The Android Based Visual Sensory Substitution Device

Brian Volpe, Matt Colletti, Jordan Sudario-Cook *Biomedical Engineering, University of Rhode Island*
September 12, 2011 <Brian_volpe@my.uri.edu> <mcolletti@my.uri.edu> <jsudario-cook@my.uri.edu>

***Abstract*— Our device will use image processing to translate motion to vibrations that can help the visually impaired. By programing an android based cellphone we can create a small visual sensory substitution device.**

I. Introduction

A sensory substitution device is a tool that takes stimuli from one sense and transforms it into a stimuli of another sense. This aid is used to help certain sensory impaired people. Our device is designed to help visually impaired people by using their sense of touch. With a cell phone camera we will develop an application that relays the motion of an object into vibrations that correlate to the direction of the object.

Figure 1. Android App

II. PROJECT MANAGEMENT

Our project management goals are to design a functional Android based visual sensory substitution device that follow the FDA guidelines aids the visually impaired people around objects. Setting a project timeline we have set dates for design implementation and completion. Having a project manager (Brian Volpe), hardware designer (Jordan Sudario-Cook) and software designer (Matt Colletti), we will develop and utilize our individual skills and abilities to collaborate them as a team towards our project goals. By meeting twice a week, once during the class period on Friday (1 to 6PM) and the other on Wednesday (2 to 5PM) we will be able to keep up with our deadlines and communicate effectively throughout the group.

III. DESIGN PROCESS

For our design process we will use an Android phone to relay motion information to a belt with buzzers as a sensory substitution device to allow the user to feel which direction the motion is coming from. By creating individual components separately we hope to reduce the complications and make trouble shooting easier. Planning our project we have decided to first design the image processing component for the Android based phone. From there our hardware manager will build the belt with multiple buzzer in a semi-circular pattern. Then we will create a circuit using a microprocessor that will be connected to the belt. While designing this device we have taken into account the FDA regulations and standards for medical and electrical devices. Some of the medical standards we adhered to are IEC 60812 (Failure Modes, Effects, and Criticality Analysis), IEC 60601-1 (Medical Equipment Part 1 – General requirements for safety) which reduces the risk of physical hazards such as electrical shock, fire, and excessive energy output. The electrical standards we adhered to were ROHA – Restriction of Hazardous Substances and IEC 60062, the standard for markings of resistors and capacitors.

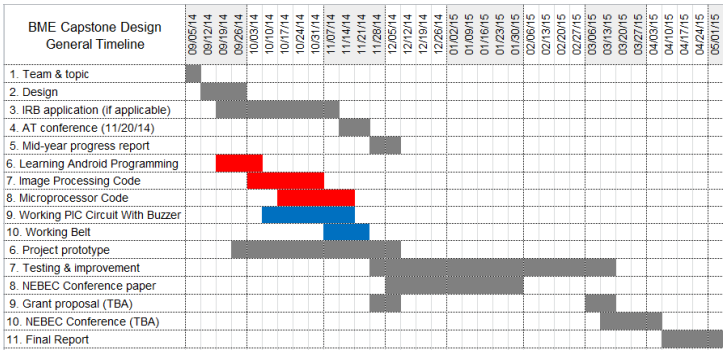

Figure 2. Project Timeline

IV. Methods

This device relays motion information to an Android based Smartphone through touch/auditory sense. Then using Matlab and an Android Eclipse programming environment we will design and create an algorithm for image processing where we

will set an image to grey scale and work on a way to cancel out smaller noise in the image and focus on big objects to be picked up. The algorithm will take a video and take multiple images and determine differences in the images that relate to motion. These larger objects will be determined by the number of pixels we choose for it to be recognized. We will also implement an accelerometer, which will be in the smartphone, to allow the camera to tell that it is stationary so that movements of the camera do not relay motion information. With the assistance of a vibrating belt, we can translate the objects of a certain pixel size to a vibration on the belt depending upon the objects size. From here, we can write an Android app that uses the camera to relay the incoming information to the algorithm for it to be read and then translated to a set of vibrations to tell the user where the objects are in front of them and how big they are.

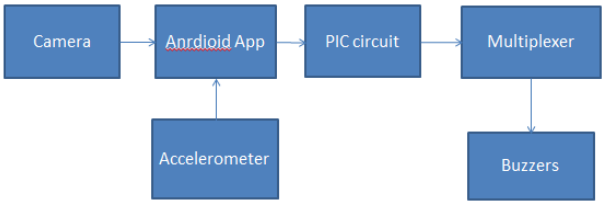

Figure 3. Block Diagram

REFERENCES

[1] Wikipedia: Biomedical Engineering <http://en.wikipedia.org/wiki/Sensory_substitution>

[2] FDA Classification Database <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpcd/classification.cfm>

[3] Blake G, Bly RW. *The elements of technical writing*. Longman, 1993.

[4] Wu J, Sun Y, DiCecco J, Hill R. A universal instrument for biological measurements, stimulation, clamping, and processing. *31st Annual Northeast Bioengineering Conference*, pp. 25-26, 2005.

[5] Sun Y, Wu J, Collis L, Hill RB. Apparatus for neuromuscular measurement and control. US Patent No. 7,489,965 B2, 2009.