
iKnow
"Bringing the journey into focus"

## Research Proposal

People who are blind are really good at navigating when it comes to getting to a specific destination; Go three streets north, take a right passed the smell of fresh coffee, and a left at the beeping crosswalk and you've arrived at your destination. Unfortunately, there is one thing on which blind people really miss out: the journey. The smell of fresh coffee is just a smell from which you could infer that there is a coffee shop near by, or perhaps a coffee stand. For a blind person, knowing what they are passing on their way to their destination is mostly just an educated guessing game. It would make for a much more informative and fulfilling journey if they could know that they just passed Espresso Royale on State Street on their way to campus. This is where our idea would really take flight. Meet MiKnow.

MiKnow is a grand symphony of Radio Frequency Identification (RFID), wearable computing, and social database technologies. Using an uncumbersome, wearable computer to read small, inexpensive, and unpowered RFID tags inconspicuously placed around Ann Arbor, a blind person using this system will be able to experience their walk around the city in a whole new way. Now, as they walk by the smell of piping hot Peruvian coffee MiKnow will auditorily inform the user they are passing Espresso Royale. They walk in to get a cup of coffee only to find that the menus are not available in brail. No problem, MiKnow knows what's on the menu and that information is again auditorily presented to the user.

The possibilities are endless. Rows and seats in theaters, crosswalks, room numbers in buildings, objects (such as printers)... even people could keep a tag in their wallet or purse to inform blind users who is near them.

Behind the scenes would be an extensive online database linking each tag to relevant information. Normally, maintaining such a large database would be a monumental task, but don't worry, MiKnow uses a database that is updatable by anyone in the MiKnow community. Find a great coffee shop while walking around town? Ask MiKnow to save the tag number so you can give it a description when you get home using the accessibility-focused MiKnow website. By opening up the database to a community of interested parties the task of updating and populating said database becomes not a monumental task but an obtainable social activity with incentive. And the best part? This database is accessible whenever the user has a cellular signal. Using an EVDO wireless card, MiKnow can connect to the internet and retrieve up-to-date information about any location.

The Blind would not be the only ones who could benefit from such a system. People who don’t know English, tourists, and senior citizens could all utilize devices that read RFID placed around Ann Arbor. The universal accessibility element of this project offers the possibility of building on an existing network of RFID tags in the future.

We have done some preliminary research and literature review about the different technologies available to accomplish this task and we are confident that with a GROCS grant I, along with a team of students from the School of Information and School of Public Health, would be able to build a prototype wearable computer, develop the MiKnow speaking software, and jump-start an online community. The collaborative element of this project would be evident in both MiKnow's outcome and its' production.

*"MiKnow. Bringing the journey into focus"*

## Literature Review

A preliminary literature review on the subject of RFID tags and the blind revealed some prior work on the subject but nothing that directly matches what we are proposing here. There seems to have been a focus on projects that guided users to a specific location using RFID tags are audio

breadcrumbs, but we were unable to locate any work that combined an internet database and location tagging for the blind.

We've compiled a list of resources that we feel will benefit our research and development of MiKnow:

> *RFID Information Grid for Blind Navigation and Wayfinding*
> Willis, S., Helal, S.
> http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=1550783
>
> **Abstract**
> We describe a navigation and location determination system for the blind using an RFID tag grid. Each RFID tag is programmed upon installation with spatial coordinates and information describing the surroundings. This allows for a self-describing, localized information system with no dependency on a centralized database or wireless infrastructure for communications. We describe the system and report on its characteristic performance, limitations, and lessons learned.

> *An Estimation of Convenient Electronic Warning Sign for Blind Using LF Band RFID.*
> Hosaka Ryosuke
> http://sciencelinks.jp/j-east/article/200206/000020020601A1047711.php
>
> **Abstract**
> A new type electronic warning sign in public space for blind is proposed in this paper. The new sign is constructed by LF band RFID sensor and its marker. RFID is a sort of small sized beacon system. The marker have no battery. The marker is operated by energy of received signal from the sensor. In this method, the RFID marker is buried under end of walkway. The RFID sensor is set into a cane for blind. If the blind approach to the end of walkway, an information communication is occurs between the marker and the sensor. The blind is able to get warning information from the sensor in the cane, since the situation information is transmitted to the sensor from the marker. Using the method, the blind is protected from some accidents at the end of walkway. (author abst.)

> *The Blind Interactive Guide System Using RFID-Based Indoor Positioning System.*
> Jongwhoa Na
> http://www.springerlink.com/content/n10p57qtq2766n02/
>
> **Abstract**
> In this paper, we designed and implemented the Blind Interactive Guide System (BIGS) for the blind person to use in the building. The BIGS uses RFID-based indoor positioning system to acquire the current location information of the user. The system consists of two parts: the smart floor and the portable terminal unit. The smart floor is a floor of a building where each tile of the floor has the passive RFID tag which transmits a unique ID number. The portable terminal unit is an embedded system equipped with an RFID reader as an input device so that the BIGS can get the current location information of the user. Using the preinstalled map of the target floor, the blind person can navigate to the final destination. The prototype is implemented and successfully operated.

> *The Use of Radio Frenquency Identification for Navigation and Location Tracking*
> Siegl, Benjamin Peter and Herman, Steven Donald
> http://www.freepatentsonline.com/20060164236.html
>
> Abstract
> Radio Frequency Identification (RFID) tags have the capability of sending large strings of

numbers unique to that tag using radio waves. This application looks to use RFID tags to assist navigation and location tracking within a building. The RFID tags, which have a radiation range of 3 feet, will be placed on the floor of the building. Each tag will represent an area on the floor with a number which can be accessed by passing an RFID reader over the area of the tag. A computer program in the RFID reader will be able to translate the number using a database into voice, print the information on the screen, search the database for items, or give directions to certain items. Also a program will be created so store managers can update the database and use a map of the building to easily write descriptions for each RFID tag area.

## Project Objectives

There are three primary objects of this project:

1. Create a prototype wearable computer the meets the following criteria:
   - Able to be carried in a small bag or purse
   - Able to read an RFID tag from 5 to 10 feet away
   - Must be able to go one working day without a recharge
   - Can communicate wirelessly with a central database
2. Develop a prototype public database interface to promote social maintenance of RFID tag information – a collaborative effort.
3. Develop a prototype open source software package that speaks to the user with information gathered from RFID Tags

## Project Activity and the Benefit of Collaboration

Our team is comprised of four members, each with their own unique input and knowledge on the subject. Meet the MiKnow team:

**Sara Baumann:** As a student in the school of Public Health, Sara is very interested in promoting the use of public space to increase the quality of life of the population. We will be utilizing Sara's skills as a social surveyor to gauge community interest in potential involvement to determine the most efficient method of placing and describing RFID tags.

**Kumud Bihani:** Having already had a lot of experience with RFID technology and its' application to the blind, Kumud will be our practical application consultant. We will be depending on Kumud's prior knowledge of the subject to avoid potential roadblocks and provide a much needed resources for existing work experience in the field.

**Jakob Hilden:** Jakob is very interested in mobile computing for the impaired. He is currently studying Human-Computer Interaction at the School of Information but also has a background in Computer Science. We will be utilizing Jakob's programming skills to develop the aforementioned prototype open source software as well as developing a system to promote collaborative maintenance of the RFID tag database.

**Jason Stewart:** A former Anthropologist, Jason is interested studying the effect this system would have on the daily lives of blind users of it. As a current student in the School of Information studying Human-Computer Interaction, Jason will also contribute to the group by designing and constructing the wearable computer.

As a group, we feel believe that our collective skill set and common interest in the universal benefit of human beings will enable us to not only have our minds focused on this project, but also our hearts. We look forward to working together to create something that will enhance the daily experiences of those less fortunate than us.

## Other collaborative learning impact

Wikipedia, Youtube, Facebook, and Myspace are all websites that are successful because of user-contributed material. We are hoping to capitalize on this latest trend of mass user contribution to entice users to contribute to MiKnow. We are also considering integration with Wikipedia, which already contains a plethora of information that could be adapted for use with MiKnow. Thus, if a user is contributing to MiKnow, they will be contributing to Wikipedia and vice-versa.

We are also determining if it would be possible to utilize information from the popular collaborative site wikimapia.com whose tag line is “Let’s describe the world!” This project uses a Google Maps interface to allow users to create Wiki entries of anything around the world. There are already hundreds of entries for site in and around Ann Arbor that could potentially be useful for the blind.

## Special Equipment Requirements

If we receive the CROCS grant we will use the money to purchase the equipment we need. Here is a preliminary list of items for this project:

1. OQO Model 02 Handheld Computer
2. Jack-PC – Wall Socket Computer
3. Motorola Bluetooth Headset
4. Lithium Ion Battery to power the wearable computer
5. RFID Reader/Writer
6. RFID Tags
7. EVDO Data card and cellular plan
8. Domain name and web hosting account