Title

Project Synapse: A Portable, Affordable, and User-Friendly EEG Device to Monitor and Study Neural Activity During Sleep

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Publication Date

2015-03-30

Peer reviewed

Project Synapse

A Portable, Affordable, and User-Friendly EEG Device to Monitor and Study Neural Activity During Sleep

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Steven Bui, EECS, Product Design

Background

EEG machines for sleep study are large and not accessible for home use. Collecting neural activity during sleep requires the patient to go to a specialized sleep study center for monitoring. For many people, a sleep study lab is not an ideal setting for getting a typical night's rest. As a Result, the data retrieved would not give an accurate representation of a patient's neural activity during sleep. We aim to solve this problem by creating a low cost, portable EEG device that will connect to a user's smartphone to process, log, and display data.

Other companies have portable EEG devices that connect to smartphones, but they are typically not usable during sleep. One device, the Emotiv, uses a hard plastic structure. This would be uncomfortable or perhaps unusable during sleep. We will use a comfortable and flexible headband. Other portable EEGs that are usable during sleep are expensive (upwards of $1500). We aim to keep our product under $200 in order to make it accessible to as many people as possible.
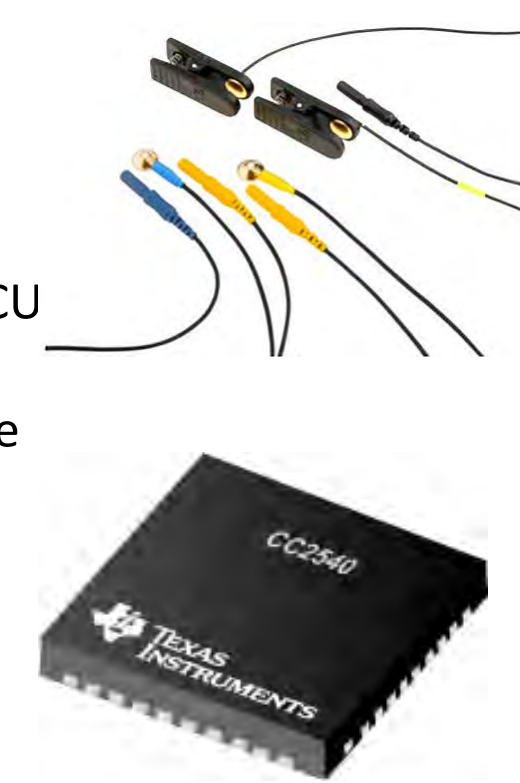
Block Diagram

Our Solution

A single board solution that will have a 2 channel EEG to keep costs low and have a manageable amount of data to start with. Each one of the channels will monitor one of the hemispheres of the brain. A later version of our product could be expanded to more channels as needed.
The Android application will be used to display the data from the EEG headband.
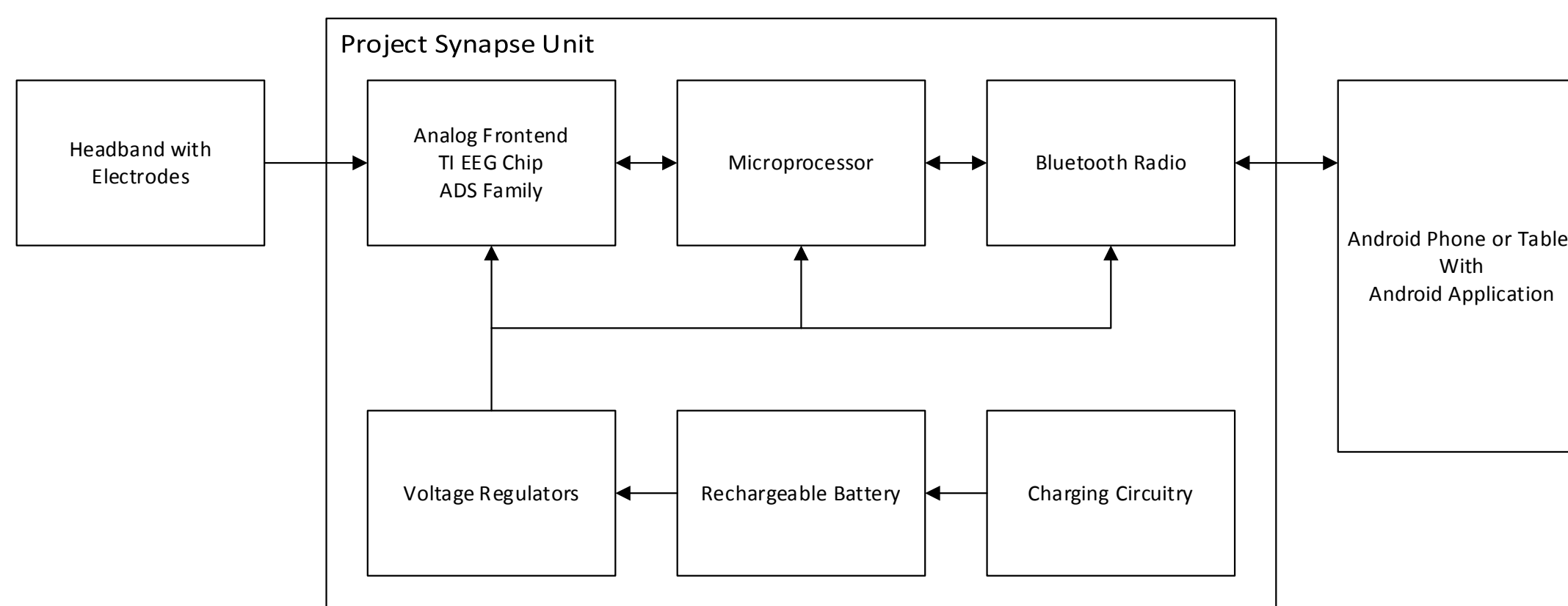
Innovation in Design

A comfortable low cost, EEG at an affordable price, that can be used during sleep. It wirelessly connects to any android device that has the app installed, which will be used to display the data collected by the device. In addition, it can record current data and playback any saved recordings.
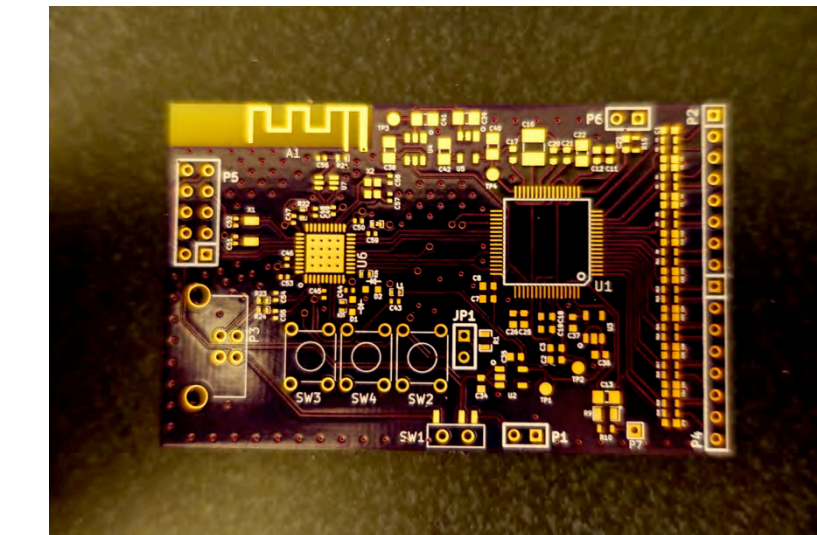
Major Components

Sensors:
Four electrodes attached via headband (2 Channels, 1 Bias, 1 Reference).
Data Acquisition:
EEG Analog Frontend ADS1299. eight channel, low power, analog to digital converter for EEG applications. 24 bits per sample.
Microcontroller/Bluetooth Radio: TI CC2540. Bluetooth Smart Wireless MCU max data rate 1 Megabit per second with an integrated microcontroller.
Power Supply: Low dropout regulators that are suited for low-power mobile devices.
3 AAA rechargeable NiMH batteries (1.2V, 750 mAh each)
Android Application:
Receives samples via Bluetooth Low Energy.
Processes samples to separate data into different brain wave frequencies.
Logs data to be reviewed or transmitted later.
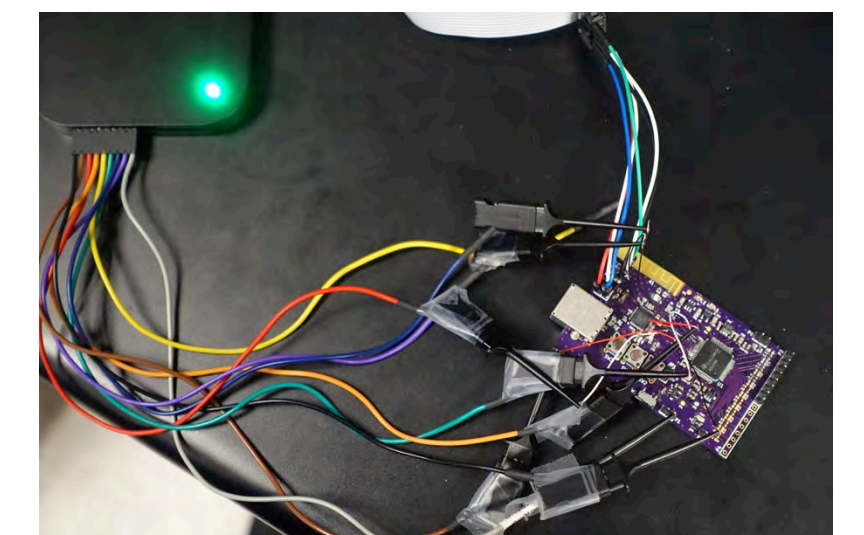Allows data to be viewed on a graph.

Schedule

Week 4: Complete Design for Final Prototype PCB and sent for Fabrication
Week 6: Finalize Android Application Prototype.
Week 8: Complete Hardware Build and Test.
Week 9: Complete Testing and Data Characterization
Week 10: Oral Presentation.
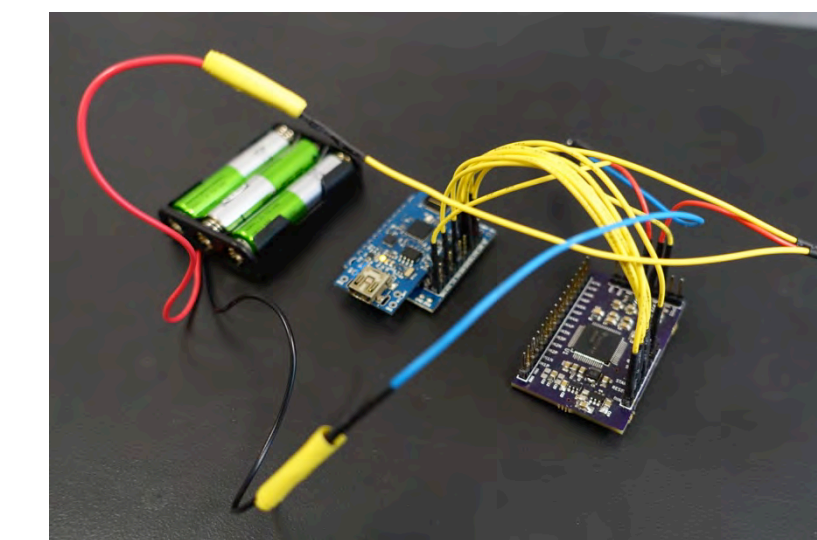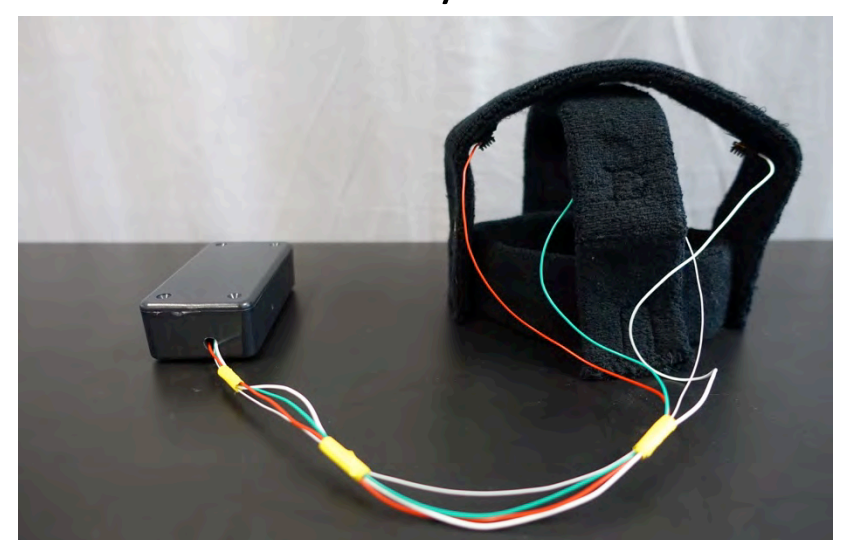Week 10: Final Report Submission.

Progress/Results

Designed PCB from Fab
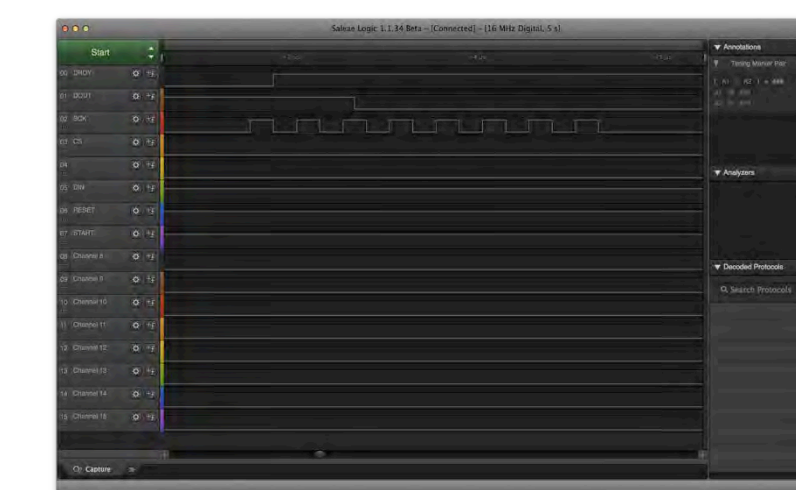

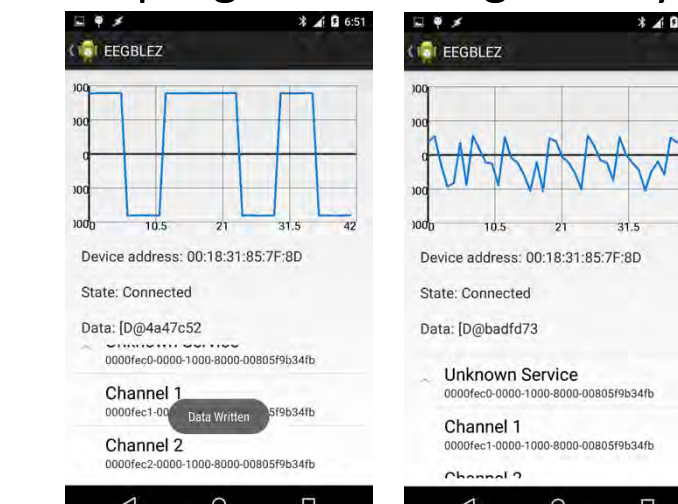Testing the board with a logic analyzer

Rev2: EcoBT and 1299 Prototype

Finalized Product Casing

Measurements

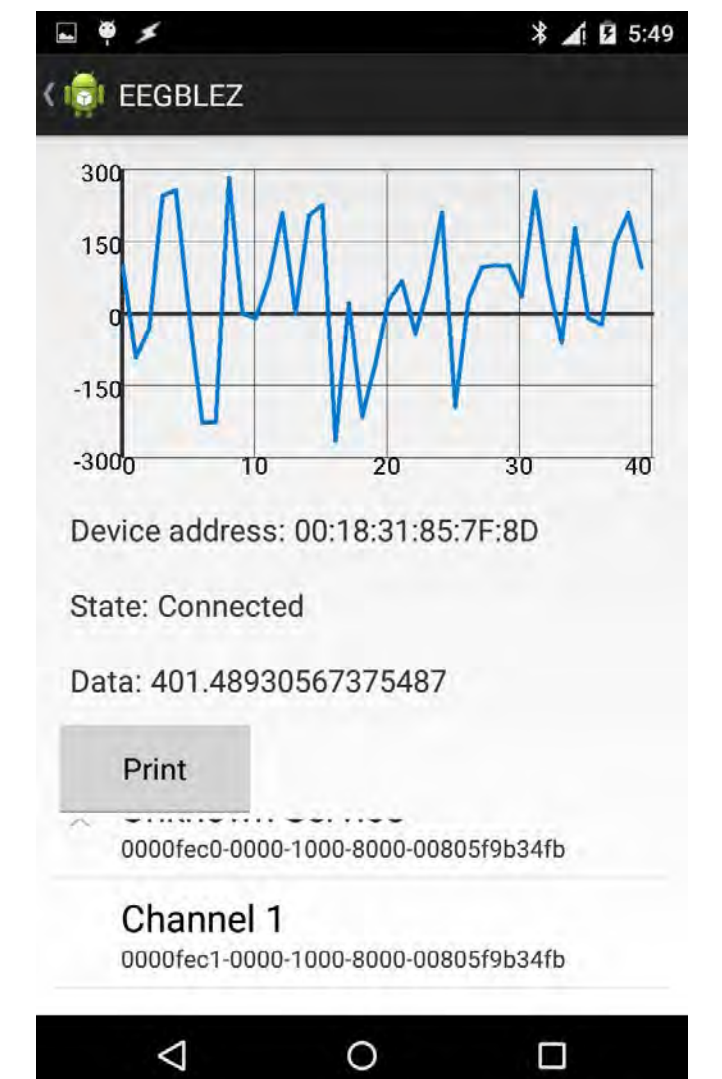Chip Signal from Logic Analyzer

Square and Triangle Waveforms

Android Application in Action

Contact

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