NaviGlasses Final Report

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Introduction

a. Statement of Purpose

Our project was a fragment of wearable navigation technology that helps to navigate between a particular origin and destination through vibrations that signify the direction in which a turn must be made. The primary objective of this project was to create a way to navigate without the need to look at a screen while on the street. Eventually, we realized that what we had come up with could also be seen as a valuable innovation for the blind to navigate.

b. Features and Benefits

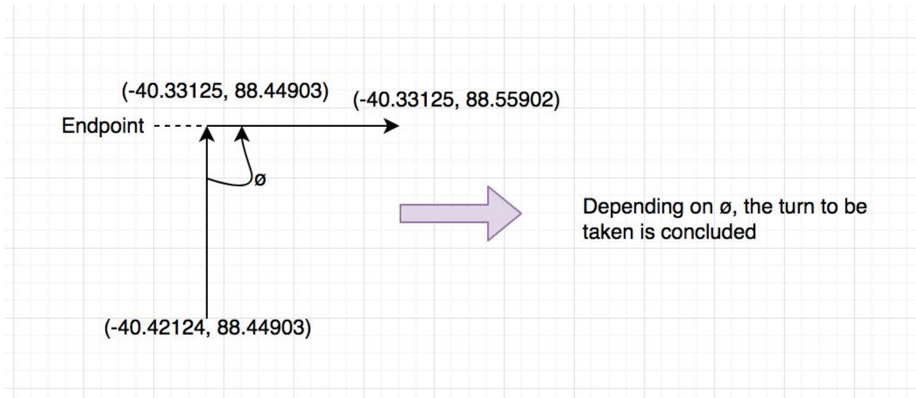
The hardware, the wearable portion of the project runs in conjunction with the phone. On the phone, the user can enter their start and end location and the phone will communicate with the circuitry to specify in which path to travel on. Depending on the turn to be made, a vibration motor on the respective side will activate to mention the turn to take.

Design

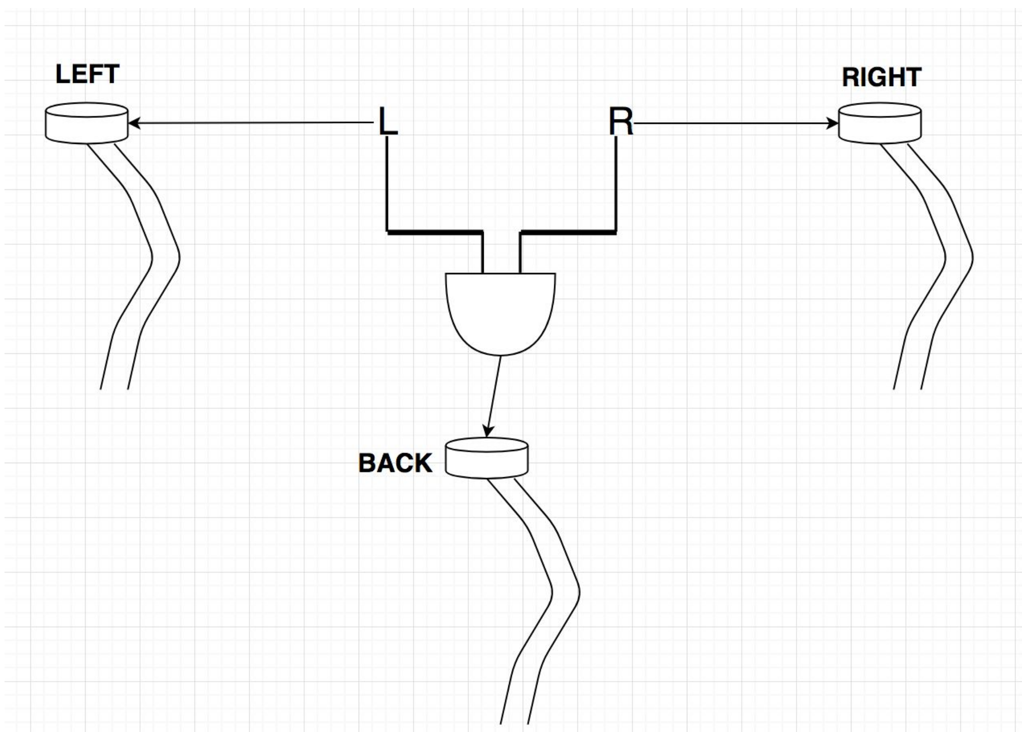
System overview:

Android Software-We used MIT's app inventor to create our android app. The app exists to communicate location information and information about the route to the Arduino. The app also creates a user interface to serve as our front end. The app has three main tasks: determine the waypoints, transmit the waypoints, and transmit current location information. When the user enters a starting and ending location, the app uses this information to query the Google Maps Direction API. The query requires 5 parameters: origin, destination, key, mode, and, Departure_time. The final three parameters are hard coded to our API key, "walking" and "now" respectively. When the query is made and the response is received, we parse the response. The parsed results are an array of waypoints which is sent out over bluetooth. The app also polls the location sensor of the phone and transmits that as well.

Arduino Code-The Arduino receives a string that describes the complete path of the journey with data (latitude and longitude) of every point of the path at which a turn must be taken. The Arduino also receives a current location from the phone to keep track of when to notify the user of the turn. When the user arrives at a turnpoint the code identifies the angle of change in direction between the future path vector and previous path vector as follows:



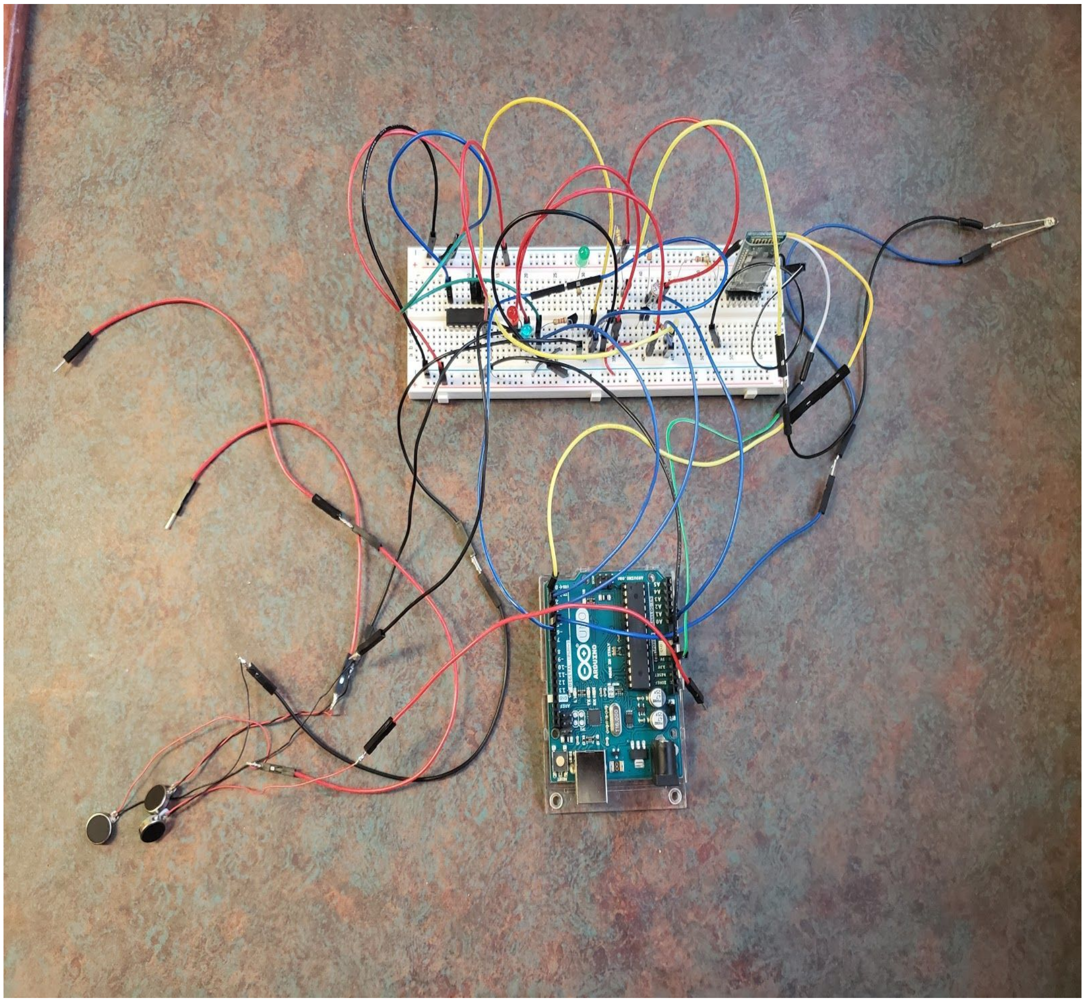
If the turn to be taken is Right, the “R” signal connected to pin 4 of the arduino is activated, and if it is a left turn, the “L” signal connected to pin 2 of the arduino is activated.

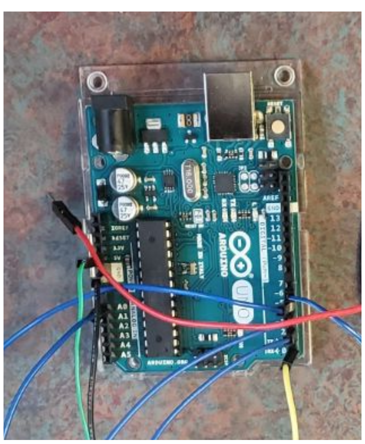


Digital Logic Element:

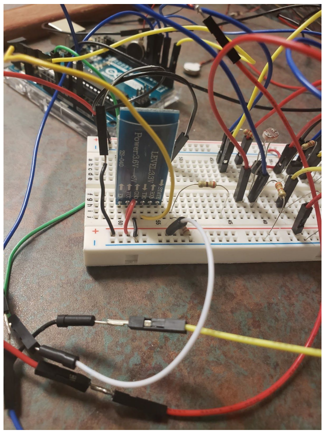
If both the signals are high at the same time, the motor at the back of the head is also activated through an AND gate which signifies to the user to go back when they miss a turn.

Refer to Fig.1 in Appendix for Additional schematics

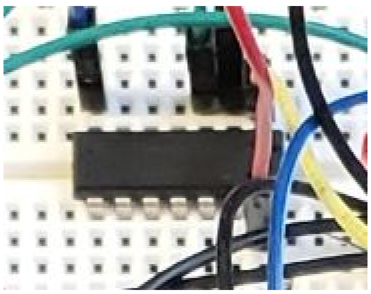




- Digital Pin 0: RX
- Digital Pin 2: Left
- Digital Pin 4: Right
- Digital Pin 5: Photoresistor Output
- Digital Pin 6: Alert



This is the HC-05 Bluetooth Module. It receives information and sends it to the RX pin on the Arduino. It is powered with the 5V line of the Arduino.



This AND gate is used to trigger the alarm vibrator using the right and left vibrators in case to person walks too far from the desired turn.

This is a photoresistor that helps the consumer detect incoming traffic during nighttime.

Results

Sensor Characterization

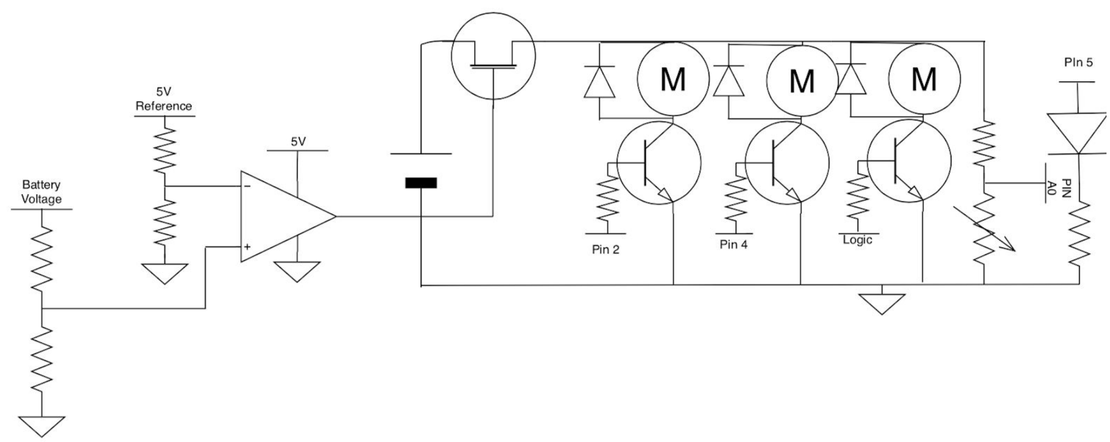
We used a photoresistor as one part of a two resistor voltage divider to determine if it was night or day. The photoresistor varied its resistance between a high in the hundreds of kiloOhms and a low of approximately 80 ohms. Used the oscilloscope to measure the voltage in the middle of the divider. The scope showed that the voltage varied between 2.0V and 0.6V when it is bright and dark respectively. We decided to set the threshold at 1.6 volts. The voltage was read by an analog pin on the arduino. If the voltage was below 1.6 volts, we would turn on the LED.

Testing

The final product was able to receive current location at regular intervals from the phone and use the information to give appropriate directions to the user. However, since the app was only able to identify and share a displacement larger than 20m, most testing was done by simulating the current location with an array of current locations filled with the endpoints of the path after we were confident that the motors gave the right directions at an endpoint.

Problems and Challenges

Parsing in app inventor is rather difficult, but it was done. Also, this OP amp comparator circuit which we attempted to implement as a safety feature for when the battery voltage went too low. This circuit did not work. We would need more time to examine the circuit more closely, however our initial suspicions is that the 5V reference decays as the battery voltage drops which would never turn the circuit off.

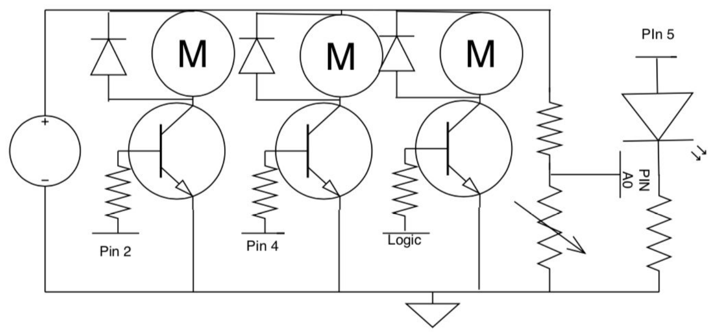


Future Plans

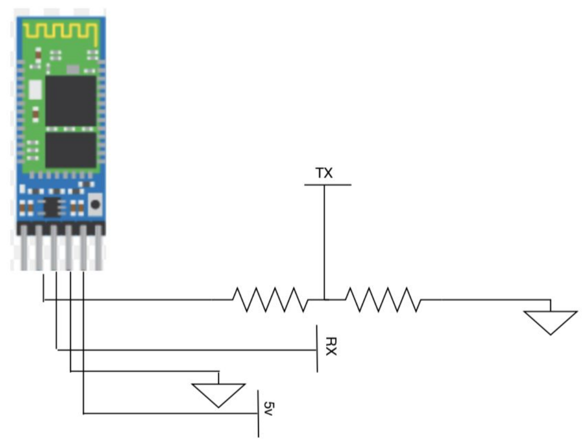
There are many new ideas we would like to implement to our current product. Firstly, we will integrate a compass to our device to detect the direction the user is facing, and change the direction of the turn accordingly. Additionally, we would like to proportionally alter the intensities of vibration between both the motors depending on the angle of turn. Also, we plan to use a more efficient app that can detect change in coordinates more precisely.

Appendix

Fig. 1:



M
M
M
PIn 5
PIN
A0
Pin 2
Pin 4
Logic



TX
RX
5v