A Survey on GPS Based Security Measure for Blind People

Dr. M. Preetha
Associate Professor
Department of Computer Science and Engineering,
S.A. Engineering College, Avadi, Chennai, India

M. Naveenkumar
UG Students
Department of Computer Science and Engineering,
S.A. Engineering College, Chennai, India

V. Ramasamy
UG Students
Department of Computer Science and Engineering,
S.A. Engineering College, Chennai, India

M. Robinson
UG Students
Department of Computer Science and Engineering,
S.A. Engineering College, Chennai, India

ABSTRACT
Visually impaired people face unique challenges in their day to day life while navigating in unfamiliar public locations. Using a walking stick relies on trial and error, particularly in unfamiliar locations. Also from a walking stick the user can only identify obstacles which are touching the stick and cannot identify the obstacles which are above his waist height. Electronic Travel Aids (ETAs) are devices that use sensor technology to assist and improve the blind user's mobility in terms of safety. In this context, we implement a system whose objective is to give blind users the ability to move around in unfamiliar environment, whether indoor or outdoor, through an interface specifically designed to cater the visual imperfections. In this blind people issues the commands and then receive the response using audio signals. GPS receiver is used to receive the values of the latitude and longitude continuously. With the advancement in technology usage of voice recognition is easier to send commands regarding directions to the blind people. As an application of this GPS technology here GPS based voice alert system for the blind persons are explained practically in subsequent paragraphs.

Keywords
Electronic Travel Aids, GPS, GSM, Sensors, Visually Impaired.

1. INTRODUCTION
As it is well known, people affected by blindness and visual diseases need to use special devices to overcome daily tasks, e.g. moving and navigating around unfamiliar environments. Usually, blind people walk assisted by supports ranging from the traditional white cane to more technological devices, namely Electronic Travel Aids (ETA).Such systems are mainly based on ultrasonic or optic sensors, whereas the use of the electromagnetic (EM) technologies to develop a support system for visually impaired people is a research topic currently under development. It is generally agreed that neither ultrasonic nor optical ETA's satisfy all the needs of a visually impaired person. The ultrasonic ETA's exhibit a limited operating range due to problems when operating with highly reflective surfaces e.g. smooth surfaces, with a low incidence angle of the beam and when detecting small openings, e.g. a narrow door. One of these applications regards the possibility of augmenting the reality of visually impaired people by navigating through their daily lives. It is proposed that a radar sensor scans the environment, then the target angle and distance information are collected, evaluated and mapped into the audio space by using virtual 3D audio rendering techniques. A FMCW radar has been used in with the aim of realizing a device to be mounted on a white cane. Great attention has been paid to the antenna design, but no details on the system performances nor evidence of proofs with actual end users have been reported. In this context, our preliminary studies had previously concerned the comparison between the performances of an EM system and those of the traditional supports. This type of investigation had never been presented in the literature, thus representing a pioneer research activity on the expected advantages coming from the adoption of the EM technology as an aid for visually impaired users. Briefly, such preliminary investigations demonstrated the potential for the EM technology in terms of resolution, efficiency and comfort for the user. Since the very first tests were carried out by using laboratory instrumentation, recently our attention has been focused on the realization of a cost-effective compact radar system characterized by a suitable performance. The main idea is to realize a device small enough to be attached onto the white cane to enhance the usefulness of a traditional and widely accepted travel aid [7, 8]. As a matter of fact, when realizing a novel support for disable people, it is important not to forget the personal considerations and impressions of end users. The positive reception of a new device within the blind community is a very critical issue. Most requirements concern aesthetics characteristics and appearance: they should be unobtrusive, unnoticeable and easy to carry. For such reasons we chose to design a small and user-friendly component integrated onto the white cane, the most widely used and accepted system, in order to make the user more confident and eager to try the new technology. Starting from the laboratory set up used for the first tests, the attention has been paid on the reduction of the antenna dimensions, which implies the use of a higher frequency, as well as on the miniaturization of the circuit board. In this paper, the last improvements, together with the realization and testing of the first complete laboratory prototype are reported. In detail, Section II defines the design requirements, Section III gives an overview of proposed system and its application, and Sections IV and V explain the antenna design, realization and its experimental validation, respectively. Then, Section VI reports some laboratory measurements carried out by using the final prototype for testing the system performances and efficiency. To conclude, in Section VII some discussion and hints for future improvements are proposed.

2. SYSTEM REQUIREMENTS

The system works as a short-range radar and has to satisfy the following requirements, arising from the specific and innovative type of application:

1. Small dimensions and reduced weight, to preserve the user's comfort and to promote the acceptability of a new device;

2. Working frequency inside the free-use band for short-range radar applications as defined by the national and international regulations [10]. A resolution of about 10-20 cm is required, which implies a frequency bandwidth of about 1 GHz;

3. radiation pattern shaped as a vertical fan beam, narrow over the horizontal plane ($\leq 10°$) and wide over the vertical one (about 40°), as schematically depicted in Fig. 1. Over the azimuthal plane, the direction of the obstacle is detected by scanning the environment with the classical horizontal motion of the cane. This scenario has been described in Fig. 1a. Over the elevation plane, as shown in Fig. 1b, the wide beam allows even the detection of suspended obstacles, e.g. the branch of a tree;

4. Observation range from 1 m to 5 m. Such limits have been arbitrarily chosen according to the end user needs. Indeed, the radar is designed to be mounted on the white cane, which efficiently works for very short distances (< 1 m). The upper limit of 5 m is a trade-off between the need to efficiently warn the user about the presence of obstacles, and the risk of annoying him with warnings due to very far targets. Our system is able of generating a maximum output power of 11 db. This value complies with the international regulations regarding the exposure to EM fields [11]. Accordingly, at a distance of 1 m from the antenna (a reasonable minimum distance considering the presence of the white cane) the regulation imposes a maximum E field of 6 V/m, which in our case corresponds to a maximum power of 15 db.

3. DESIGN AND SYSTEM IMPLEMENTATION

Vision impairments can result from a variety of causes, including congenital conditions, injuries, eye diseases, and brain trauma, or as the result of other conditions such as diabetes and multiple sclerosis. The navigation of visually impaired people is a difficult task due to the lack of extracted information for passing through obstacles and hazards in their pathway. The orientation and navigation in unknown environment seems impossible without any external assistance. Even if there are various technological solutions have been proposed, none of them clearly addresses a method for assisting daily activities of totally blind or visually impaired people. Within this context, a system that can provide robust and accurate localization of visually impaired user in urban environments is a necessity. There is a wide range of navigation systems and tools available for visually impaired individuals. White canes and guiding dogs are the most popular. White cane is the simplest, cheapest and the most popular navigation aid. However, it doesnot provide all the required information such as the speed of an object, volume and distances for obstacles, which are normally gathered by eyes and are necessary for the perception and the control of locomotion during navigation. With the advancement of digital world, the research efforts are being directed to produce improved navigation aid systems, in which video cameras are used as vision sensors. The obstacle will be detected using various image processing techniques

3.1 Navigation System

GPS Module is used to get the current GPS Coordinates of the user and Arduino Pro Mini ATmega328 micro-controller has been used to serially communicate with raspberry pi module and obtained coordinates are sent to Google MAP API to find out the current location. The nearby places that user needs to reach can be found usingGoogle place API. The directions for a selected place can be found using the Google direction API. The complete system architecture is illustrated in. The proposed system architecture of the ETA.

3.2 Detecting objects

Human retina is just a flat screen inside the eye. An image is the equivalent of visual input to the brain from both eyes. The brain takes both image inputs together and uses the slight differences between them to create a perception of depth for objects. In this system the distance for the objects are calculated by comparing disparity of the two images taken by two front cameras as shown in. Disparity of images taken from two cameras the distance of the particular object can be calculated considering the point in which the popular plane cuts through image planes. Forming apopular line in each plane would lead to finding the object distance from the equations.

4. ELECTRONIC AID FOR VISUALLY IMPAIRED PEOPLE [1]

The Navigation Guide is a novel electronic device to assist visually impaired people with obstacle free path-finding. The highlight of the Navigation Guide system is that it provides simplified information on the surrounding environment and deduces priority information without causing information overload. The priority information is provided to the user through vibration and audio feedback mechanisms.

The proof-of-concept device consists of a low power embedded system with ultrasonic sensors, vibration motors, and a battery. To test the effectiveness of the NavGuide system in daily-life mobility of visually impaired people, we performed an evaluation using 70 blind people of the "school & home for the blind." All evaluations were performed in controlled, real world test environments with the Navigation Guide and traditional white cane. The evaluation results show that Navigation Guide is a useful aid in the detection of obstacles, wet floors, and ascending staircases and its performance is better than that of a white cane.

5. ELECTROMAGNETIC SENSOR PROTOTYPE [2]

The feasibility of an electromagnetic sensor to assist the autonomous walking of visually impaired and blind users is demonstrated in this paper. It is known that the people affected by visual diseases usually walk assisted by some supports, among which the white cane is the most common. Our idea consists in applying microwave radar on the traditional white cane making aware the user about the presence of an obstacle in a wider and safer range. Compared to the already existing electronic travel aids devices, the proposed system exhibits better performance, noise tolerance, and reduced dimensions. In the following, the latest developments of this research activity are presented, with special concern for the miniaturization of circuit board and antennas. A laboratory prototype has been designed and realized and the first test results of obstacle detection are hereby shown to demonstrate the effectiveness of the system.

6. SMART GUIDING GLASSES [3]

To overcome the travelling difficulty for the visually impaired group, this paper presents a novel ETA (Electronic Travel Aids)-smart guiding device in the shape of a pair of eyeglasses for giving these people guidance efficiently and safely. Different from existing works, a novel multi-sensor fusion based obstacle avoiding algorithm is proposed, which utilizes both the depth sensor and ultrasonic sensor to solve the problems of detecting small obstacles, and transparent obstacles, e.g. the French door. For totally blind people, three kinds of auditory cues were developed to inform the direction where they can go ahead. Whereas for weak sighted people, visual enhancement which leverages the AR (Augment Reality) technique and integrates the traversable direction is adopted. The prototype consisting of a pair of display glasses and several low-cost sensors is developed, and its efficiency and accuracy were tested by a number of users. The experimental results show that the smart guiding glasses can effectively improve the user's travelling experience in complicated indoor environment. Thus it serves as a consumer device for helping the visually impaired people to travel safely

7. AN ENHANCED OBSTACLE AVOIDANCE METHOD [4]

Various obstacle avoidance (OA) methods with the monocular vision have been studied to assist visually impaired people. Recently, a method that effectively locates obstacles at a risk of collision using the shape variation of a grid, called deformable grid (DG), was introduced. To further improve the detection performance of the previous work, a vertex deformation function representing the displacement of each vertex in the DG is firstly defined employing the perspective projection geometry. Then, the collision risk is accurately estimated based on the shape variation of the DG that is measured using the vertex deformation function. Experimental results show that the proposed method outperforms other conventional methods as well as the previous work in terms of both the accuracy and processing time, and clearly detects obstacles that present a risk of collision in a variety of scenarios. This method is suitable for application to electronic travel aid (ETA) systems using consumer devices, such as smart-phones, tablets, and wearable devices

8. OPTICAL DEVICE INDICATING A SAFE FREE PATH [5]

An active optical pathfinder using a LED and a photodiode is implemented as an electronic travel aid to improve the mobility of persons who are blind. The protected path is optimized by using radiometric calculations. Protection zones for typical configurations of obstacles are studied: an opening, a side panel, a front panel, and a post. The results in real configurations such as parked cars, trees, and dustbins are presented too. Finally, we explain how the device can be used in real life by visually impaired people, in conjunction with the typical white stick. Typical obstacles (walls, openings, and vertical rods) have been used to draw the protection zone of the IR device. The ability of the IR sensor to find a path wide enough for a person to go through has been demonstrated. Theoretical and radiometric calculations based on optical geometry have been made to improve the design and performance of the system.

9. WEARABLE OBSTACLE AVOIDANCE [6]

The last decades a variety of portable or wearable navigation systems have been developed to assist visually impaired people during navigation in known or unknown, indoor or outdoor environments. There are three main categories of these systems: Electronic travel aids (ETAs), electronic orientation aids (EOAs), and position locator devices (PLDs). This paper presents a comparative survey among portable/wearable obstacle detection/avoidance systems (a subcategory of ETAs) in an effort to inform the research community and users about the capabilities of these systems and about the progress in assistive technology for visually impaired people. The survey is based on various features and performance parameters of the systems that classify them in categories, giving qualitative–quantitative measures. Finally, it offers a ranking, which will serve only as a reference point and not as a critique on these systems.

10. MULTISENSOR STRATEGIES [7]

The development of electronic sensing devices for the visually impaired requires knowledge of the needs and abilities of this class of people. This paper presents a rough analysis that can be used to properly define the criteria to be adopted for the design of such devices. In particular, attention will be focused on clear-path indicators, highlighting their role in orientation and mobility tasks. A new device belonging to this class is presented. The detector is based on a multisensory strategy and adopts smart signal processing to provide the user with suitable information about the position of objects hindering his or her path. Experimental trials demonstrate the efficiency of the device developed.

11. HAPTIC BASED WALL [8]

This paper proposes a new product concept of an electronic travelling aid with haptic perception for the visually impaired people. The device is much similar to the conventional white cane in appearance and it is fabricated using ultrasonic sensors, a vibrator motor scheme, a controller and a power unit inside the walking stick. The sensor system comprises of three ultrasonic sensors to acquire obstacle distance measurements and the user can interpret the distance information as a tactile sensation. The sonar sensors are fired with a sequential firing mechanism to avoid crosstalk. Distance is felt by the user in terms of the vibration intensity change. This device was tested with blind school students and results are presented.

12. CONCLUSION

This concept leads to provide navigation for visually impaired people. The advantage of this system lies in the fact that it helps to overcome the complexity of the blind people around the world. The induced system is a combination of various working units which collectively produce a real-time system that detects obstacles while making motion of the blind people more safe and secure.The implemented system was planned to provide GPS for locating the position of the user. Location of the user is tracked using GPS system and the coordinates are integrated with Google Maps API to get the address of the current location. The important feature in the navigation system is the alerting a third party about an emergency for the user. So this will send an SMS to the predefined third party (relation/doctor) conveying the emergency.

REFERENCE

[1] Design and Construction of Electronic Aid for Visually Impaired People Kailas Patil, Member, IEEE, Qaidjohar Jawadwala, and Felix Che Shu.

[2] An Electromagnetic Sensor Prototype to Assist Visually Impaired and Blind People in Autonomous Walking Emanuele Cardillo, Member, IEEE, Valentina Di Mattia , Giovanni Manfredi, Paola Russo, Alfredo De Leo, Alina Caddemi, Member, IEEE, and Graziano Cerri, Member, IEEE.

[3] Smart Guiding Glasses for Visually Impaired People in Indoor Environment Jinqiang Bai, Shiguo Lian, Member, IEEE, Zhaoxiang Liu, Kai Wang, Dijun Liu.

[4] An Enhanced Obstacle Avoidance Method for the Visually Impaired using Deformable Grid Mun-Cheon Kang, Sung-Ho Chae, Jee-Young Sun, Sung-Ho Lee, and Sung-Jea Ko, Fellow, IEEE.

[5] Optical Device Indicating a Safe Free Path to Blind People Joselin Villanueva, Student Member, IEEE, and René Farcy

[6] Wearable Obstacle Avoidance Electronic Travel Aids for Blind: A Survey Dimitrios Dakopoulos and Nikolaos G. Bourbakis, Fellow, IEEE.

[7] Multisensor Strategies to Assist Blind People: A Clear-Path Indicator Bruno Andò, Member, IEEE, and Salvatore Graziani, Member, IEEE.

[8] S. Chumkamon, P. Tuvaphanthaphiphat, and P. Keeratiwintakorn, "A blind navigation system using rfid for indoor environments, " in ECTI-CON 2008, vol. 2, May 2008, pp. 765 -768.

