Introduction to the Talking Points Project

[Extended Abstract]

Scott Gifford
Dept. of Elec. Engin. & Comp. Sci.
University of Michigan
gifford@umich.edu

Jim Knox
Accessible Technologies Computing Site
University of Michigan
jimbo@umich.edu

Jonathan James
School of Information
University of Michigan
jjamesz@umich.edu

Atul Prakash
Dept. of Elec. Engin. & Comp. Sci.
University of Michigan
aprakash@umich.edu

Categories and Subject Descriptors

J.7 [**Computer Applications**]: Computers in Other Systems—*Location Awareness*;
H.1.2 [**Models and Principles**]: User/Machine Systems—*Human factors/Human information processing*

General Terms

Design, Human Factors

Keywords

Location Awareness, Visual Impairment, RFID

1. INTRODUCTION

A number of systems, technological and otherwise, exist for helping blind and visually impaired users navigate from place to place. [5, 3] However, in focusing only on the destination, these systems often neglect the journey. We propose to rectify this, with a device to improve a user's peripheral awareness of their surroundings. This is the motivation and the primary goal of this project.

The Talking Points project aims to create a system for attaching information to places and objects, in a format that can be easily converted to speech. It allows blind and visually impaired users to get information about the places and objects they are walking by, and can also be used to provide digital information to other passersby.

We have created a proof-of-concept of this system. The system reads passive RFID tags from a mobile reader. It looks up a tag's ID number to find associated text, then uses text-to-speech software to read that speech to the user. This system has a low deployment cost, works reliably both indoors and out, and is straightforward to extend to more advanced features.

We have a working demonstration of a Talking Points system. We use a desktop RFID reader, a laptop, and a portable power supply along with several passive RFID tags. Smaller and low-power versions of these components are available but expensive; we believe the cost of all components will continue falling, making systems based on this technology affordable in the near future.

2. VISION AND GOALS

The primary goal of the Talking Points system is to associate digital information with places and objects in an accessible way, creating a type of augmented reality [7]. The simplest piece of information is a description of the place or object, in a format that can be read aloud to a user. However, the system is designed to be easy to extend, so a point could also contain a longitude, latitude, and altitude; information about nearby points; and dynamic information, such as the current exhibits at a museum, a room's meeting schedule, or upcoming events at a theater.

By associating rich information with a point in space, it is possible to build powerful applications on top of a simple infrastructure. By making the set of information easily extensible, new applications can be constructed without making changes to the physical deployment.

The system was designed with the Universal Design Principles [2] in mind. We believe that if our system is useful to both sighted and non-sighted individuals, we will achieve higher acceptance and better understanding of the system.

In order to be successful, this system must work both indoors and outdoors. It must have good enough resolution to find individual businesses along a street, and individual doors within an office building. It must be inexpensive to deploy and easy to use.

3. RELATED WORK

The primary focus of the Talking Points project is to associate digital information with points in the physical world, in the style of ubiquitous computing [7], as compared to

Copyright is held by the author/owner(s).
ASSETS'06, October 22–25, 2006, Portland, Oregon, USA.
ACM 1-59593-290-9/06/0010.

wayfinding systems [5, 3]. While specific analog information, such as that provided by *Talking Signs* [6], is useful, digital data can be easily processed by a computer, allowing it to filter, process, and record the information. By ensuring that the digital format is accessible to all users, we can ensure that the information is accessible as well.

Much work has already been done on location detection [4], including systems that use RFID [8]. This project proposes a new location detection mechanism with a lower large-scale deployment cost and more accuracy than other systems we are aware of. It uses long-range, passive, standards-based [1] RFID tags, which allow easy and inexpensive deployment over multiple large areas with minimal coordination.

4. IMPLEMENTATION

Our current proof-of-concept implementation attempts to meet all of these goals in a straightforward way, showing that the basic ideas are sound and creating a base upon which future work can be built.

We use a 900MHz RFID reader and passive tags. For indoor use, the tags are mounted on a laminated foam backing with the Talking Points logo. This backing serves to keep the tag a short distance away from the wall, improving read range, and to provide information about the the project and the purpose of the tags. For an outdoor installation we would seal this packaging against the elements. The reader is a desktop model with two antennas, one on the left and one on the right, which we use to distinguish the direction of the tags. Both reader and tags adhere to EPC standards [1].

The reader is connected to a laptop, running software we developed. The reader reports tags within its scanning range to the laptop, which looks up their ID numbers in a database to find a textual description of the place the tag is associated with. This description is passed to text-to-speech software, and is read aloud via the laptop's sound card.

The desktop RFID reader is powered by a portable UPS. The whole system is situated on top of a rolling cart, which allows it to be moved around easily. As it moves, it announces the tags in its proximity.

5. FUTURE WORK

This system is designed as a proof-of-concept. As such, there is a great deal of interesting work remaining. We plan to continue refining the system, in consultation with the blind and visually impaired community at the University of Michigan.

This system introduces some unique challenges in human-computer interaction. Using techniques from HCI in conjunction with the universal design principles will allow us to create a system which is both usable and useful, and we expect to learn important lessons about the needs of the blind and visually impaired community during this process.

One such issue we anticipate is the form factor of the system, which could clearly use improvement. It is too large to be easily used, especially by a blind user who may already have a cane or dog. We believe it can be reduced to the size of a handheld computer using today's technology, and hope that even smaller equipment will be available in the near future.

Another issue is the amount of information presented by the system. By announcing every tag, too much information is presented, which would probably be both overwhelming and annoying for prolonged use. Filtering is necessary to reduce this information to a subset that is likely to be of interest to the user.

Finally, the system for authoring, storing, and accessing the information is currently very simplistic. We are designing a Wiki-style system with support for distributed authoring and a rich and flexible set of information.

6. CONCLUSION

We have demonstrated that it's possible, by using off-the-shelf equipment in a novel way, to determine nearby objects by reading tags from objects and places in the physical world. Once we have that information, we can associate it with a description of a place, and combine available software components to read the description aloud.

These elements combined create a useful proof-of-concept for determining which objects are nearby and communicating that information to a blind or visually impaired user.

By extending on this basic model, we can create powerful applications providing information about the physical world to both sighted and non-sighted users.

7. ACKNOWLEDGMENTS

This work is funded in part by the National Science Foundation under grant EIA-0303587 as "An Infrastructure for Wide Area Pervasive Computing" and by a grant from Intel

8. REFERENCES

[1] EPC radio-frequency identity protocols; class-1 generation-2 UHF RFID protocol for communications at 860MHz–960MHz. `http://www.epcglobalinc.org/`.

[2] B. R. Connell, M. Jones, R. Mace, J. Mueller, A. Mullick, E. Ostroff, J. Sanford, E. Steinfeld, M. Story, and G. Vanderheiden. Validation of principles of universal design. pages 450–452. RESNA Press, 1996.

[3] European Space Agency. Satellite guidance for the visually impaired. `http://www.esa.int/esaCP/SEM4MWK8IOE_index_0.html`.

[4] J. Hightower and G. Borriella. Location systems for ubiquitous computing. *IEEE Computer*, 34(8):57–66, 2001.

[5] D. A. Ross and B. B. Blasch. Wearable interfaces for orientation and wayfinding. In *Assets '00: Proceedings of the fourth international ACM conference on Assistive technologies*, pages 193–200, New York, NY, USA, 2000. ACM Press.

[6] Talking Signs, Inc. Talking signs infrared communication system. `http://www.talkingsigns.com/`.

[7] M. Weiser. The computer for the 21st century. *Scientific American, September 1991*, 1991.

[8] S. Willis and S. Helal. Rfid information grid for blind navigation and wayfinding. In *Proceedings. Ninth IEEE International Symposium on Wearable Computers, 2005*, pages 34–37, 2005.