

EPICS: Engineering Projects in Community Service

Team Name: Squid Squadron Mk III

Team Members: Dino Filippini, Tyler Charles, and Sean Gibbens

Spring Semester 2014

Project Name: Indiana School for the Blind and Visually Impaired

Primary Contact: Jeff Frownfelter



## **Table of Contents**

Analyzing Requirements and Goals – pg. 1

Becoming Acquainted with Accessibility – pg. 2

Research – pg. 3

Global Positioning Systems – pg. 4

Image-Based recognition in regards to location – pg. 5

Wireless Access Point signal triangulation – pg. 6

Gesture Technology and VoiceOver in mobile applications – pgs. 7, 8, 9

Indoor Positioning Systems – pg. 10

Gaming and Virtual Reality Simulations – pg. 11

Location Services companies – pg. 12, 13

Project Organization & Management – pg. 14

Future Work – pg. 15

## Analyzing Requirements and Goals

At the beginning of the semester, information was gathered primarily from the site contact: Jeff Frownfelter. Mr. Frownfelter is the Information Technologies director at the Indiana School of the Blind and Visually Impaired, and he himself is partially blind. Two members of the team (Dino and Sean) primarily conversed with him to gather information on the usability concerns for the visually impaired. The request set before the team was to create an accessibility aid for the visually impaired in the form of a mobile application, with the added request of leaving room for the program to expand out to larger markets or audiences.

To accomplish these requests, the team had originally set out on the following goals:

- Create a simple mobile application to become familiar with practical mobile development
- Discover and create a list of potential technologies to use as a pilot program
  - (Hardware versus Software)
- Maintain communication with the client and create a knowledge base of contacts
- Gather information in regards to the User Experience for visually impaired users

With the focus of the project being so large, the team's approach was to do a little research in each category and narrow down the results, pinpointing some specific solutions the team could implement. This report is, in essence, a research packet summarizing all of our findings.

## **Becoming Acquainted with Accessibility**

The entire EPICS team was unfamiliar with visual accessibility controls for touch screen mobile devices at the start of the semester. To better understand the control style required for the project, the team leader Dino Filippini ran the team members through an exercise using the iOS Voiceover accessibility feature, where the team members would effectively attempt to navigate the software through audio feedback instead of visual. The exercise proved to be very difficult for Tyler and Sean, because using VoiceOver in iOS was something they had not done before. Team members were encouraged to look into coding for accessibility compatibility in an exercise in iOS mobile development lead by the dedicated team developer Tyler Charles.

The team also attempted to gather more outside contacts to aid the research phase. Professor Maurer was contacted by our liaison, Sean Gibbens, but the team failed to receive a reply to our communications. Additionally, Sonali Shah, an adjunct human-computer interaction professor had expressed knowledge in the field, and could prove to be a resource in design phases.

## Research

Over several weeks the team collaborated to compile a list of useful technologies to use as reference or for practical purposes. The different technologies that were researched follow:

- Global Positioning Systems
- Image-Based recognition in regards to location
- Wireless Access Point signal triangulation
- Gesture Technology and VoiceOver in mobile applications
- Indoor Positioning Systems
- Gaming and Virtual Reality Simulations

Each piece of research will be talked about in detail below.

## **Global Positioning Systems**

<https://www.gimbal.com/> (concerned about precision)

<http://blog.elpassion.com/bluetooth-beacons-for-business/> (high cost)

<http://support.apple.com/kb/HT6048> (Apple specific)

**Image-Based recognition in regards to location**

The one source Tyler found (May be beyond our capabilities)

<http://www.wikitude.com/>

**Wireless Access Point signal triangulation**

Some of the sources Tyler looked into:

<http://www.skyhookwireless.com/>

<http://www.navizon.com/>

<http://www.infsoft.com/> (indoor mapping) <http://www.combain.com/> (indoor & outdoor)



## **Gesture Technology and VoiceOver in mobile applications**

### VoiceOver

If making a prototype iOS application is one of our goals, it is important to determine what makes a good UI for a blind or visually impaired user. We have a tremendous amount of knowledge about how to format the visual GUI to please our seeing users, but what if the user cannot look at the screen? This adds a completely different dimension to app development, as you must add iOS VoiceOver accessibility to your code. This ensures that your application is accessible to a wide-range of users.

“iOS 3.0 and later includes the UI Accessibility programming interface, which is a lightweight API that helps an application provide all the information VoiceOver needs to describe the user interface and help visually impaired people use the application.”

The following two URLs are accessibility programming guides for iOS:

[https://developer.apple.com/library/ios/documentation/userexperience/conceptual/iPhoneAccessibility/Accessibility\\_on\\_iPhone/Accessibility\\_on\\_iPhone.html#//apple\\_ref/doc/uid/TP40008785-CH100-SW1](https://developer.apple.com/library/ios/documentation/userexperience/conceptual/iPhoneAccessibility/Accessibility_on_iPhone/Accessibility_on_iPhone.html#//apple_ref/doc/uid/TP40008785-CH100-SW1)

[https://developer.apple.com/library/ios/documentation/userexperience/conceptual/iPhoneAccessibility/Making\\_Application\\_Accessible/Making\\_Application\\_Accessible.html#//apple\\_ref/doc/uid/TP40008785-CH102-SW5](https://developer.apple.com/library/ios/documentation/userexperience/conceptual/iPhoneAccessibility/Making_Application_Accessible/Making_Application_Accessible.html#//apple_ref/doc/uid/TP40008785-CH102-SW5)

Link to a Stanford Lecture on iOS programming with the priority of accessibility:

<http://www.youtube.com/watch?v=5b0V6MltEnw>

I think that creating a small prototype iOS application is something that our group wants to do, and incorporating VoiceOver accessibility into our code is extremely important. It is also very well established, because VoiceOver is a feature that many developers utilize in their apps today. I rate VoiceOver integration at 9 out of 10 in feasibility and 10 out of 10 in importance.

### Gesture Technology

Gesture Technology, or Gesture Recognition, is the idea that a piece of technology can detect and interpret bodily gestures, without having to touch the screen at all. This could possibly eliminate the need for input devices such as keyboards or touch screens.

Adding Gesture Recognition to mobile devices could be highly beneficial to blind or visually impaired users, especially if VoiceOver or another accessibility tool was added in parallel.

Link to a University of Washington article about “AllSee”, a low-cost gesture recognition system that “runs without batteries and lets users control their electronic devices hidden from sight with simple hand movements.”

<http://www.washington.edu/news/2014/02/27/battery-free-technology-brings-gesture-recognition-to-all-devices/>

Although there are some Samsung phones that currently use primitive gesture technology, it does not seem very feasible for our purposes at this point. It may be helpful in the future, but it's a technology that is still working out the kinks and we want something that is established, with a history of success in aiding visually impaired users. For that reason, I would rate Gesture Technology at 3 out of 10 in feasibility and 3 out of 10 in importance.

**Indoor Positioning Systems**

See location services companies.

## **Gaming and Virtual Reality Simulations**

Explained by Dino in conference call.

## **Location Services companies**

Several companies in the location services industry were contacted and examined as possible partners to aid the team's idea that this project shouldn't have to start from scratch. Navizon, one of the aforementioned location services companies, has an academic program that will allow us to utilize their location software development kit on academic campuses. While some concern was expressed from the client about the positioning hardware technology in iPhones, the team believes that this can be offset by the use of software that gathers location data not only from a positioning network, but through triangulation of local wireless signals. Navizon's SDK will let us do just that and is compatible with iOS, allowing the team to code for the operating system currently used by the campus, without the need of additional hardware. In conversations with the representative from the company, it was learned that there were two distinct SDK's offered:

**Navizon One**, is a global solution, and the following message comes from the Navizon Representative regarding it:

"Navizon One can allow you to provide real time location to any device, based on Wi-Fi and/or cell towers triangulation. This solution can work all around the world, without needing a "training" of the site, and the accuracy may vary, but is usually lower than using Navizon Indoors. There is an API to call to get the location based on the Wi-Fi scans or the cell tower scans. It is useful for outdoor areas where the GPS is not precise (i.e. big cities with high buildings), or to locate someone indoors, but with a low precision. It is something we do not suggest if you want to provide a precise indoor positioning, actually."

**Navizon Indoors**, the option the team believes best fits the requirements of the project, focuses more on precision. The representative quote follows:

“This is a local indoor solution, which allows you to provide real time positioning to users of a mobile app based on our SDK, with an accuracy of 1-2 meters. This solution can work only in buildings where an initial "site survey" has been performed.”

## **Project Organization & Management**

Our team's was structured so that each individual member had a specific role, which corresponded to their strengths.

Dino Filippini – Team leader, organized meetings and structured activities, primary contact with Navizon

Sean Gibbens – Client liaison, primary contact with Mr. Frownfelter and Professor Linos, sent emails to keep the client posted on our progress, completed all WSRs, sent emails about group meetings

Tyler Charles – Primary source for coding information, led group in Xcode exercises, completed all research into location services companies

The team primarily completed work by discussing potential solutions at meetings on either Tuesdays or Thursdays, while outside time was spent on the bulk of the work. In order to work in this fashion, Dino had to do an excellent job of distributing work and keeping an open line of communication. Our WSRs do a great job of documenting our work throughout the semester, as we progressed through each week. Please see each WSR on our Wiki.



**Future Work**

The primary goals of this EPICS semester focused on the research and action plan for future groups to take, creating a documented resource pool of information, contacts, and tools to be used effectively. The team still has a pending grant request that would enable future teams to have financial assets to aid with the exploration of options, or purchase testing tools for development. Both Sean Gibbens as well as Tyler Charles have expressed interest in working on this project over the summer season, and will better ensure a smooth transition to future teams.

A lot of future work depends on our success with Navizon Indoors this summer, so we'll see how much progress is made come the Fall semester.