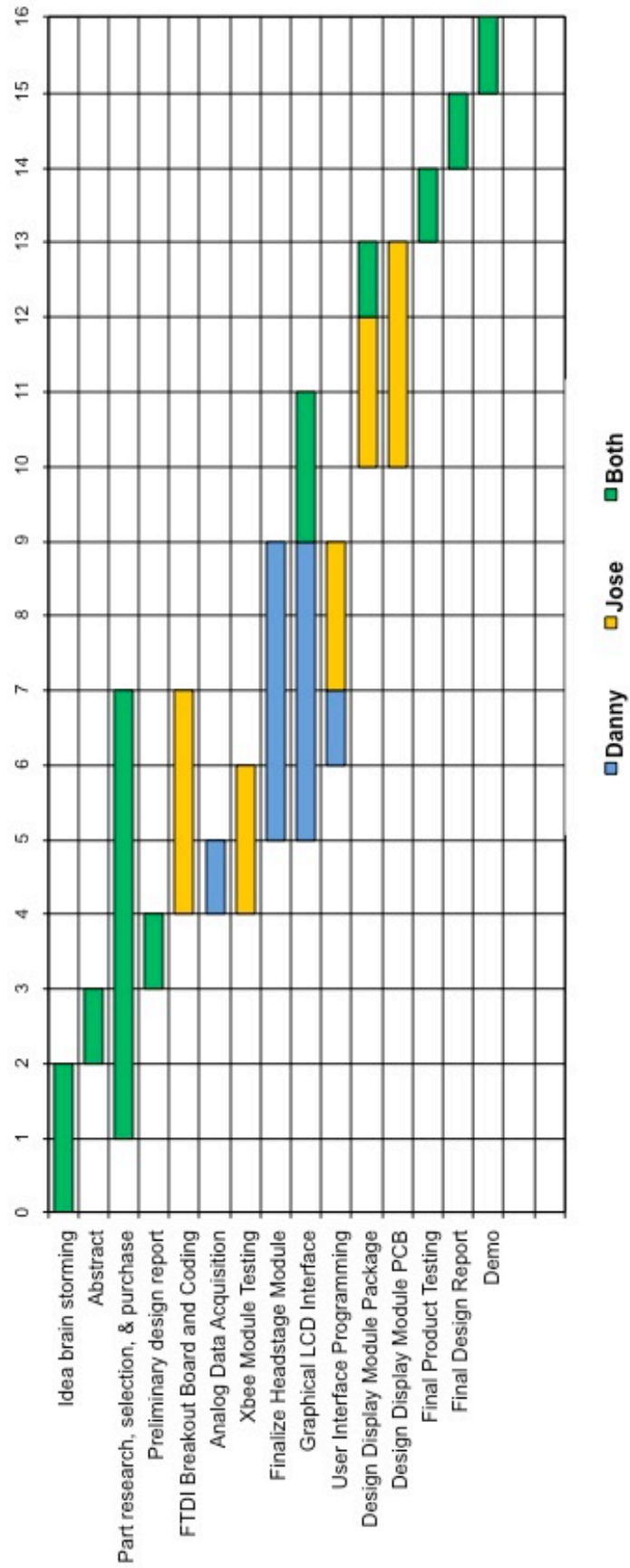


Figure 4 - CEEGALS Gantt Chart