UC SANTA CRUZ
Baskin Engineering

Capstone Project

Visor Mounted Navigation System

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VISORNAV

Abstract

Traditional GPS navigation systems and smart phone navigation apps require the user to take their attention off the environment and look down at a small screen, or hold a device in their hand. Apps like Google Maps and other navigation systems typically display a complicated map with superimposed arrows and text. The rider must visually decode this information to figure out what to do next. VisorNAV is mounted to the helmet visor, located in the rider's peripheral vision, and uses simple animations to indicate only what's immediately relevant to the rider. This product is for assisting navigation by bicyclists. It gives simple turn by turn directions using a minimalist visual display located just above the eyes of the cyclist by integrating a map application with an LED light bar located under the visor of a helmet.

Approach

Application:

- Don't reinvent the wheel, use an existing navigation system
- Integrate current systems with our device
- Ideal system would be a "plug-in" for existing navigation applications

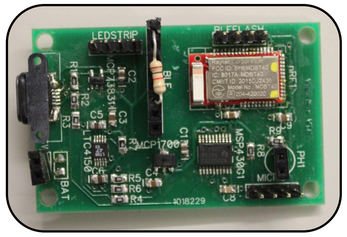
Electronics:

- Simple, Small, Low Cost Components
- Low Distraction
- Easily interpretable signals
- Long battery life

Mounting System:

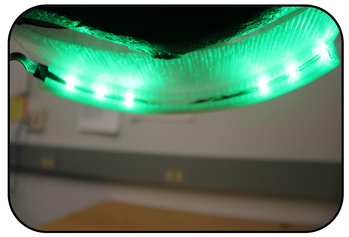
- Lightweight & Balanced
- Universal

Overview

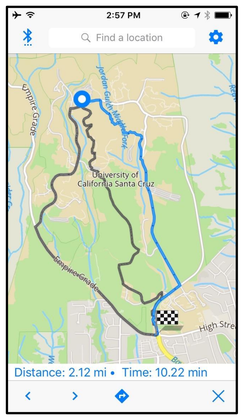


Custom PCB

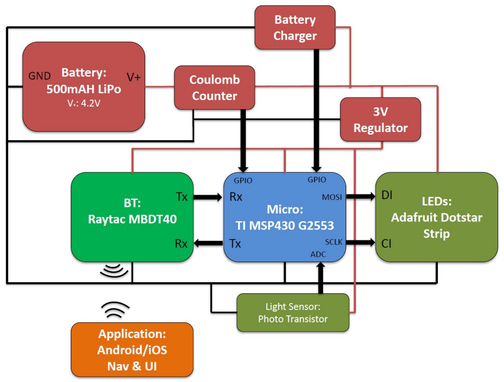
Visor Mounted System

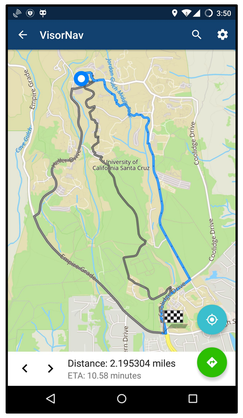


LED Signaling



iOS App





Android App

Application:

Using Skobbler's Navigation API, we were able to create both an Android and iOS app capable of routing and translating navigation information to our device via Bluetooth LE. Keeping the bulk of the processing on the smartphone allowed for a much longer battery life and stable connection for our device.

Electronics:

Starting with a perfboard design, we were able to successfully create a system for interpreting and displaying navigation signals to the user. Once complete, we were able to move to PCB Design in order to create a smaller, more compact system for users.

Mounting System:

In order to create a universal device, we modeled our visor after a baseball cap and modeled a mounting system after the successful GoPro mounts. To balance weight on the helmet, we placed the hardware on the back to offset the visor, much like many headlamp manufacturers have done.

Acknowledgments

We would like to thank Dr. David Munday and our TA, Patrick Ayers, for their mentorship over the course of this project. We would also like to thank Spencer Castro, Rob Martin, Annie Pugliese, and Jesse Smith for their work on the original VisorNav prototype, and the UCSC Police Department for their input on low-distraction based design.
Special thanks to Skobbler for their Navigation API and CITRIS for providing a 3D-Printer for our designs.

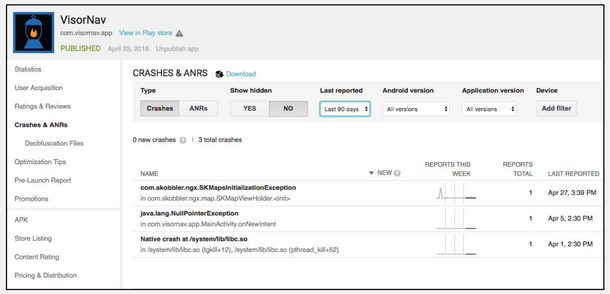
skobbler

CITRIS

Analysis

Application:

In order to get a feel of how our app functioned and to uncover any bugs, we opened our app up for Beta testing with friends and peers. Using Google Play Services, we were able to log real time crash reports and receive feedback from users on the usability and intuitiveness of our application.



Device:

We wanted to make sure that we were creating an ideal system for a range of users. At each step of development, we received feedback from friends and peers on the various aspects of our design (LED spacing, number of LEDs, signal methods, user interface.) In addition, we studied similar products currently on the market to see where we might be able to improve our designs.

Results

Our team was successful in creating a feature complete application for both Android and iOS devices capable of routing on bike trails, displaying alternate routes, saving frequent locations, searching addresses, and much more. Getting a working perfboard design, we were able to take our education a step further and learn/design a custom PCB for our system. With careful planning, and help from our mentors, we were able to populate and get a working PCB on our first run. Thanks to the efficiency of Bluetooth LE and low power considerations when choosing out parts, our initial goal of a 2 hour runtime is now closer to 48hrs of continuous use.

Conclusion

Moving forward, there are a lot of directions this project could take. For starters, we would like to run further tests with the device to determine if this method can truly reduce distraction for cyclists looking for a navigation solution while riding. While we do believe this is a product that could have a strong market presence, we feel as though there is still a lot of work to be done before we would be happy selling it to users. In addition, there are improvements to the app that we feel could revolutionize the navigation industry, such as GPS location accuracy in areas of low satellite coverage (like the Santa Cruz forests). These are all ideas that came up for us during this project, but were out of scope for the time and resources available to us this quarter.