House in Your Head

Team G1-FrigidWaters

Launch Report

Cycle # 1

Date: 10/06/2014

Team Members:

Name: Samuel Bever

Name: Michael Conway

Name: Joseph Muoio

Name: Kyle Patron

Name: Kevin Zakszewski

The System/Product

System/Product Name

House in Your Head

Introduction

Amyotrophic lateral sclerosis (ALS) (also called "Lou Gehrig's Disease") is a neurodegenerative disease affecting the brain and spinal cord. The motor neurons progressively degenerate and die off, leading to the loss of muscle control and death. Affected indivuals suffer a spectrum of symptoms culminating in total lock-in. In this state, the patient is aware but cannot move their body in any way. They cannot breathe on their own or even blink their eyes. Because of this, late-stage ALS patients are unable to interface with conventional assistive technologies.[1]

The goal of the project is to build a system which people afflicted with ALS can use to interact with their houses through Home Automation Systems (HAS). This includes controlling the thermostat, lights, stereo, and television as well as interfacing with social media. By having a Brain Computer Interface (BCI) to their automated house, individuals with ALS can still interact with their environment despite full paralysis. This builds off of a previous senior design project. The interface will be improved, methods of input training and processing will be experimented with, and a more robust array of input options will be used.

Highlighted Features

- Interpret brain waves
- Calibrate interface to individual users
- Allow users with ALS to perform basic household tasks

Sponsor or Proxy User

Our outside stakeholder is **Sara Feldman**, PT, DPT, ATP, MDA/ALS Center of Hope, Drexel University College of Medicine. We will be meeting with Dr. Feldman on an ongoing basis to continually reevaluate the progress and project goals to ensure that this product will be useful to ALS patients.

Issues

Brains are complicated, and so expecting them to perform a task in a deterministic way is not necessarily realistic. This means that we will have to have a sophisticated signal processing system in place. There is no one correct way to do this, and since the current method is not robust enough for general use, we predict that this will occupy a significant portion of the project development cycle.

Gathering project requirements will present difficulties because we cannot easily identify with the daily experiences of ALS patients and communicating directly with late-stage ALS patients is challenging. To circumvent this, we will have to depend heavily on our contacts at Drexel Medicine, who work with ALS patients.

Project Costs

The Emotiv device[2] costs between $300 and $500. This cost is being covered by the Drexel College of Engineering and College of Medicine. Before being able to be used, the device will have to be trained, costing the user time. The software will be fully open source, so it will be free for users to download and use as long as they have an Emotiv device.

Benefits

The biggest benefit will be the quality of life improvement for patients who are suffering from ALS, specifically, those that are totally paralyzed and cannot even move their eyes. The device we are developing software for is much cheaper than the alternatives, which can cost upwards of $17,000. Since this project is open source, there is a large potential for our project to grow and be used in future work.

The Team

Team Name

G1-FrigidWaters

Team Members and Their Specialties

Samuel Bever enjoys working in algorithms, artificial intelligence, and graphics. Role: Tester.

Michael Conway has experience and interests in the areas of algorithms, programming languages and computer security. Role: Technical Lead.

Joseph Muoio has experience and interests in the areas of AI, mobile app development and software development. Role: Team Leader.

Kyle Patron is interested in mathematics, particularly as it relates to signal processing and machine control. Role: Tools lead.

Kevin Zakszewski has experience in UI/UX design and front end implementation. Role: Lead Designer.

Team Communication

Our team will be meeting at least once a week to discuss our progress, outline our tasks for that week, and address any other issues. If necessary, more meetings will be scheduled. Most group communication outside of these meetings will be done via email and Google Hangouts. For source code management, we will be using a GitHub repository, which comes with an issue tracker and a project wiki. We will also be using review board in order to organize and distribute code reviews to the team.

Team Issues

We are all busy and have many other school and work commitments. Finding time to meet on a regular basis will be important but possibly difficult.

There are some differences of opinion when it comes to technical aspects of this project. We are still debating which language we should use.

The Plan

Objectives

Our goals for this first cycle are meant to begin each of the portions of the project so that we can use the other terms to integrate our different subsystems and poslish the resulting amalgamation.

- Begin experimenting with the Emotiv system to determine its capabilities and limitations
- Gather requirements from our stakeholder
- Construct a rough UI that will serve as a baseline for future iterations
- Combine these initial elements to create a rough prototype, which will serve to
  - test the feasibility of the design
  - identify the most important challenges to focus on in the remaining cycles
- Present the prototype to prospective users in order to clearly define assumed, unstated or non-obvious requirements

Schedule

| Week	Person	Contribution
2-3	Everyone	Write launch report
3-5	Joe Muoio	Set up coding infrastructure
3-5	Kyle Patron	Gather requirements and meet with stakeholder
3-7	Sam Bever	Experiment with default Emotiv functionality
4-8	Kevin Zakszewski	Develop prototype UI
5-8	Kyle Patron	Develop initial system design
7-10	Mike Conway	Combine parts into prototype
8-11	Everyone	Prepare presentation

	Fall Term										
	1	2	3	4	5	6	7	8	9	10	11

Write launch report

Launch Report 1 ◆

Gather requirements and meet with stakeholder

SRS 1 ◆

Develop initial system design

SDS 1 ◆

Experiment with default Emotiv functionality

Set up coding infrastructure

Develop prototype UI

Combine parts into prototype

Prototype 1 ◆

Prepare presentation

Presentation 1 ◆
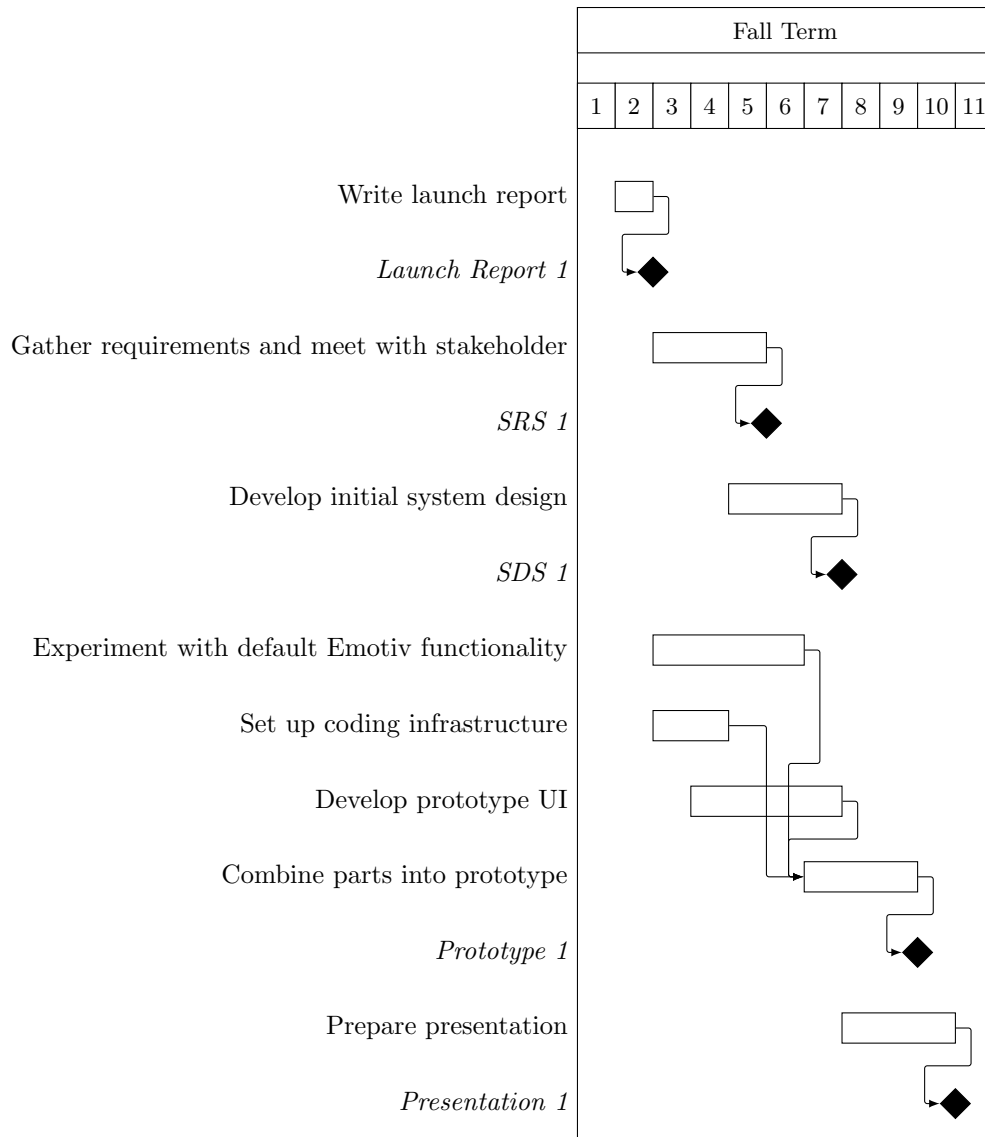
Table of Contributions

	Section	Writing	Editing
1	Project	Joe Muoio	Mike Conway
2	Team	Everyone	Sam Bever
3	Plan	Kyle Patron	Kevin Zakszewski

Bibliography

[1] The ALS Association. (2014, October, 5). *What is ALS?* [Online]. Available: `http://www.alsa.org/about-als/what-is-als.html`

[2] Emotiv, Inc. (2014, October, 6). *Emotiv—EEG System* [Online]. Available: `http://emotiv.com/`

I certify that:

- This paper/project/exam is entirely my own work.

- I have not quoted the words of any other person from a printed source or a website without indicating what has been quoted and providing an appropriate citation.

- I have not submitted this paper / project to satisfy the requirements of any other course.

Signature: <u>Samuel Bever</u>   Date: <u>10/06/2014</u>

Signature: <u>Michael Conway</u>   Date: <u>10/06/2014</u>

Signature: <u>Joe Muoio</u>   Date: <u>10/06/2014</u>

Signature: <u>Kyle Patron</u>   Date: <u>10/06/2014</u>

Signature: <u>Kevin Zakszewski</u>   Date: <u>10/06/2014</u>

Grading

The grade is given on the basis of quality, clarity, presentation, completeness, and writing of each section in the report. This is the grade of the group. Individual grades will be assigned at the end of the term when peer reviews are collected.