ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)
Volume 2, Issue 1, January 2013

Review of Real Time Two Phase Navigation System for Interactive Path Finding and Tracking Approach for Assisting Visually Impaired People

Sanjay M.Malode
Department of Computer Technology,
K.D.K. College of Engineering
Nagpur, India.

Dr. S.K.Shriwastava
Director, SBITM,
Betul, India

***Abstract*— Even in today's modern world social restrictedness is observed for visually impaired people. India being the country with world's largest number of blind, there is a tremendous need of systems that can assist such people in navigation in unfamiliar environment. This paper presents a review on vision aided systems and presents the outline of the proposed low cost design for a navigation system for the visually impaired people using Android devices.**

Keywords- Android, visual impaired person, blind navigation, Guide dogs, GPS, image processing.

INTRODUCTION

One of the most important of the complex sensory systems in humans is the vision system. This visual system forms the basis for almost all navigational tasks performed by human body. Without this facility, visually impaired people suffer inconveniences in their daily and social life. A total loss of eyesight is one of the most serious misfortunes that can happen to a person. According to a census by World Health Organization currently there are about 180 million people worldwide that are visually disabled, of which 55 million are blind and this population is estimated to be 75 million by 2020. India alone homes more than 15 million blind people [1].

The first essential aspect is to find an application for a pedestrian navigation system with social relevance. The second issue is to develop an overall outdoor navigation concept, i.e., covering the whole spectrum of navigation from positioning to guidance. Imagine walking into an unfamiliar airport, the places that a person has to look for are: the ticket counter, security check-in, boarding gate etc... These places are hard to find even when the person can see the signs and for a visually impaired, it is almost impossible without help from external sources. Everyday situations like these, present a similar challenge.

Accessibility to the environment is important for all individuals. Access includes not only physical mobility, such as making a trip to a store by the selected mode of transportation but also being able to recognize key points or decision points in the environment. For many blind people the loss of sight is paralleled with the loss of independence. This is perhaps the most humbling of all the disadvantages associated with the loss of sight. A wearable device that can reduce dependence in all manners of interaction with all local environments is of the utmost importance to increase the quality of life for the blind or visually impaired individual.

Assistive technology enables people with disabilities to accomplish daily living tasks and assists them in communication, education, work and recreation activities. Principally though, it can help them to achieve greater independence and enhance the quality of life. Of the various assistive technologies available, a special focus was put on those that help blind or visually impaired people with their mobility.

One of the other techniques still used to assist a blind person is by the use of "Guide Dogs". Guide dogs can help a blind owner navigate around obstacles and find things like chairs and restrooms, and locations by name. Guide dogs are specially trained to guide their blind masters around obstacles and to help them find destinations on command. They are trained to guide their masters around pot holes, mail boxes, utility poles, low hanging branches, and many other things that could cause injury to the blind person. A guide dog is a dog individually trained to assist a person who is blind with navigation. They are trained to recognize and navigate around common obstacles such as pot holes, utility poles, curb cuts, mail boxes, and low-hanging branches, among other things. The most well known of these is the Seeing Eye, in Morristown, New Jersey. Only dogs that graduate from the Seeing Eye are properly called "Seeing Eye Dogs," all other dog guides are called "guide dogs." In some countries the term "guide dog" is also used to refer to assistance animals of all kinds, but in the U.S., the term "guide dog" refers specifically to dogs who assist owners who are legally blind. There are several disadvantages of using a guide dog for instance Although the dogs can be trained to navigate various obstacles, they are partially (red-green) color blind and are not capable of interpreting the street signs, also Guide dogs go through extensive training. It takes between 2 and 5 years for a guide dog to be ready to be matched with a disabled person and the person should be compatible with the dog.

Similarly, the use of SONAR systems though effective, is very costly and works on short range.

LITERATURE SURVEY

Finding one's way through the environment depends on two distinct 'processes: navigation through large scale space and the sensing of the immediate environment for impediments to travel, such as obstacles and drop-offs. Navigation, in turn, involves updating one's position and orientation during travel with respect to the intended route.

Two commonly used techniques for many years to aid a blind person is the use of a long cane and the guide dog. From the early 1950's several efforts in the provision of travel aids for visually impaired people have been made. They range from the simple cane to advanced computer based aids. While the development of other assisting devices such as Braille electronic reading machine to aid visually impaired people in their everyday life has been very effective [2].

In 1991, Golledge et al; were the earliest to propose the use of GIS, GPS, speech, and sonic sensor components for blind navigation in a progress notes on the status of GIS [3]. MOBIC, is a GPS based travel aid for blind and elderly. It also uses a speech synthesizer to recite the predetermined travel journey plans [4]. This test prototype is implemented on a handheld computer with preloaded digital maps and limited wireless capabilities to get latest information from a remote database. A similar system was implemented by Golledge et al; using a wearable computer [5].

Another pioneering work by Zelek et. al. involves stereo camera and was designed to provide information about the environment through tactile feedback to the blind [6]. The system comprises of a laptop, a stereo head with two cameras and a virtual touch tactile system. The tactile system is made up of piezoelectric buzzers attached to each finger on a glove worn by the user. Here the cameras capture images, and the disparity is calculated from those images. The depth information is conveyed to the user by stimulating the fingers. In this work no image processing efforts are undertaken to highlight the object information in the output. More over the system suffers in stereo matching.

In particular for outdoor navigation the availability of GPS-compatible cell phones and PDAs prompted appearance of a number of software products, some of which have accessibility features making them potentially suitable for the blind and visually impaired users. An example of such software that provides verbal instructions is CoPilot Live [7]. A number of electronic mobility aids using sonar have also been developed to detect obstacles, but market acceptance is rather low as useful information obtainable from them are not significantly more than that from the long cane. The outputs produced are also complex for user understanding.
The infrared based Talking Signs [6] has been extensively tested and proved to be helpful, in particular for crossing intersections. This system uses directional infrared transmitters mounted in the environment, and a handheld receiver with a speaker.

Loomis [8] proposed a model to assist navigation for visually impaired people and proposed that any such system can be organized in three basic components:

1) The position unit and orientation is responsible for supplying the navigation system with the user's spatial location, in the form of local and global coordinates. Due to the strong dependence on the environment in which the system is used, this is the functional block that more specifically characterizes the navigation systems;

2) The geographic Information System (GIS) contains main geo-referenced database system data. This functional block is an essential component of the navigation systems. Its main function is to store additional information about user's position, navigation maps, object positions and possible dangers;

3) The user interface is the most critical component in the navigation system for assisting the visually impaired because it acts as a substitute for vision sensing (or attempts to). The user interface must be user-friendly in such a way that the user does not encounter difficulties which would impede daily use. Typically interaction with the visually impaired is through audio interfaces, like Text-To-Speech (TTS) or virtual audio (sonification) and tactile displays like Braille keyboards or vibrotactile devices.

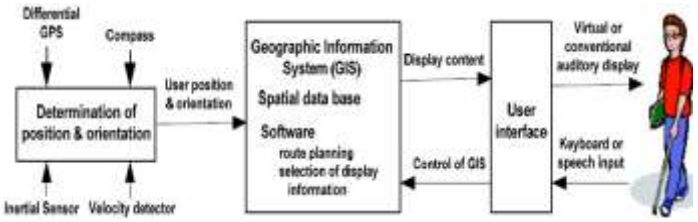

Figure 1.

Figure 2. Functional block diagram of the navigation system proposed by Loomis et al [8].

Thus in general most of these systems available suffered through following drawbacks:

- High cost

As active transmitters require installation and maintenance

- Limitations in capability and usefulness

IR requires line-of-sight Active transmission requires power supplies and maintenance

- Limited user studies to prove effectiveness, and thus provide incentive for implementation

Recent research efforts are being directed to produce new navigational system. Such a system should over the above mentioned drawbacks of the available visual aiding systems.

Figure 3. SVETA - A Stereo Vision based system

Other terrestrial navigation support using augmented reality is developed for the sighted people. Metronaut, is a CMU's campus visitor assistant that uses a bar code reader to infer its position information from a series of bar code labels

placed at strategic locations of the campus [9]. Attempts are also made to use computer vision techniques for outdoor augmented reality applications. Behringer et al; have developed a system based on the use of horizon silhouettes for precise orientation of camera to the user's view [7-11]. This approach is more applicable to natural terrain environments.

Since GPS does not work inside a building, most systems rely on relative positioning using sensors such as active badge, digital tags, accelerometer, temperature, photodiodes and beacons [10][11]. The People Sensor, an electronic travel aid for the visually impaired, uses pyroelectric and ultrasound sensor to locate and differentiate between animate and inanimate obstruction in the detection path [12].

PROPOSED MODEL

Advancements in technology have led to the development and integration of navigation systems and media into the mobile hardware. This is useful for receiving and processing different satellite signals like GPS and are used for emergency calls. In many of these applications, real-time capability implicitly plays an important role. But, only little effort has been put into using real-time capability of mobile phones. Position-based navigation (called pilotage or piloting) relies on external signals indicating the traveler's position and orientation.

Since there has been a tremendous increase in android phones in the market, the proposed navigation system is built for Android smartphones and tablets. The system employs the use of GPS, where the GPS module sends the current location to the device, which is reverse tracked to give the exact name of the location and is then used to guide the visual impaired person towards the destination by instructing him/her through the correct path. The proposed system is a two phase system as it employs both current real time measurements and also past history. For example a person uses the system to move from A to B for the first time and on the next day he wants to again go from A to B, then in this case the system takes into account the previous history to better assist the person on repeated paths, thereby felicitating fast and quick response time.

CONCLUSION

In this paper, a survey of different systems to facilitate movement for visually impaired persons is presented. Further an efficient and low cost two phase navigation system for visually impaired people using Android phones is proposed. Since the proposed model is a built in app for android OS there is no need to purchase separate expensive visual aiding instruments, thus making the proposed system a low cost one.

REFERENCES

[1] World Health Organization (2004) Available: http://www.who.int//mipfiles/2400/AllenFoster.pdf

[2] F. Wong, R. Nagarajan, S. Yaacob, A. Chekima and N. E. Belkhamza. "Electronic travel aidsfor visually impaired - A guided tour", Proceedings of Conference in Engineering in Sarawak.Malaysia, pp. 377-382, 2000.

[3] R.G. Golledge, J. M. Loomis. R.L. Klatzky. A Flury and X. L. Yang."Designing a personalguidance system to aid navigation without sight: progress on the GIS component".InternationalJournal of Geographical Information Systems. Taylor and Francis Ltd. London. 1991, 5(4): pp.373- 395.

[4] H. Petrie, V. Johnson, T. Strothotte. A. Raub S. Fritz, and R. Michel. "MOBIC: Designing a Travel Aid for Blind and Elderly People'". Joarnal of Navigation. Road Institute of MitigationLondon, 1996, 49(1): pp. 45-52.

[5] R.G. Golledge, R.L. Klatzky, J. M. Loomis. J. Spiegle and J. Tietz, "A geographicalinformation system for a GPS based personal guidance system'". International Journal ofGeographical Information Science. Taylor and Francis Ltd.. London. 1998. 12(7): pp. 727-749.

[6] J. Zelek, S. Bromley. D. Aamar and D. Thompson, "A haptic glove as a tactile vision sensory substitution for way finding". Journal of Visual Impairment and Blindness, 2003. pp. 621-632.

[7] S. Long, D. Aust. G. D. Abowd and C. Atkeson. "Cyberguide: Prototyping Context-AwareMobile Applications". In CHI "96 Conference in Engineering. Publisher, 1996,pp.293-294.

[8] Loomis, J.M., Golledge, R.G., Klatzky, R.L., Speigle, J.M., Tietz, J., "Personal guidance system for the visually impaired", Proceedings of the First Annual ACM/SIGGAPH Conference on Assistive Technologies, Marina Del Ray, CA, October 31-November 1, 1994, pp. 85-91. New York: Association for Computing Machinery, 1994.

[9] Y. Kawai and F. Tomita, "A support system for visually impaired persons to understandthree-dimensional visual information using acoustic interface'".IEEE 16th conference on PatternRecognition, 2002, 3: 974 -- 977.

[10] S. Ram and J. Sharf, "The People Sensor: A Mobility Aid for the Visually Impaired", TheSecond International Symposium on Wearable computer. Pittsburgh. PA, 1998, pp. 166-167.

[11] C. Randell and H. Mailer."Context byanalyzingaccelerometer Data". The Fourth International Symposium on Wearable computer. Atlanta. GA, 2000. pp. 175-176.

[12] A. Smailagic and R. Martin. "Metronaut: A Wearable Computer with Sensing and Global Communication Capabilities". The First International Symposium on Wearable computer. Boston MA. 1997, pp. 116-122.