



NaviCane: Navigation Assisting Cane

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Vincent Guan, CEO

- Mechanical Design

Edwin Leong, COO

- Embedded Software

Raymond Li, CFO

- Hardware Design

Darren Tong, CTO

- Software Application

1. Background and Motivation
2. Project Overview
3. Project Specification
4. Business Model
5. Future Work & Improvements
6. Acknowledgements
7. References

*“It is not miserable to be blind; it is miserable
to be incapable of enduring blindness.”*

- John Milton



[1]

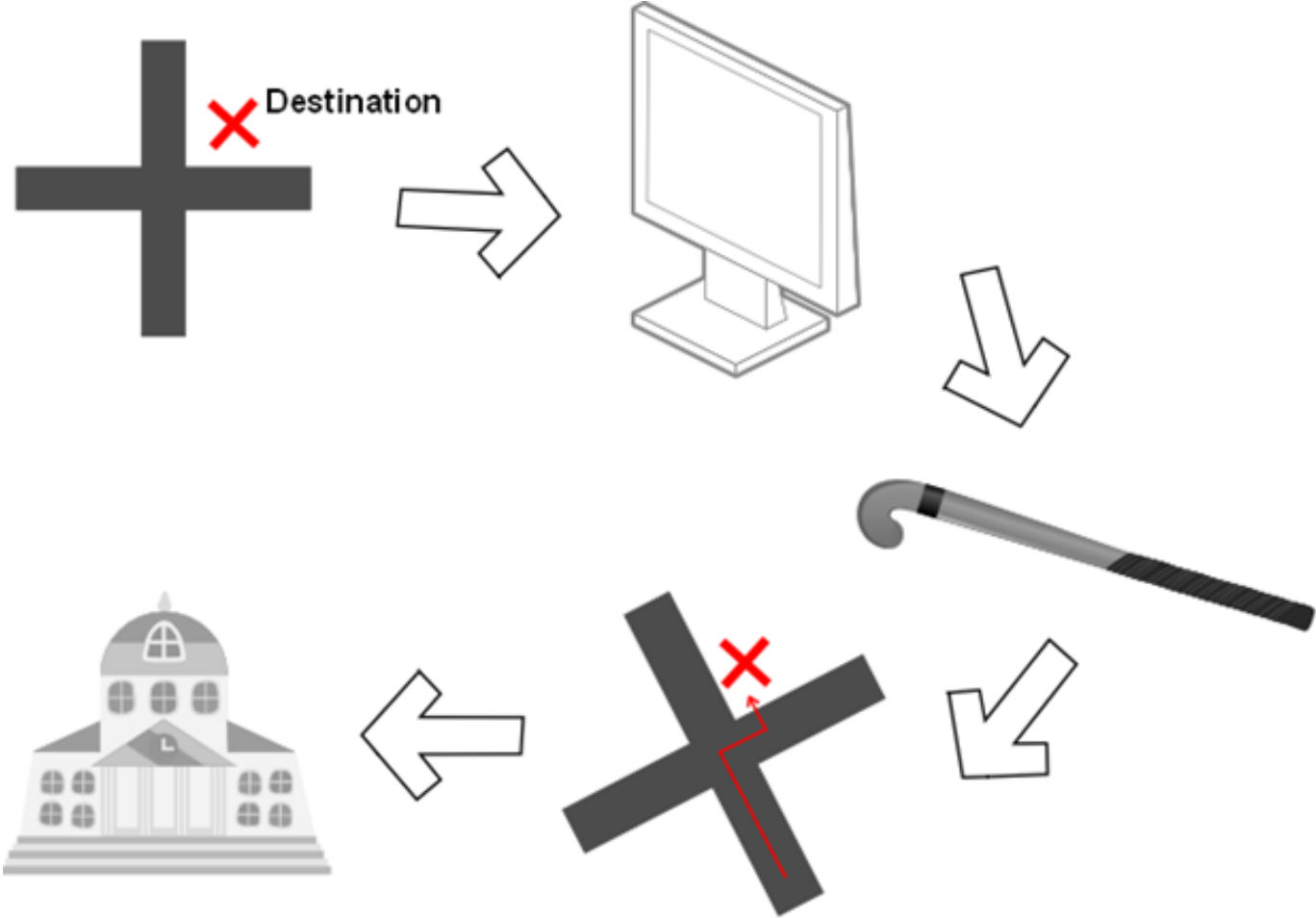


[2]

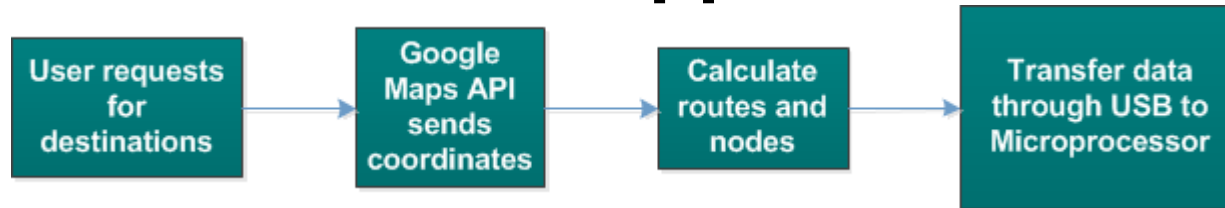


[3]

How do we effectively enhance the travel of a visually impaired user?

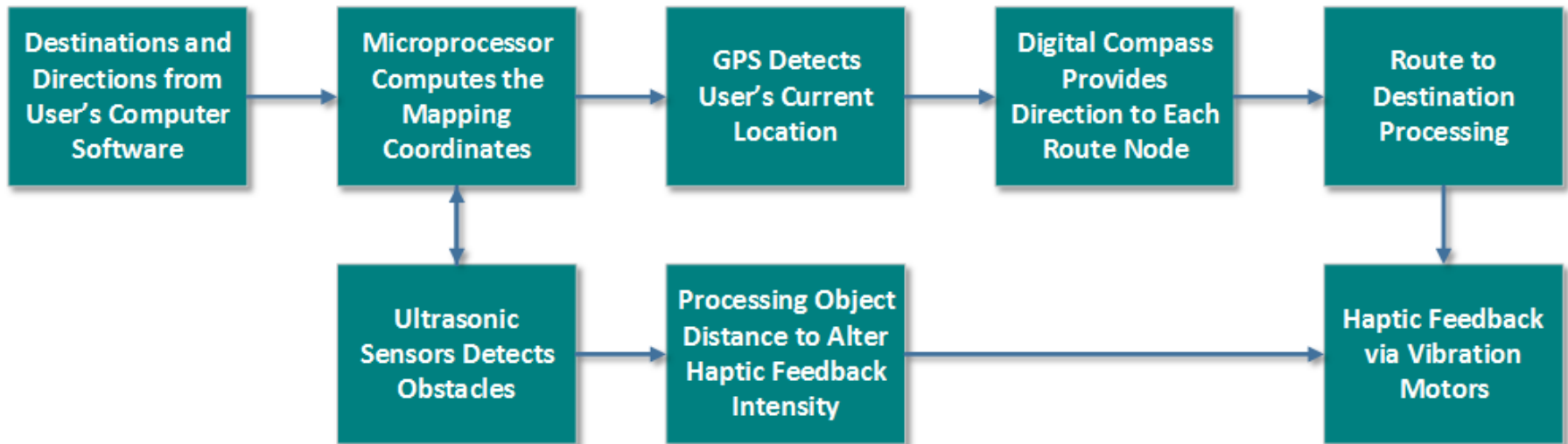


Software Application

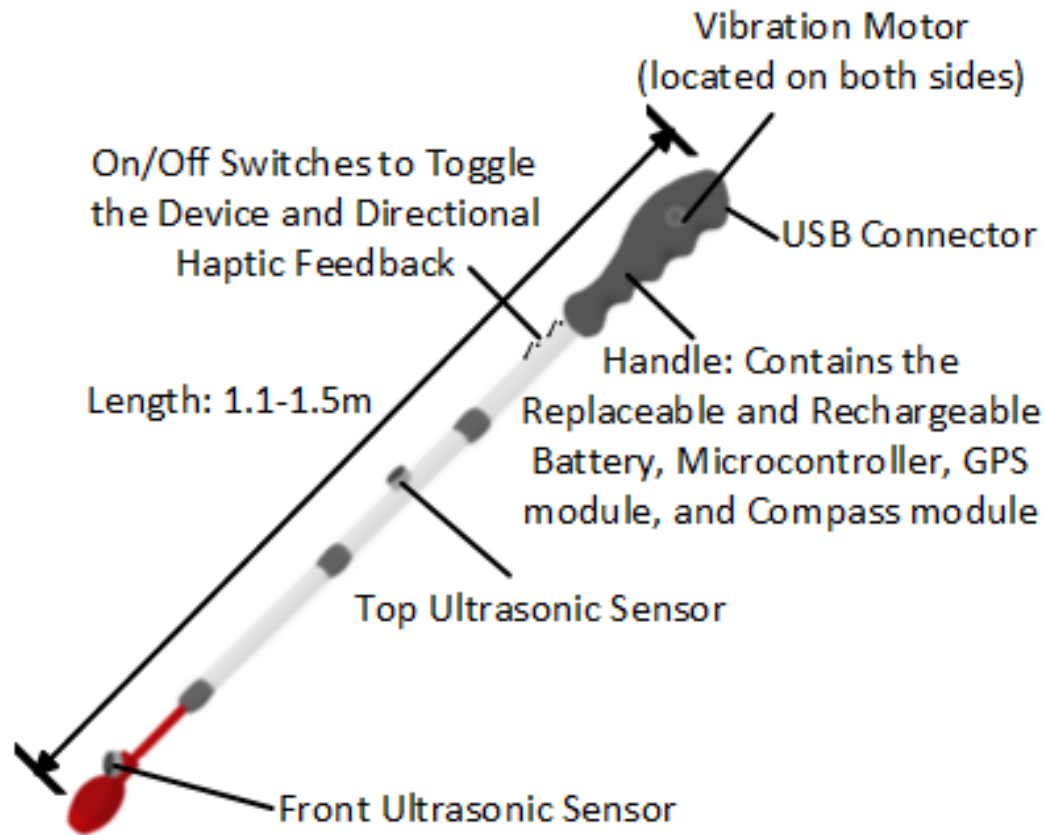


NaviCane

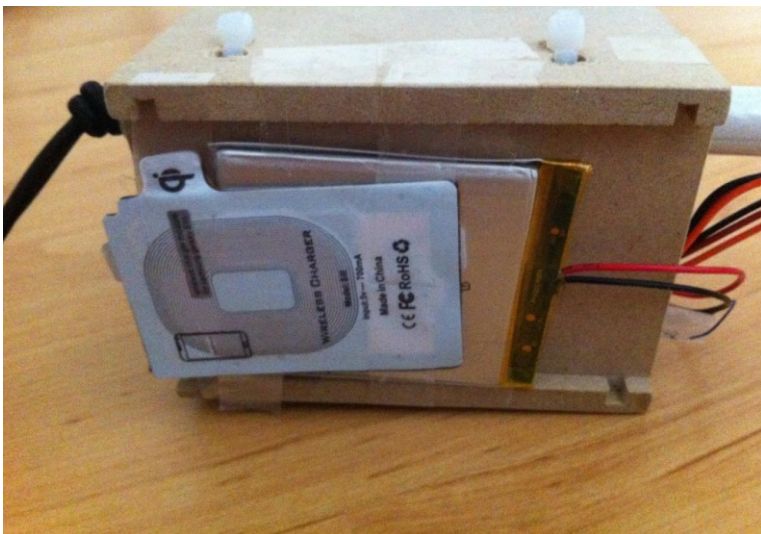
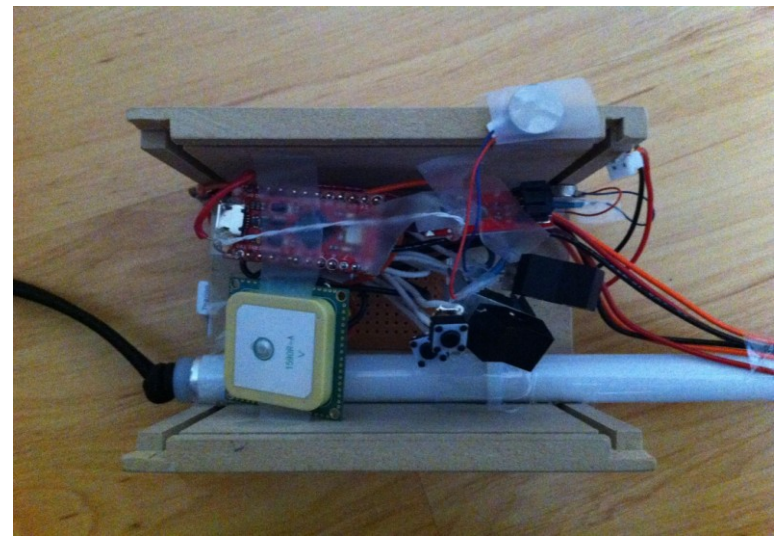
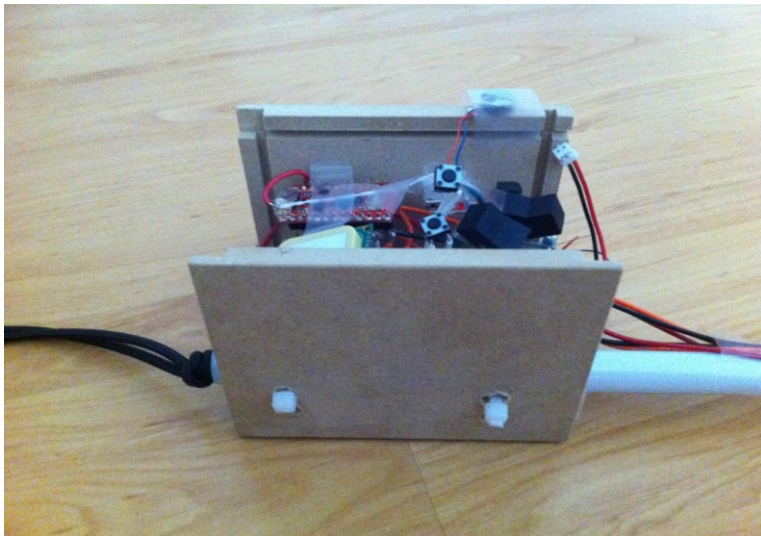
Input



Output







Mechanical Design

Weight:

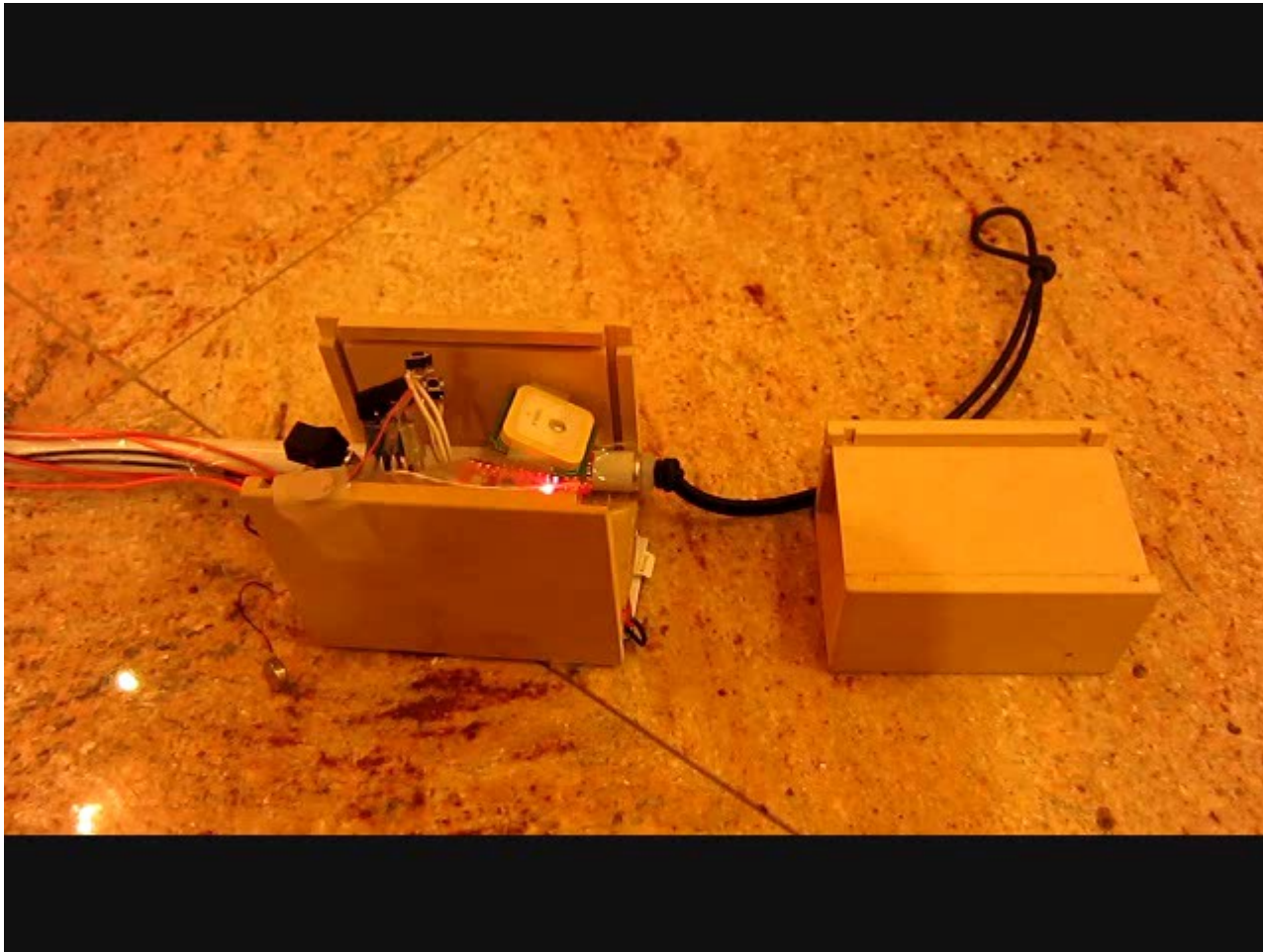
(Cane: less than 300 grams)

Wooden case: weighs 80-100 grams

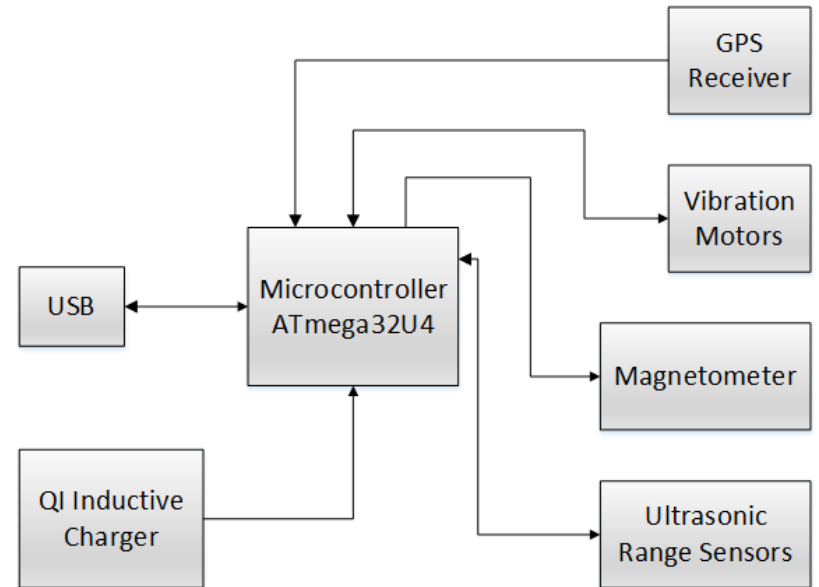
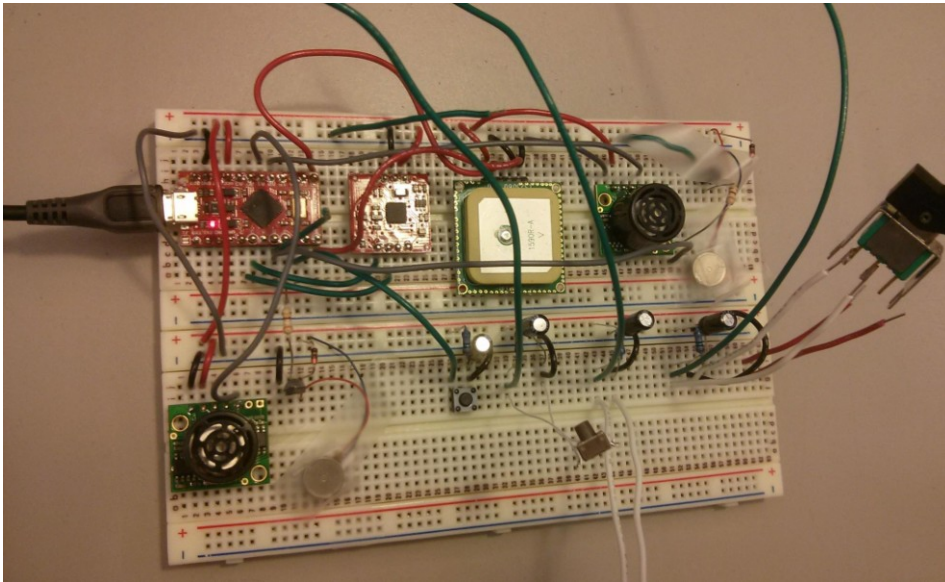
Dimensions:

71mm (w) x 99mm (h) x 75mm (d)

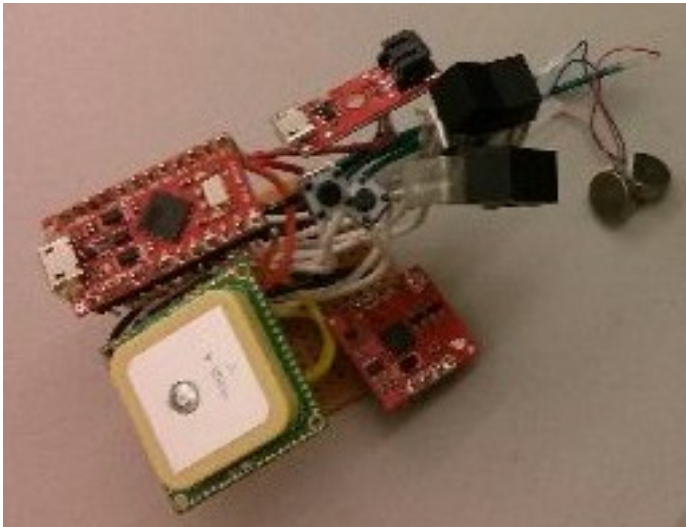
- Slidable doors to allow easy access to hardware components
- Light material for handle
- Hidden slot for battery underneath



Developmental Hardware Design

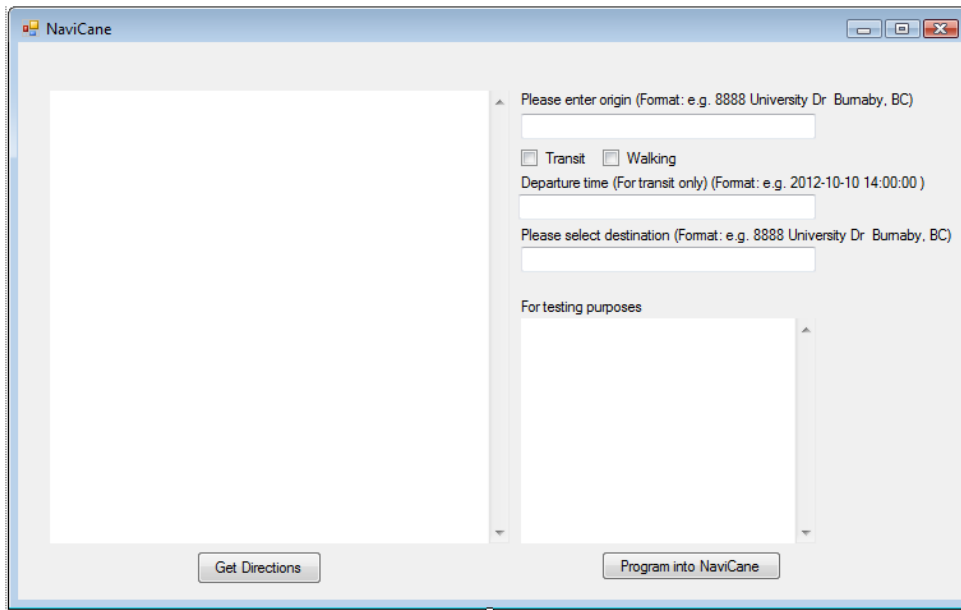


Hardware Prototype

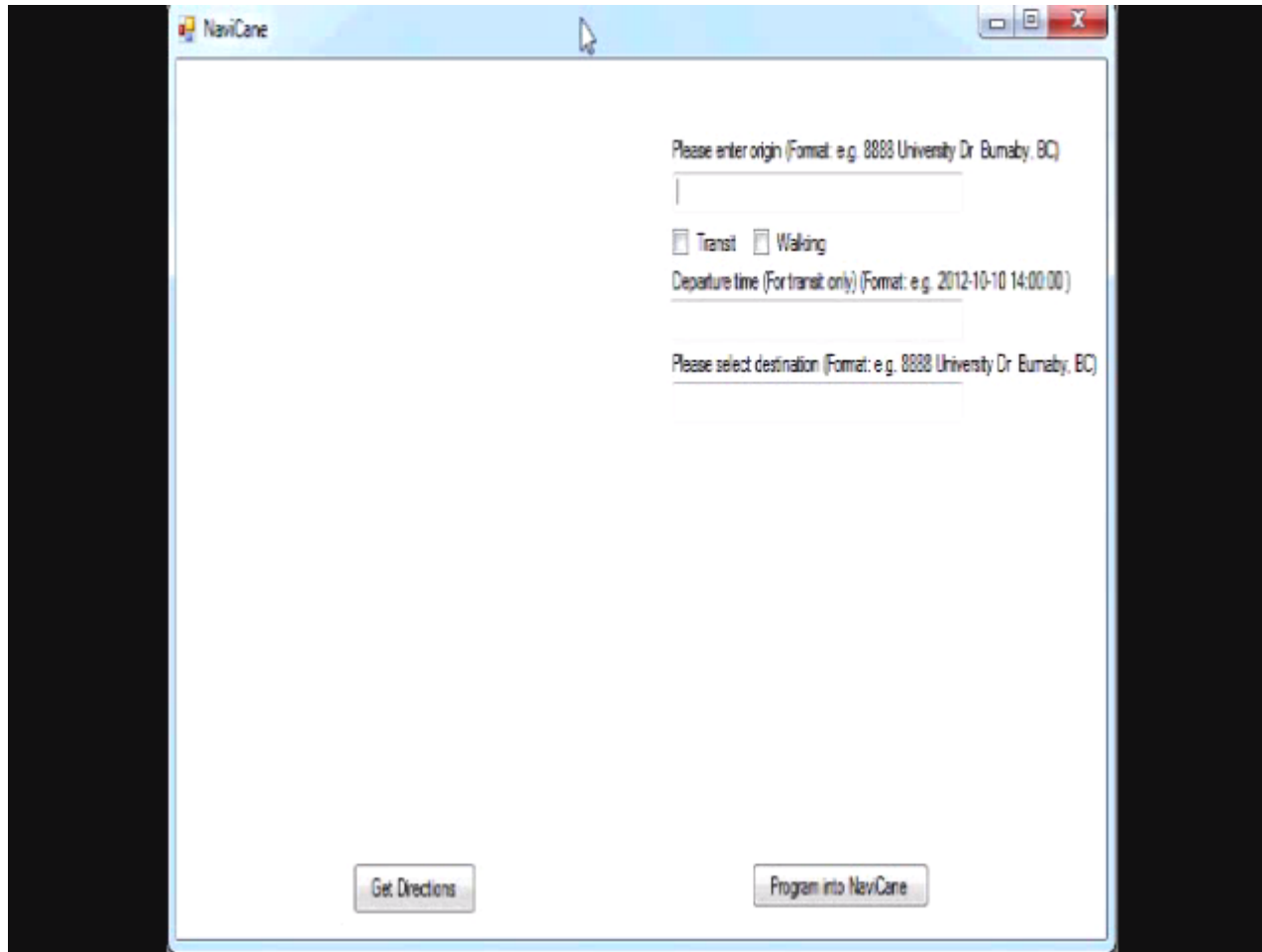


- Two toggle switches
- Two push buttons
- Two vibration motors
- USB charging
- Wireless charging
- Weighs about 50 grams
- Battery life of at least one day during real use

Software Application



- Directions from Google Maps API
- 3 textboxes, 2 buttons, 1 checkbox
- Outputs the GPS the coordinates that Google Maps API provides for the route



Embedded Software

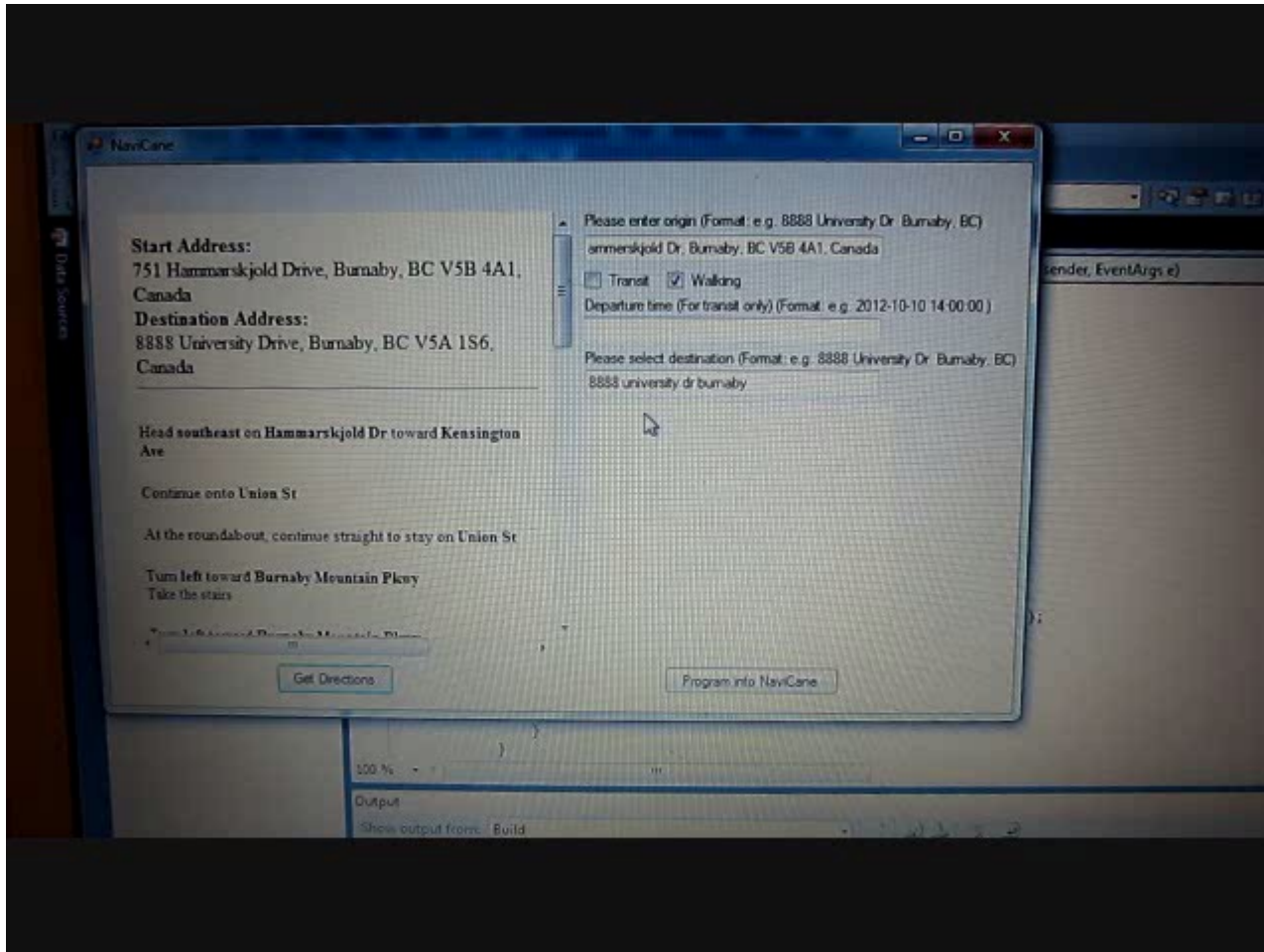
Ultrasonic Object Detection

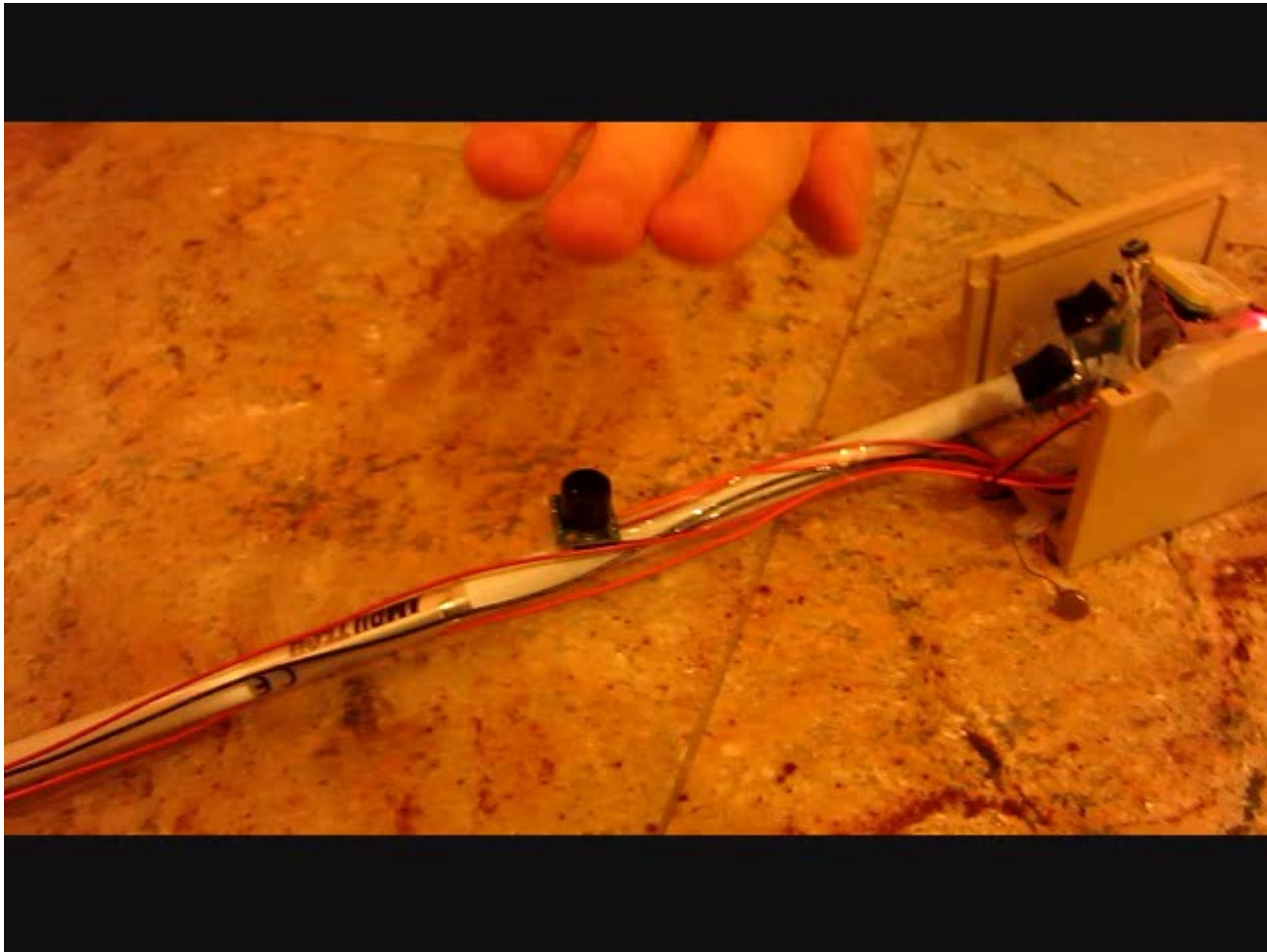
- 2 ultrasonic sensors
- 1 haptic feedback motor

GPS Navigation System

- GPS module, communicates to satellite
- Compass, determines direction
- 1 haptic feedback motor

Serial Port Communications





Market

- 31.9% of the participants surveyed indicated they require the use of a white cane. [6]
- Estimated that 285 million people worldwide are visually impaired, equating to roughly 4% of the entire human population. [5]

Market

- In 2001, about 196,000 people with a "severe" limitation in seeing have access to the Internet, and about 102,000 persons with a severe limitation in seeing use a computer on a regular basis. [7]

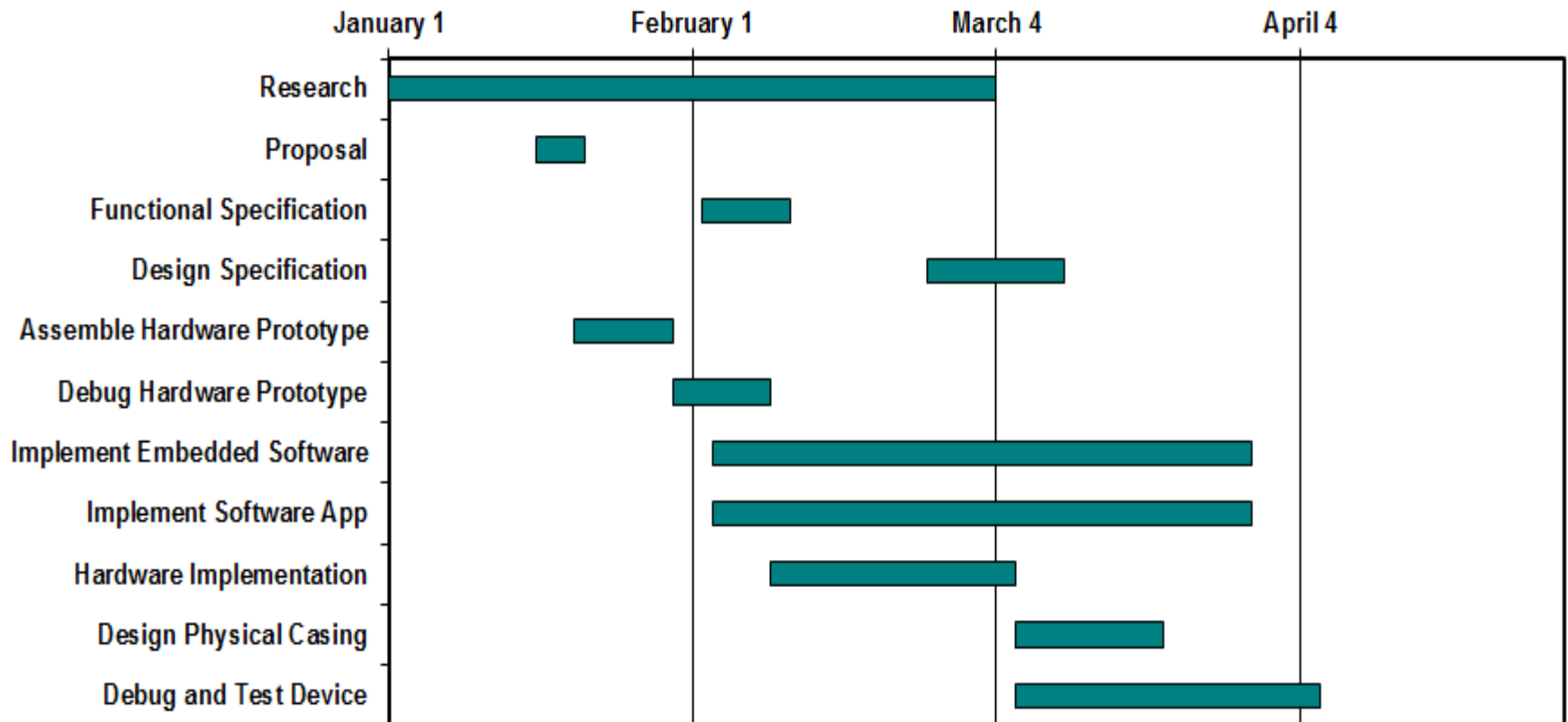
Competition

Competitor	Pros	Cons
Guide Dog	<ul style="list-style-type: none"> • Live reflexes to determine safety • Genuine interactions with a companion 	<ul style="list-style-type: none"> • Training one costs over \$35,000 [4] • Raising costs ~\$700 per month
White Cane	<ul style="list-style-type: none"> • Cost-efficient; averages ~\$40 • Introduced for almost a century, after WWI 	<ul style="list-style-type: none"> • Only provides basic functionalities • Cannot detect obstacles not within the cane's reach
GPS for Visually Impaired	<ul style="list-style-type: none"> • Allows audio feedback to communicate with user • Independent mobility device 	<ul style="list-style-type: none"> • Cannot determine if proposed route is applicable • Not discreet • Can cost up to \$2000

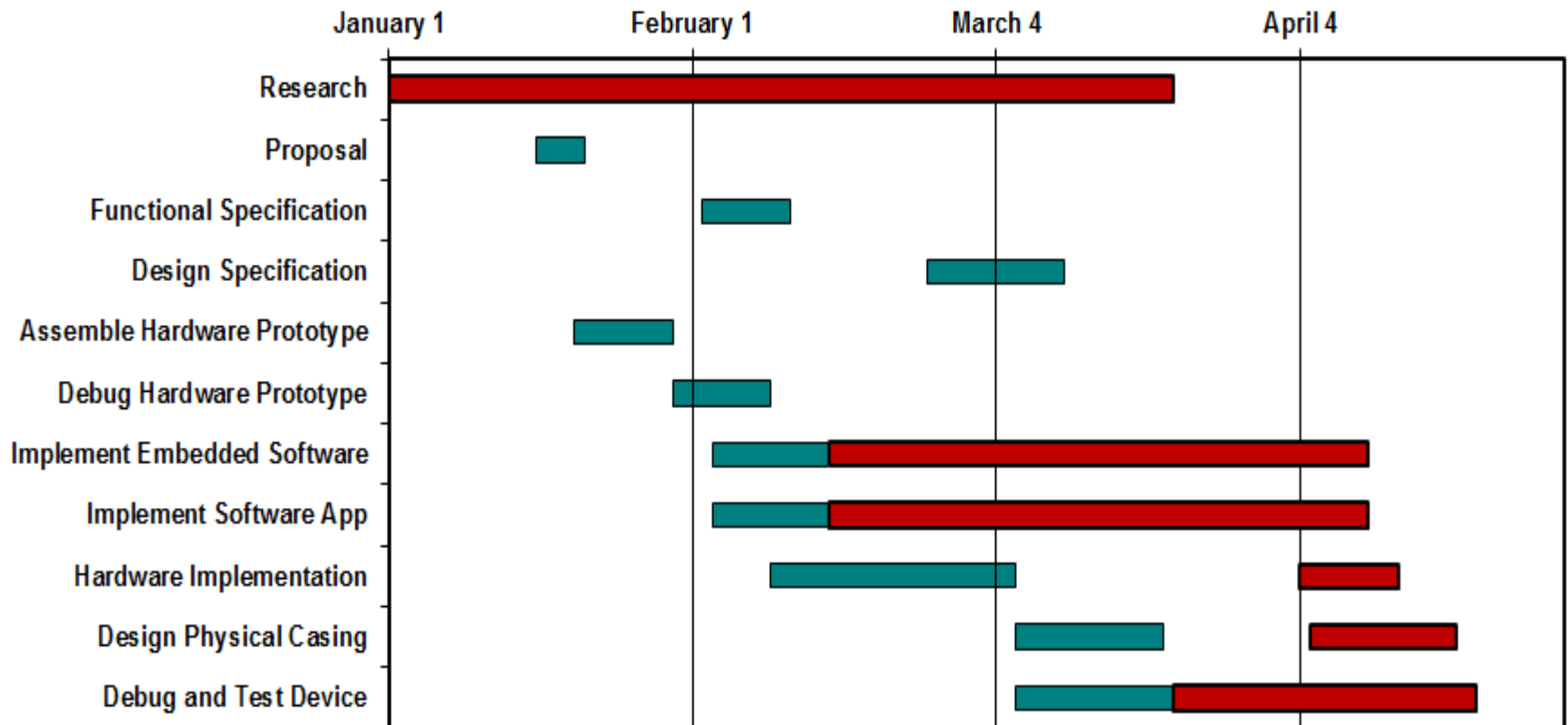
Materials & Costs

List of Materials	Estimated Unit Cost	Actual Unit Cost
Arduino Pro Micro	\$30	\$25
Two Ultrasonic Sensors (LV-EZ0 and LV-EZ1)	\$60	\$54
Two Vibration Motors	\$10	\$10
GPS Module with Embedded Antenna (LS20031)	\$60	\$60
Magnetometer Breakout Board (LSM303DLMTR)	\$15	\$30
White Cane and Physical Case	\$40	\$35
Buzzer/Speaker	\$5	N/A
Battery + Charging Circuit	\$30	\$27
Wireless Charging Circuit and Charger	N/A	\$80
Printed Circuit Board	\$150	N/A
Miscellaneous (Header pins, Electronic components, Protoboard, cables)	\$15	\$15
Miscellaneous (Taxes, Shipping+Handling, Duties+Brokerage)	\$70	\$158
Total Cost	\$470	\$494

Estimated Schedule



Actual Schedule



Scope & Design Changes

- Alternative routes as a "next node"
- Mechanical case as an attachment
- Incorporated Qi wireless inductive charging
- Implemented support for travelling using public transportation

- Audio Feedback
- Voice control
- GLONASS
- Battery fuel gauge
- Battery temperature monitor (thermistor)
- 3G modem Assisted GPS and Connection
- Bluetooth connection to smartphones

- Built a navigation assisting prototype cane
- Designed a client application to receive and transfer route information from Google Maps
- Implemented an intuitive code to guide a visually impaired user to a destination

Things we've learned

- Hardware and software experience
- Communication
- Planning
- Time management
- Plan for mistakes
- Don't be optimistic

- Dr. Andrew Rawicz
- Mr. Steve Whitmore
- Mr. Lukas-Karim Merhi
- Mr. Ali Ostadfar
- Mr. Hsiu-Yang Tseng
- Mr. Ken Guan
- Engineering Student Society Endowment Fund

- [1] Israel Guide Dog (2012, May 30). *Israel Guide Dog Center for the Blind*. [Online]. Available: <http://israelseen.com/2012/05/30/israel-guide-dog-center-for-the-blind>
- [2] Visually Impaired Persons of Charlotte County. *Welcome to VIP of Charlotte County*. [Online]. Available: <http://www.vipofcc.com>
- [3] Navigadget. (2007, Jun. 26). *GPS for the blind or visually impaired*. [Online]. Available: <http://www.navigadget.com/index.php/2007/06/26/gps-for-the-blind-or-visually-impaired>
- [4] Canadian Guide Dogs for the Blind. *The Guider Project*. [Online]. Available: http://www.guidedogs.ca/_txtguiderproject.htm
- [5] World Health Organization. (2012, June). *Visual Impairment and Blindness*. [Online]. Available: <http://www.who.int/mediacentre/factsheets/fs282/en/>
- [6] Canadian Government. (2009, Feb. 26). *Table 2 Aids and assistive devices used by people with severe seeing limitation, 2006*. [Online]. Available: <http://www.statcan.gc.ca/pub/89-628-x/2009013/tab/tab2-eng.htm>
- [7] Elaine Gerber and Corinne Kirchner. (2001). *Who's Surfing? Internet Access and Computer Use by Visually Impaired Youth and Adults*. *Journal of Visual Impairment & Blindness*, 95 (3), 176-181.

Questions & Answers

Thank you!