envision today

Written Progress Report for NaviCane: Navigation-Assisting White Cane

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Introduction/Background

Envision Today is developing a mobility aid for visually impaired users. This Navigation-Assisting White Cane (NaviCane) is capable of guiding visually impaired users to unfamiliar places as well as regular travel to familiar destinations. By using our client software, the users will input their origin and destination. The directions will be queried and Google Maps API will return the corresponding walking routes. Afterwards, the walk routes will be programmed into the microcontroller. The microcontroller uses the GPS and compass modules in order to accurately track if the user is walking in the right direction. The ultrasonic sensors and vibrational motors provide haptic feedback during travel to avoid obstacles and follow the programmed routes. The NaviCane consists of a basic white cane with an ATMega32U4 microcontroller attached within the handle. The cane's handle is being developed by our team, in order to provide ergonomic features and hardware protection.

Schedule

Figure 1 below shows the original NaviCane's development schedule.

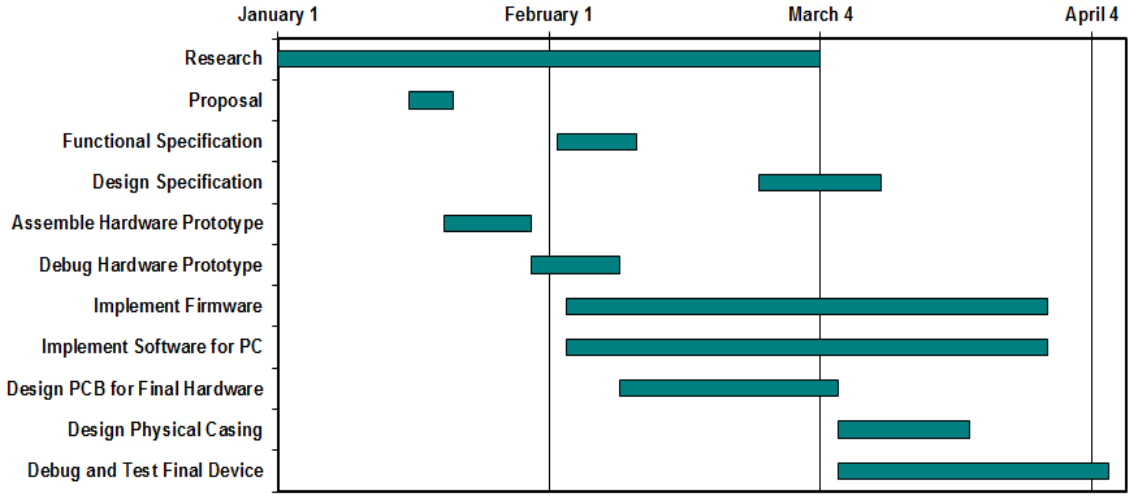

Figure 1: NaviCane's Original Development Schedule

Note that due to unforeseeable circumstances while coming up with new design solutions, we are currently about a week or two delayed from implementing the final product. With constant changes to the design features of the NaviCane, we had postponed the design of the final physical casing until the hardware implementation is deemed complete. We expect the mechanical casing to be completed by April 13. Along with the physical casing, the debugging and testing process has been shortened and postponed until April 13 when the case will be complete. The firmware and software is on schedule and is currently undergoing the final touches of debugging and testing. The main hardware components have been implemented but it is still necessary to fine-tune and test the haptic feedback for the end-user.

Financial

Envision Today is currently financially stable and we do not expect to require any additional expenditures. The primary source of funding for Envision Today was obtained through the Engineering Student Society Endowment Fund (ESSEF) where we were granted $500. This fund was used to purchase the majority of the hardware components (such as the GPS, microcontroller, ultrasonic sensors, magnetometer, vibration motors, and the charging systems) as well as the physical cane. We have also received a funding of $50 from Simon Fraser University in order to obtain miscellaneous electronic components such as capacitors, wires, and headers.

Progress

Research

With regards to research, we had reached out to third party organizations such as CNIB, ASIC, WAPVI, and the “Eye of the Dragon” dragon boating team. Since then, none of these organizations have responded to our request for a focus group consultation. During the oral progress report, Dr. Rawicz advised us to reach out to SFU Disability Office. However, we were already well into our design phases that it seemed unlikely for us to change our design.

Mechanical Design

For the progress of the mechanical design, we are finding alternative materials to construct the NaviCane handle that will enclose all the electronic components. We talked to Vincent’s relative who works in a cabinet construction company that is willing to give us left over wood to build our design. We are still in the testing stage (testing done on breadboard) in getting all the components to do the core functions of the device before finalizing and soldering all the components together onto a custom PCB. This process should be done by the end of the week. We already have the dimensions of all of the electronics components but not the size of the PCB. When the size of PCB is finalize (end of the week), the construction of the NaviCane handle casing begins after.

Embedded Software

Currently, the code of what is considered the core functionality of the device is mostly completed with regards to the ultrasonic sensor object detection and algorithms concerning the storing and processing of routes and waypoints. The sections that remain outstanding are the implementation of interrupts (switches), motor control, small sections of the serial communications and extra functionality such as the implementation of alternate routing. We have also tested much of the waypoint routing algorithm. We have tested the sensors to make sure that the output is correctly detecting obstacles blocking the path. We are on progress of adjusting the user interface for the interaction between the vibration motors and ultrasonic sensors and waypoint routing decisions that affect the user experience. The majority of the work currently focuses on solving the issues related to the serial communications as without this crucial task, we will be unable to load the list of waypoints necessary to navigate the user. After this, we expect to move onto completing the interrupts and then finding a good solution for

alternative routing which has been identified by our investors as an item of importance. The work on interrupts is currently being held up waiting for the switches, LEDs and other miscellaneous circuit elements to arrive.

Software Application

The software application is able to communicate with Google Maps API and retrieve the appropriate data for the user's requests. The client software relies on the user to manually enter the origin and destination. Speech-to-Text software has been tested to ensure that it is possible for a visually-impaired user to request directions. Directions are displayed in a browser for the user or a 3rd party software to read. The software takes the longitudinal and latitudinal coordinates from the Google Maps API and programs it into the data. The outstanding part of the software application deals with the serial communication with the microcontroller. At the moment, the software is able to write to the microcontroller, but unable to read from it.

Remediation

Depending on the status of wooden material for mechanical design, we have planned an alternative solution to use Lego pieces in order to construct an appropriate mechanical casing for the hardware. Lego pieces will not need to be purchased if we do pursue this route as we have excess Lego pieces. The design aspects for both mechanical designs will be similar in order to ensure hardware protection.

With regards to the communications issue between PC and microcontroller unit, we currently have multiple alternative solutions planned in the case that we are unable to solve our current method. These solutions may introduce newer bugs and have varying degrees of inefficiency but in the worst case solution can be utilized. These include avoiding event based communications on the PC side and simply implementing a timeout and/or one-way communications. We will make all attempts to salvage our current event driven communications if possible by also requesting help from the Arduino and C# community at large but if a solution is not found within a reasonable period of time (a week at maximum) then we will default to one of the previously mentioned work-arounds. We expect that solving this problem will extend us a few days out of our planned schedule and push full system testing further back but we do not expect this problem to affect our final deadline. The delay on miscellaneous parts for the interrupts and switches may delay us a few more days and should they not arrive within a week, we may simply be forced to purchase some elsewhere. It is highly possible that a solution for alternative routing may turn out to be highly costly for the device. Solutions would have to include expanding the memory of the device which may not be possible within our time-frame.

Summary/Conclusion

We fully expect to be able to meet our final deadline for the completion of the device and plan on being able to perform a full demonstration of the device by April 23rd. We also expect to have a filmed demo of the product being used by this date. All current issues with implementation are being actively resolved with alternative solutions in mind and only minor alterations to the schedule are expected.

