Senior Design I

Initial Project Document

Stress Relief Wristband & Study Spot Finder

Group 12

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Contents

Description

As college students, we sometimes find ourselves struggling to find a study space. At the University of Central Florida, we might have it a bit harder due to the amount of students on campus and how far study spaces are apart from each other when searching for one. This wastes our time, give us frustration, and even can ruin a perfect day for studying.

Our proposed solution is a hardware device that is attached to a study table that allows users to find out if the spot is available. Multiple devices can be attached to different study tables around campus. This device will have an app that students can download to reserve a spot. It will have lights that represent different states such as: available in green, reserved in yellow, and taken in red. The user will be able to easily find available spots on the app, tentatively reserve it, and lastly confirm by pushing a button that will turn the light red as in “taken”. We believe this solution will make finding a study spot a breeze and we hope that students spend more time studying than actually trying to find *where* to study.

Goals and Objectives

1. The application will be easy to use and works in real-time.
2. The hardware device will be accurate to the data sent from the app.
3. The device will be small and it will not be an inconvenience when attached to the table.
4. The device will be low cost and energy efficient.

Requirements

Power

If implemented, the device would be required to monitor a single study spot and stay active during the entire time that the building is open. This means that it needs to consume power at all times. In order to keep operating costs low, it must consume a small amount of electricity. A logical starting point would be equal to or less than the power consumption of a CFL bulb (~15 Watts) , since they are on all of the time as well. Also, since we are dealing with bluetooth technology, microcontrollers and other small electronics, we will need a DC power source of around 5V, a common voltage for logic devices. Being located in a building, the most ideal power source would be 120V AC wall outlet, which would need to be converted and reduced.

Connectivity

Since the location would be within a building, bluetooth connectivity would only need to be confined to that building, which would equate it to a Class 2 device (10 Meters). The actual physical location of the study spot can be stored in the app once it is initially configured to a desk so Students can find their way to it from outside the building.

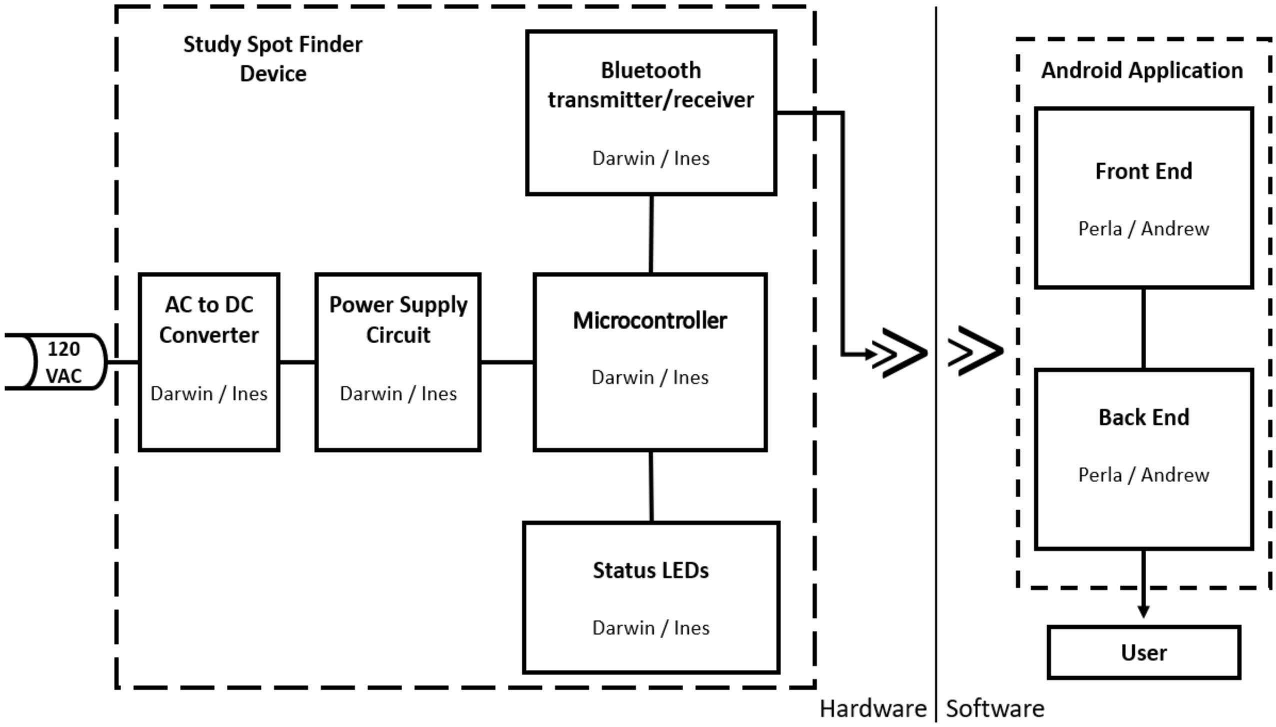
Size

This device must be convenient and simple, as it will appear on all of the study spaces. To achieve this, it must be as small as possible while still achieving its function. An estimated size for this device would be within the volume of 14cm x 14cm x 16cm. This would allow the device to occupy a minimal amount of space while containing proper electronics and components.

Ease of Use

This device must be intuitive for students as this will be accessible to everyone. In order to achieve this, the device will have one central, visible button to claim / release the study space. This button must be large and also very reliable / durable since it will be pressed multiple times in a day. The rest of the interactions will take place in the application, which will be designed to be user-friendly. To notify users of the study space's availability, there will also be 3 LEDs (Or a color adjustable LED strip) to indicate status. The simplicity of this design will allow all students to easily adapt to using this device.

Project Block Diagram



Project Budget

Item	Cost
Bluetooth Transponder	$5
Microcontroller	$13
LED	$1
Protoboard	$5
Sauter / Electric Tools	Free
Plastic Spool for 3D printing	$5
Button	$3
Circuit Components	$30
Total	$62

Project Milestones

Milestones	Deadlines
Fall 2019	
Concept	Sept 20
Research	Sept 27
Initial Design	Oct 4
Peer/Professional Review	Oct 11
Second Design	Oct 18
Parts List	Oct 25
Prototype 1	Nov 8
Peer/Professional Review	Nov 15
Final Design	Nov 22
Prototype 2	Nov 29
Spring 2020	
Power Supply	Jan 10
LED Circuit	Jan 24
AC/DC Converter	Jan 31
Bluetooth Enabler	Feb 14
Front-End For App	March 6
Back-End For App	March 20
Housing Design	March 27
Housing Manufacturing	April 3
Testing	Constantly
Final Project Due	April 17
Presentation	April 24

Description

Customers

People with stress issues who would like to reduce stress and their risks.

Motivation

Daily routines can cause stress to people in which can lead to dangerous consequences if it is not managed or treated properly, such as mental health disorders, cardiovascular diseases, gastrointestinal problems and eating disorders. In the United States, according to a 2014 survey, 77% of people experience symptoms caused by stress. In the workplace, stress is a growing concern, as 120,000 deaths are associated with it every year. In academia, it is estimated that 98.4% of college students have experienced some type of stress. Stress can cause later health issues, loss of productivity, and financial setbacks.

Goals & Objectives:

Build a small, lightweight and accessible device that helps tracking, reducing, and controlling levels of stress. Use measurable symptoms of stress such as blood pressure, heart rate, etc to track levels of stress through sensors. Track the stress symptoms continuously and analyze the stress level of the user. If these levels are above normal, notify the user and give options to lower the stress level to normal. This will help manage stress and prevent future risks. If stress levels are normal keep tracking the symptoms.

Function:

In order to measure stress, it is defined by increased heart rate, increased blood pressure, and body temperature, which are quantified variables that we can measure and build for our project. In order to effectively reduce stress, we need to measure what the body outputs, and analyze/process the data stated below:

- Measure blood pressure
- Measure heart rate
- Measure body temperature
- Actigraphy - measure sleep cycles

After the data is processed we can give some solutions to reduce the stress the user has:

- Produce healing vibration
- Produce vibration to wake up
- Breathing exercise notifications
- Connect to Spotify to play music to reduce stress
- Send notifications to have the user walk if inactive for a certain amount of time

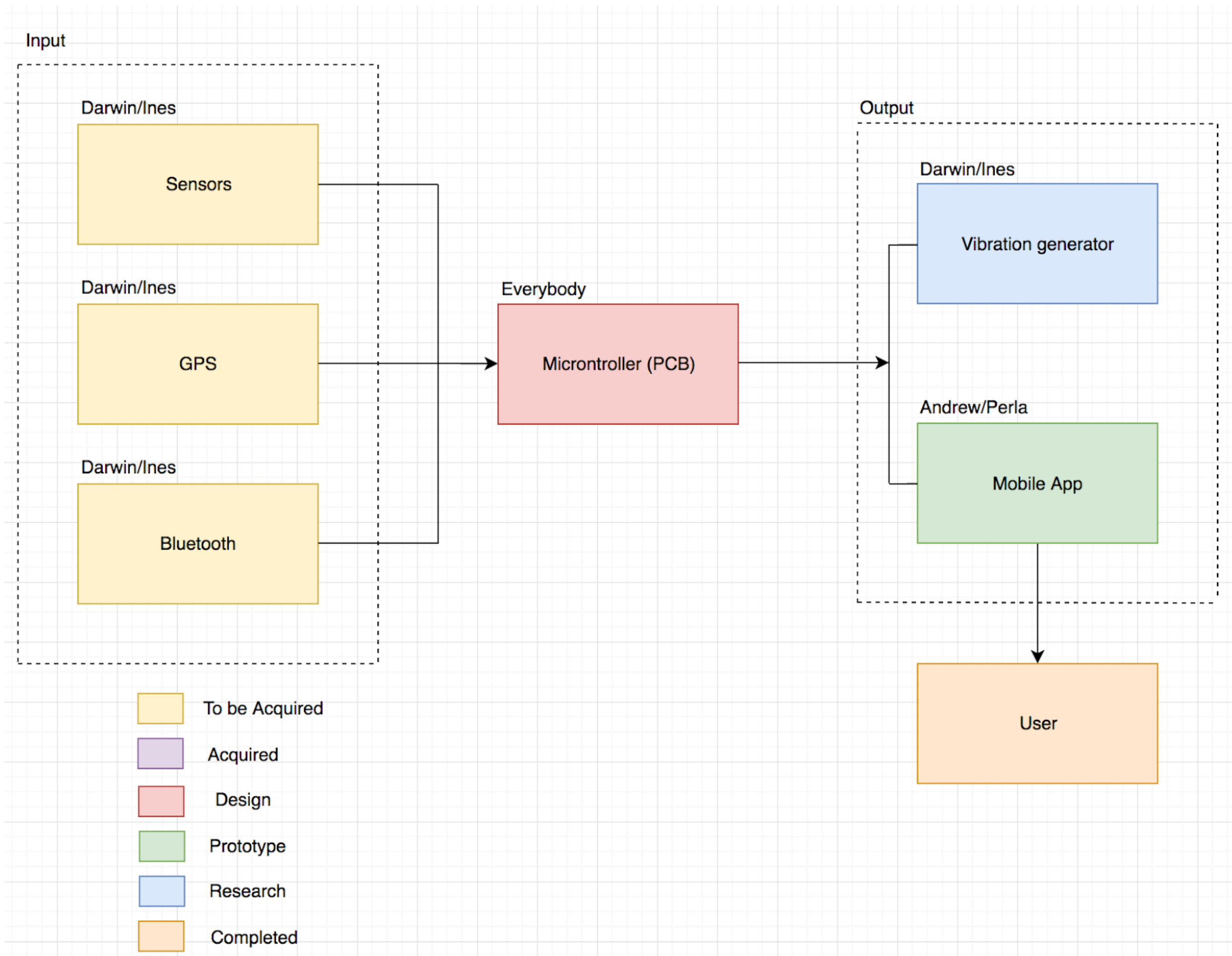
Requirements

- Sensors
- Lithium Ion Battery
- Music player API
- Mobile Application/Web Application
- 3-D Printed Case made of Nylon and/or ABS
- Bluetooth
- GPS tracking
- PCB
- Battery charger
- Regulators
- Pulse monitor

Constraints & Related Standards

Some of the project constraints are how many features we can pack into the watch, as the more features, the harder it is to implement it. This leads to size constraints - we do not want a watch that is too bulky for the user to use, considering the size of the sensors and the power source that it is running on. This device will be similarly based on the Apple Watch Series and/or Fitbit. In terms of dimensions, we should aim for a maximum case size of 40 mm x 34 mm x 10.7 mm. In terms of power, we should aim for a lithium ion battery. For connectivity, we are going to Bluetooth, as it will use less power than WiFi and give us greater control for connectivity for our mobile/web application. The standards used in the design process of this device are Institute of Electrical and Electronics Engineers standards (IEEE) and the National Society of Professional Engineers standards (NSPE). Moreover, standards such as IPC and The American National Standards Institute (ANSI) standards will be required for the PCB and the electronics industry.

Block Diagram



Project Budget

The project will be self funded, with the total cost of the project being split evenly by the 4 of us.

Items	**Estimate**
ABS/PLA	$ 25/kg
Lithium Ion Battery	$30
PCB	$40
MCU	$30
Bluetooth Sensor	$5
GPS sensor	$10
Other unaccounted sensor	$25
Additional parts for testing	$35
Total	$200

Milestones

General

Milestones	**Due Date**
Define	September 20, 2019
Research	December 2, 2019
Design	December 1, 2019
Prototype	April 15, 2020
Test	May 1, 2020

Senior Design 1 Deliverables:

Required Documents	Deadline
Initial Project Document - Divide and Conquer	September 20, 2019
Updated Divide and Conquer (V2)	October 4, 2019
Standards Assignment	October 25, 2019
60 Page Senior Design Draft	November 1, 2019
100 Page Submission	November 15, 2019
Final Document	December 2, 2019

Senior Design 2

Required Items	Deadline
Prototype	April 15, 2020
Test	May 1, 2020

Decision Matrix

Both projects were given a score from 1 - 10 (the higher the score the better) for various categories in order to assist with making a decision.

	Study Spot Finder	Stress Relief Wristband
Cost	9	4
Sponsorship	0	0
Familiarity	8	6
Goals	6	6
Motivation	6	8
Total	29	24