Senior Design I Initial Project Document

Optical Supplemental Navigation Device

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Project Narrative Description

The blind and visually impaired face different and unique challenges every day. One of these challenges includes navigating around a room, which may contain objects and boundaries unknown to the individual. Unknown objects pose a threat of tripping and even the possibility of injuries. The blind and visually impaired must navigate with caution in new areas as well as familiar ones. There is always a need to be cautious. Something, like a chair, could be moved and change even the most familiar settings. Currently, to help the blind, canes and guide dogs are both options to circumvent through these obstacles. A guide dog is highly beneficial for sensing the surroundings at a farther distance, however, there are still many things the dog cannot communicate to the individual. Not everyone blind or visually impaired is fortunate enough to have a guide dog though. This can be either for reasons of price, care, or allergies. Canes, although very simple, are the standard aid for navigating. Canes do the job and are fairly affordable. They help the visually impaired through doorways or up a staircase. Although very useful, they still are limited to the length of the cane, which can average 41 to 46 inches. Both solutions are a beneficial to the problem, but both also have limitations that we want to improve on. Adding on to this distance limitation can give a better understanding of surroundings and lead to the prevention of accidents and possible injuries.

Our objective is not to create a new solution to the navigation for the blind and vision impaired. Rather the objective of the group is to create a device that will supplement and improve upon the cane or guide dog by increasing their range. We see that the current technology works for the purpose it was meant to accomplish. But given the possibilities with current technology we will improve upon them. We will create a rangefinder that will sense objects or boundaries further outside the current range of a cane or guide dog. The device will use Lidar to detect the range of any object within a certain distance. The range of the object will be transformed to a signal on the individual wearing the device, which will tell him/her how far away the object is. This signals to the individual, that there is something in the way, sooner than the cane or guide dog would, so they can react to the situation better. The response signal works by increasing or decreasing its signal frequency depending on the distance to an object. For instance, if the wearer gets closer to a wall the signal will speed up. To detect things, the individual will have to move the device aiming it, the same way a cane is used. This extra distance the device gives for detection will give the individual a bigger bubble of information and can help make the blind or visually impaired individual more confident with their surroundings. Sensing objects at a further distance out will allow them to move about at a faster pace and allow them to remain safe while doing so.

There are other products on the market designed to solve this same problem. The problems with these are they are either bulky, expensive, or can be considered too complicated. Some might require an Internet connection. We are more focused on providing a product that is low cost, easy to use, and lightweight. We think this can help to reach a wider audience. The simplicity is what makes it attractive to the marketplace. For instance a heavy

system, such as a vest works, however over time it could fatigue the user. Just like most technology now we want to provide a solution that is small and lightweight. The learning curve should also be short. The user will already be comfortable using their cane or guide dog. Adding on our sensor will be learned on the first try. The smaller system should help lower the cost, which is ideal for this product.

Partnership

For this project our team will be working with the Rehabilitation Center for the Blind and Visually Impaired out of Daytona Beach, FL. We will be in contact with Sr. Rehabilitation Specialist Jeff Malzow and Technology Instructor Joseph Carson. Working with the Rehabilitation Center will provide us with essential feedback as we build the device. They will relay to us the navigational problems blind and visually impaired deal with currently as well as critiques to our proposed solutions. We will continue to take their recommendations and work with them throughout our design process.

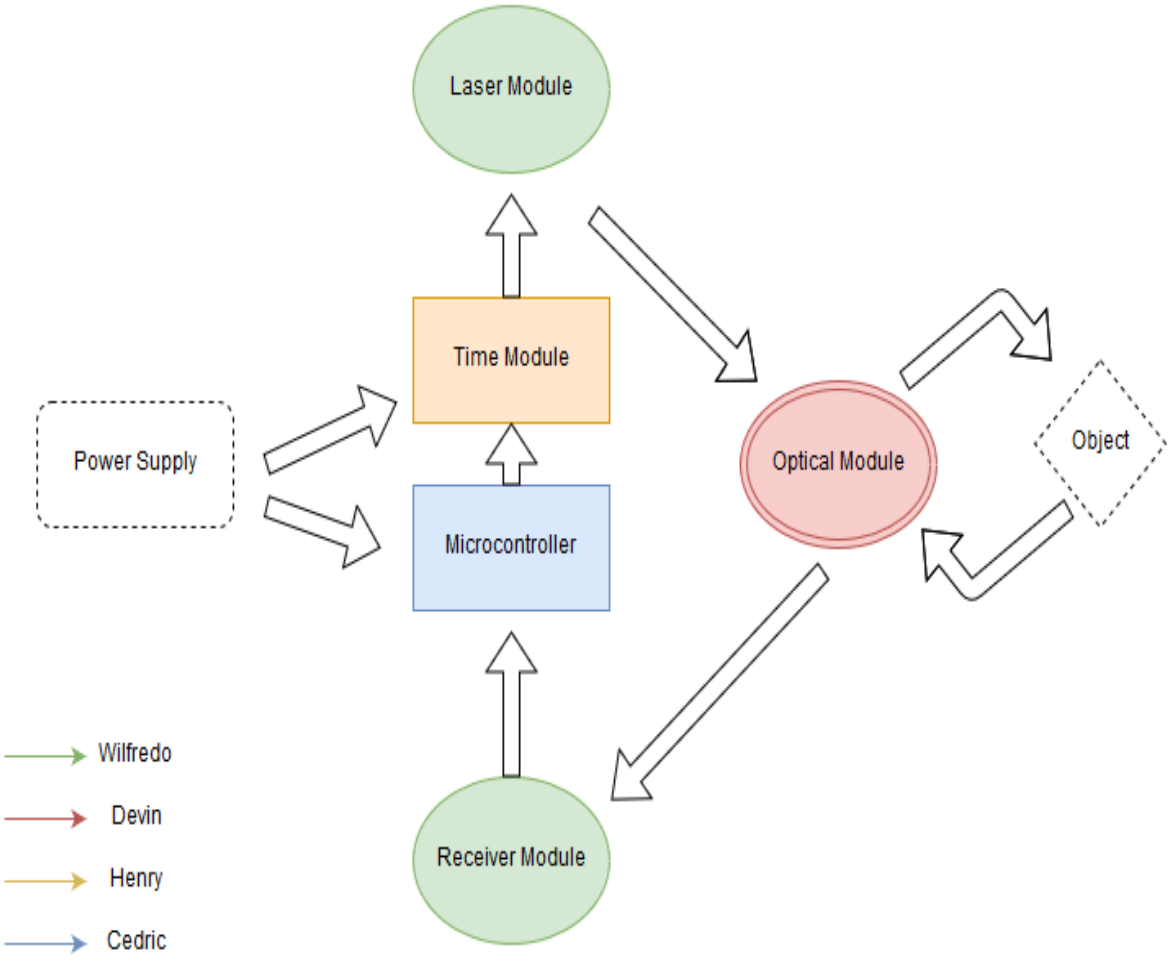
Sponsorship

There is a possibility of sponsorships resulting from a connection with the Rehabilitation Center for the Blind and Visually Impaired out of Daytona Beach, FL. Jeff Malzow and Joseph Carson have expressed their willingness to accommodate our team during this project. We will pursue these possibilities along with any other potential sponsorship.

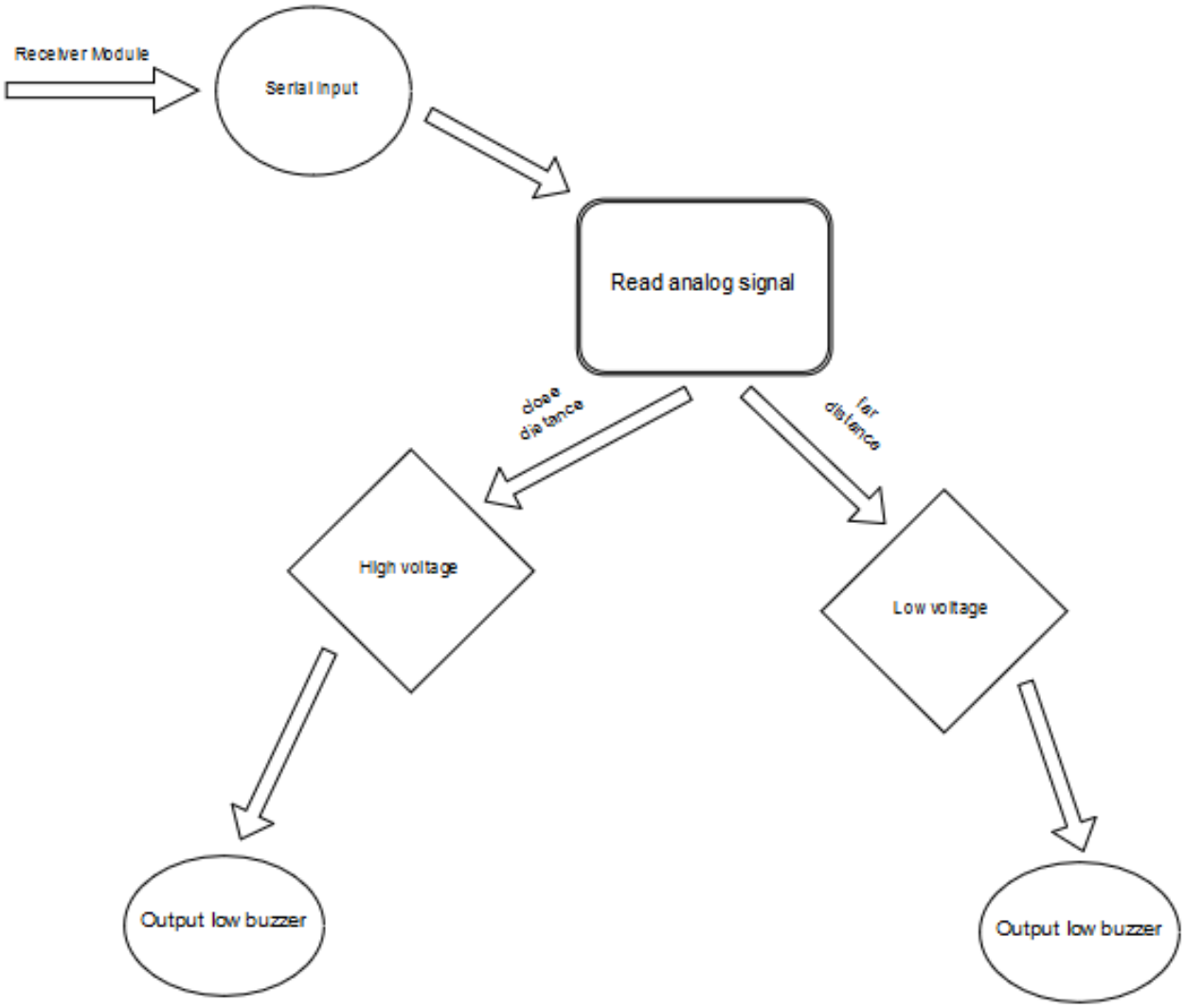
General Specifications

Overall Weight	Less than 20 pounds
Overall Size	Relatively small
Overall Cost	Less than $1500
Input power supply	Less than 12V
Laser Diode wavelength	Emits a specific range
Photodiode wavelength	Detects a specific range
Device Range	Reasonable for intended purpose

System Flowchart



Processor Flowchart

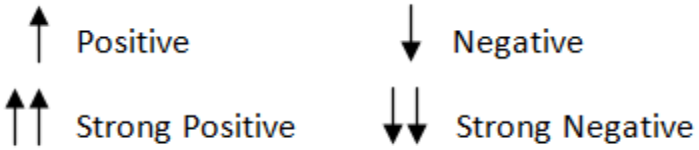


Budget

BUDGET			
Components	Price	Quantity	Total
lens	$ 10.00	2	$ 20.00
Laser Diode	$ 20.00	1	$ 20.00
Laser Driver	$ 15.00	1	$ 15.00
Receiver	$ 200.00	1	$ 200.00
Timer	$ 0.50	1	$ 0.50
Microcontroller	$ 20.00	1	$ 20.00
Power Supply	$ 5.00	1	$ 5.00
Vibrating Motor	$ 4.00	2	$ 8.00
Enclosure	$ 5.00	1	$ 5.00
PCB	$ 25.00	4	$ 100.00
Sub Total			$ 393.50
Tax	7.25%		$ 28.53
Shipping			$ 20.00
Miscellaneous	20% of Total		$ 84.41
Grand Total			**$ 526.43**

*The above chart represents the ideal total cost of the system. In reality, we will be ordering three of each component. The first will be for prototyping, the second for the actual project, and the third to have in case something goes wrong with the project. At the moment we do not have a sponsor, so the worst case scenario is that we split the total cost between the four group members. We will continue to search for an individual or group of individuals willing to sponsor our project in hopes of finding someone.

Engineering / Marketing Trade-off Matrix



		Output power	Cost	Dimensions	Weight	Quality	Install Time
		+	-	-	-	+	-
Accuracy	+	↑	↑↑	↑		↑	↓
Cost	-	↑	↑↑	↑		↑↑	↓
Low Power	+	↑↑	↑				↑
Usability	+			↓	↓↓	↑	↓
Portability	+	↓↓	↑	↓↓	↓↓	↓	↓

GROUP 24 SENIOR DESIGN