A Survey on Visually Impaired Assistive Systems

Araivnda.C.V, Asst Professor
Dept of ISE, SJBIT
SJB Institute of Technology
Bangalore, India

Mahendra Kumar M
4th sem, MTech Dept of ISE, SJBIT
SJB Institute of Technology
Bangalore, India

***Abstract*— In today's advanced hi-tech world, the need of independent living is recognized in case of visually impaired people who are facing main problem of social restrictiveness. They suffer in strange surroundings without any manual aid. The proposed system introduces a cloud-based outdoor assistive navigation system (COANS) for BVI people. The main goal of the system is to provide easy street navigation and help to make outdoor walk in non-familiar environment less stressful using a smart stick and mobile application.. Hardware part from the user-side includes an android based mobile phone and smart stick. Interaction between the application and the user is based on voice commands (user-side) and voice notifications (system-side), together with the user-friendly "shaking" and "swiping" commands. The proposed system uses smart cane which uses ultrasonic sensors to find the obstacles in their path.**

Keywords—Assistive technology, Cloud, mobile, Navigation, visually impaired

I. INTRODUCTION

The purpose behind this assistant system is independent mobility of a visually impaired people. Moving through an unknown environment becomes a real challenge for most of them, although they rely on their other senses. An age old mechanism used for assistance for the blind people is a white cane commonly known as walking cane a simple mechanical device to detect the ground, uneven surfaces. However such aid fails to detect dynamic obstacles to prevent from accidents occurring to the blind person. Further the biggest hurdle for blind and disabled is to travel distant unknown or dynamically changing environments. Apart from the above mentioned walking cane there are not many systems reported so far to help them by using technology. The proposed system aims to be a techno-friend of visually impaired people to assist them in the orientation and mobility in their residences or at the required places with some assistive features of the system.

This approach uses GPS module, networking on the mobile phone. The infrastructure includes two main components a mobile device (MD) and a cloud server component (CSC). The MD computes its location using GPS satellites information and updates the cloud server with the current user location. It also serves as a video recording tool to capture the borders of the road. The CSC is responsible for receiving and processing information sent from the MD and sending notifications to the MD.

One more specific characteristic of the proposed architecture in [1] is outdoor location accuracy. Skyhook Wireless positioning system is integrated into the architecture. Skyhook is a software only location system that combines Wi-Fi positioning together with GPS and cell tower triangulation, which significantly improves Time-to-Fix. However, its location's hybrid positioning accuracy is never better than GPS (10 meters). For some applications the fastest Time-to-Fix and constant availability are the most important characteristics in location services. These characteristics are also very important for blind navigation system, however a better accuracy in location positioning detection is also in a great demand. In this proposed system embedded system [7] plays a major role which used the Ultrasonic sensor, GPS receiver, Vibrator, headphone, embedded system and Battery.

Ultrasonic sensors works on a principle similar to radar or sonar which evaluates attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. That signal is send to the embedded systems..

II. RELATED WORKS

2.1 Android

Android is a software stack and mobile operating system that includes the operating system for portable devices, middleware, user interface, and a standard application (Web Browser, Email Client, SMS), multimedia message service (MMS). Android developers were able to write applications in the Java language, a runtime library that can run the compiled byte code (Java Runtime Library). In addition, it provides the required application through the Android Software Development Kit (SDK) to develop a variety of tools and APIs. Android works on the Linux kernel and the Android system uses C / C + + libraries, etc. are included. Android, unlike existing Java virtual machines, uses an Java application made of Dalvik Virtual machine that runs on a separate process. In 2005, Google acquired Android Inc. and in November, 2007, Google announced to freely open Android platform to the public. After the announcement, 48 different hardware, software, and communication companies collaborated to design Open Handset Alliance, OHA and it has been developing an open-to-public standard. Google

distributed all source code of Android as Apache v2 license so that companies or users can independently develop Android program. A construction of Android is divided into a total of 5 class of application, application framework, library, Android runtime, and Linux kernel. Handset layout platform is adaptive to expand 3D graphic library based on OpenGL ES1.0, VGA, and 2D graphic library, and it uses SQLite database software for a purpose of data storage. Android supports connection technologies including GSM/EDGE, CDMA, EV-DO, UMTS, Blue Tooth, and WiFi. It also supports a web browser based on an open source, Webkit application framework and it allows the usage of touch screen that is supported by additional hardware, GPS, acceleration sensor, compass sensor, and 3D graphic acceleration.

2.2 GPS(Global Positioning System)

GPS [3] is a radio navigation system using satellites and it is developed by USA Department of Defense for military use navigation but it can be used by citizens with a limited range. It predicts radio coverage from satellites to a receiver, then it shows the exact 3D location, speed and time. This system can be universally used for 24 hours, and many people can use it. This GPS system can be dived into 3 different segments; SS (Space Segment), CS (Control Segment), and US (User Segment). SS (Space Segment) represents the location of 24 satellites that rotate around the Earth every 12 hours. As of April, 2007, there is a total of 36 GPS satellites with 30 of them are active and 6 of them are preparatory satellites in case of malfunction. CS (Control Segment) represents a general observation post that manages and tracks GPS satellites. US (User Segment) represent GPS users and GPS receiver [2].

Figure 2.1 Blindman Navigation

2.3 LBS(Location-Based System)

LBS[1] service indicates a wireless contents service that provides certain information based on the location change of the user. Developers of mobile handset have voluntarily tried to install LBS within their devices. However, LBS was originally developed by telecommunication companies nd mobile contents providers. Main benefit of the system is the fact that the users don't have to directly insert location as they move. GPS positioning technology is one of important technologies that allow easier excess of wireless internet service. However, in order to materlize LBS, there are more related technologies other than GPS and satellite based technologies. Within mobile communication network, there exists a management mechanism in order to manage a mobility of cell phone and there are many GPS LBS service based on the mechanism. Movements of LBS can be seen in three different parts; Positioning technology, lay-administered platform and location application.

1) Positioning Technology: Service provider can predict any location using GPS chip within wireless device. In this case, the positioning technology directly manages a calculation of location using received signal from satellite. Once the calculation is done, a variety of information can be received through mobile communication network. Depending on Mobile communication network or location information service, the system sometimes uses a single base station based information, rather than multiple base stations. Since mobile communication network, characteristically, constantly manages the mobility of cell phones, this positioning technology method can be a method of providing LBS without any additional position technology and any calculation from requests of location. The accuracy of location estimation is at the maximum when the location was estimated using GPS and the matching satellite based location prediction method. On the other hand, a base station method has the lowest accuracy of predicting location since it only allows predicting a certain part of region rather than a coordinate. LBL service can be materialized using other methods other than what are currently shown. Within current mobile communication network, there exists a variety of end terminals that have different method of predicting location. Therefore, normal mobile communication companies combines GPS, A-GPS and a base station based method to provide LBS.

2) Lay-administered Platform: A lay-administered platform is a general word for LBs service components that achieves and process user location from position technology and provides information to application through an interface with network. Within network models based on GSM, CDMA, GMLC(Gateway Mobile Location Center) has been defined as a facility that request a base station based routing information by interlocking with management system in the inner part of mobile communication service and functions as a gateway of interlocking with LBS application within IP network. These GMLC can be sorted out to be one of LBS platforms within mobile communication network.

3) Location application: This application represents a service that provides already processed contents based on locations of individual user or an object through communicating with lay-administered platform or that can manage collected location information.

Within mobile communication network, this application can be separated into Location Application server and Location contents server. Location Application Server is nicknamed as 'LBs Platform' and it is a facility of mobile

communication network that simultaneously provides extra service based on basic location and a gateway for the outer contents service. Typical contents service or areas of solution are telematics, WAP service based on location, emergent safety call service, map combined with GIS and a region service [3].

2.4 Smart cane

When referring to system usability, there are two main types of navigation architectures for blind people: so-called "wearable" systems and "mobile" systems. Wearable systems consist of several hardware components combined together and are supposed to be put on a guided person. The main disadvantage in usability of these systems is that they are usually quite heavy (around 4 kg). Although utilizing several hardware components allows achieving a better, these systems are not easy to wear and they may be not accepted by people for everyday navigation. On the other hand, mobile types of navigation systems require only one device on a user-side, which guarantees a greater flexibility to a guided person. However, because of powerful hardware limitations, these systems not always can achieve same performance rate as the wearable systems.

The older Guide Cane was designed to help the visually-impaired users navigate safely and quickly among obstacles and other hazards. Guide Cane is used like the widely used white cane, where the user holds the Guide Cane in front of the user while walking. The Guide Cane is considerably heavier than the white cane, because it uses a servo motor. The wheels are equipped with encoders to determine the relative motion. The servo motor, controlled by the built-in computer, can steer the wheels left and right relative to the cane. To detect obstacles, the Guide Cane is equipped with ten ultrasonic sensors. A mini joystick located at the handle allows the user to specify a desired direction of motion. Guide Cane is far heavier than the ordinary white cane and also it is hard to keep because it cannot be folded. Smart Cane [6] is one invention which was originally the creation of a common blind cane but it is equipped with a sensor system. This proposed system resembles Guide Cane which has a number of ultrasonic sensors. This invention is designed with the aim at helping the blind in navigating. Ultrasonic sensors need to detect and avoid obstacles or objects located in front of the user.

III. NAVIGATION SYSTEM REQUIREMENTS

The system processed in this paper functions through voices. Smart Phone recognizes the swiping commands, search for destination, routes, and provide the route to the user through voice, smart stick recognizes the obstacles ahead .

The functions of the application developed in this paper are as followed. The first function is to search destination through voice recognition and Google TTS service. After pressing 'search' button, users select the wanted destination according to the instruction.

The second function is route research using Google Map. After users have confirmed the destination, the application materializes the map after searching for route from the current location of the user to the destination. The third function is to guide the users with voice. Using DB of Smart Phone, it sees the route to the destination and it begins to guide by saying travel range, and direction for each section of the route

For further aid, smart stick which has ultrasonic sensors used to detect obstacle and alert the user using voice commands. This gives information on the distance range of the obstacle moving across them.

IV. CONCLUSION

In this proposed system, it designed and materialized a navigation system for blind people in order to provide precise location information. Suggested system, as an independent program, is fairly cheap and it is possible to install onto Smart phone held by blind people. This allows blind people to easy excess the program. The developed service utilized Smart Phone DB in order to search route between the current locations of user to the destination and provide a voice-navigation. The smart cane which helps the blind people to detect the obstacles in their path this smart stick will help the blind people to detect the obstacle within 2 meters and alert the blind person through a vibration.

REFERENCES

[1] Anna N. Lapyko, Li-Ping Tung, Bao-Shuh Paul Lin, "A Cloud-based Outdoor Assistive Navigation System for the Blind and Visually Impaired". *IEEE conference febuary 2014*

[2] Jae Sung Cha, Dong Kyun Lim and Yong-Nyuo Shin "Design and Implementation of a Voice Based Navigation for Visually Impaired Persons" *International Journal of Bio-Science and Bio-Technology* Vol. 5, No. 3, June, 2013

[3] T. Takasu and A. Yasuda, "Development of the Low-cost RTK-GPS Receiver with an Open Source Program Package RTKLIB," *Proceedings of International Symposium on GPS/GNSS*, 2009

[4] H. Makino, I. Ishii, and M. Nakashizuka, "Development of Navigation System for the Blind using GPS and Mobile Phone Combination," *Proceedings of the 18th Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, pp. 506-507, 1996

[5] S. Koley and R. Mishra, "Voice Operated Outdoor Navigation System For Visually Impaired Persons," *International Journal of Engineering Trends and Technology*, vol. 3, no. 2, pp.153-157, 2012..

[6] G.Gayathri , G.Vishnupriya, R.Nandhini , M.Banupriya , *"Smart Walking Stick For Visually Impaired ",* international journal of engineering and computer science issn:2319-7242 ijecs volume 3. issue 3 march, 2014 page no.4057-4061 page 4057