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A Survey of Smart Stick for Visually Impaired People

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ABSTRACT

This paper reviews the existing electronic assistance for blind people. Currently, blind people use a traditional cane as a tool for directing them when they move from one place to another. Visually impairment is a factor that greatly reduces the mobility of people. Currently the most widespread and used mean by the visually impaired people are the white stick, however it has limitation. With the latest technology, it is possible to extend the support give to people with visual impairment during their mobility. In this paper we proposed a system named voice aided electronic stick, whose objective is to give users the confidence to move around in unfamiliar environments. In this paper we proposed an idea of designing electronic stick using Global System Messaging (GSM), Global Positioning System (GPS) and Ultra-sonic technology.

Keywords : Electronic Stick, Visually Impaired, Blind People Electronic Assistance, Smart Stick

I. INTRODUCTION

From the research of human physiology 83% of information human being gets from the environment is via sight. The statistics by the World Health Organization (WHO) in 2011 estimates that there are 285 billion people in world with visual impairment, 39 billion of people are blind and 246 billion are with low vision. The oldest and traditional mobility aids for persons with visual impairments is the walking cane (also called white cane or stick).Historically, there are various types of assistive technologies that are currently available to blind or visually impaired people. One example is the smart phone, which addresses some of the concerns that the blind and partially sighted people needed in their daily life [1].

The smart phones allow those people to listen to voice mails and even write and send emails. Another example is the laser or ultrasonic technology. In this technology, energy waves are emitted ahead and it is reflected from obstacles in the path of the user and detected by a matching sensor. Thus, the distance to the obstacle is calculated according to the time variance between the two signals.

Recently there has been a lot of electronic travel aids designed to help the blind people to navigate safely and independently. To identify the position and location of the blind person, those solutions rely on GPS technology. Such system is suitable to be used in outdoors to trace the exact location of the blind people whenever there is any emergency occurs. This location is traced in the forms of coordinates. On the other hand, to enhance the means that assist blind persons to navigate quickly and safely in an unfamiliar environment, various projects were introduced using different technologies like Radio-frequency identification(RFID),GPS, Ultrasonic, Laser and GSM [2,3,4].

Laser cane transmits invisible laser beams to detect obstacles then produces specific audio signal. The laser cane has distinct audio ultrasonic sensors to trace the obstacle at a specific distance. Ultrasonic sensors are much more efficient than other obstacle detection sensors. Another reason why ultrasonic technology is popular is, it is relatively inexpensive and also the ultrasound emitters and detectors are portable without the need for complex circuitry. With this type of system, invention new dimension of real time assistance and artificial vision along with dedicated obstacle detection system is provided.

Nowadays people are much more concerned about inventing new aid to help visually impaired people. There are several other systems relating the aid mobility of visually impaired are existing. In [3] the author uses GPS location information with building maps and relevant spatial information to provide directions to blind people within a campus environment. On the other hand, RFID based system to aid the blind in the task of grocery shopping is proposed in [5]. The system relies on the RFID tags that are placed at various locations in the store and provides the aids just inside the store (indoor). A smart cane was aimed to assist blind people through the use of onboard sensors for obstacle avoidance [6]. The system is based on an ultrasonic sensor in which it detect obstacles and commands the two-wheeled steering axle. The blind feels the steering command through the handle and follow the stick easily without any conscious effort.

Other system that uses the ultrasonic sensor was aimed to inform the user about the distance of the detected objects by means of vibrations. The author in [7] proposed an intelligent guide stick it has emergency trigger which helps visually impaired people to be more safety on streets using ultrasound or ultra-sonic sensors. The scope of this paper is to develop a low-cost intelligent system capable of assisting the blind and visually impaired without the help of sighted person. The system is a GSM-GPS based so that it takes the advantages of the GSM network such as the popularity and cost-effectiveness. Additionally, GSM-GPS module has been used in different areas of human activity, such as the navigation of vehicles and navigation aids to guide visually impaired pedestrian enabling them to avoid obstacles and reach their destination. Thus here rather for vehicle usage, it gives an extra aid for blind to get assist easily with the use of GSM and also GPS for location tracking system.

II. LITERATURE REVIEW

S. Gangwar (2011) designed a smart stick for blind which can give early warning of an obstacle using Infrared (IR) sensors[8]. After identifying the obstacles, the stick alerts the visually impaired people using vibration signals. However the smart stick focused only for obstacle detection but it is not assisting for emergency purposes needed by the blind. And also the IR sensors are not really efficient enough because it can detect only the nearest obstacle in short distance.

S. Chew (2012) proposed the smart white cane, called Blindspot that combines GPS technology, social networking and ultrasonic sensors to help visually impaired people to navigate public spaces.The GPS detects the location of the obstacle and alerts the blind to avoid them hitting the obstacle using ultra-sonic sensors. But GPS did not show the efficiency in tracing the location of the obstacles since ultra-sonic tells the distance of the obstacle [9].

Benjamin etal (2011) had developed a smart stick using laser sensors to detect the obstacles and down curbs [10]. Obstacle detection was signalized by a high pitch “BEEP” using a microphone. The design of

the laser cane is very simple and intuitive. The stick can only detects obstacle, but cannot provide cognitive and psychological support. There exists only beep sound that triggers any obstacle and there is no any assistance to direct them.

Central Michigan University (2009) developed an electronic cane for blind people that would provide contextual information on the environment around the user. They used RFID chips which are implanted into street signs, store fronts, similar locations, and the cane reads those and feeds the information back to the user [11]. The device also features an ultrasound sensor to help to detect objects ahead of the cane tip.The Smart Cane, which has an ultrasonic sensor mounted on it, is paired with a messengerstyle bag that is worn across the shoulder.A speaker located on the bag strap voice alerts when an obstacle is detected and also directs the user to move in different direction.

Mohd Helmyabd Wahab and Amirul A. Talibetal (2011) developed a cane could communicate with users through voice alert and vibration signal) [12]. Ultrasonic sensors are used to detect obstacle in front, since ultrasonic sensors are good in detecting obstacle in few meters range and this information will be sent in the form of voice signal. This voice signal is send via speaker to the user. Here blind people might find it difficult in travelling without any emergency alert rather than having only ultrasonic sensors.

Alejandro R. Garcia Ramirez and Renato Fonseca Livramento da Silvaetal (2012) designed an assistive technology device called the electronic long cane to serve as a mobility aid for blind and visually impaired people [13].The author implements the cane with an ergonomic design and an embedded electronic system, which fits inside the handle of a traditional long cane. The system was designed using haptic sensors to detect obstacles above the waistline. It works in such a way when an obstacle is detected; the cane vibrates or makes a sound. However this system only detects obstacle above the waistline.

Joao José, Miguel Farrajota, Joao M.F. Rodrigues (2011) designed a smart stick prototype. It was small in size, cheap and easily wearable navigation aid. This blind stick functions by addressing the global navigation for guiding the user to some destiny and local navigation for negotiating paths, sidewalks and corridors, even with avoidance of static as well as moving obstacles)[14]. Rather than that, they invented a stereo camera worn at chest height, a portable computer in a shoulder-strapped pouch or pocket and only one earphone or small speaker. The system is inconspicuous, and with no hindrance while walking with the cane. Also it does not block normal sound in the surroundings.

Shruti Dambhare and A.Sakhare (2011) designed an artificial vision and object detection withreal-time assistance via GPSto provide a low cost and efficient navigation aid for blind which gives a sense of artificial vision by providing information about the environmental scenario of static and dynamic objects around them [15].

III. PROPOSED SYSTEM

The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is close the microcontroller sends a signal to sound a buzzer. It also detects and sounds a different buzzer if it where detects water and alerts the blind.

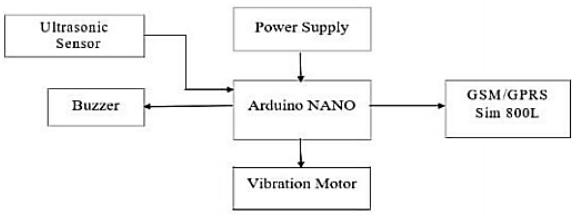

Figure 1. Block Diagram

IV. CONCLUSION

The paper analyzed the existing electronic aids for blind people and does not discuss any implementation results. Based on the limitations in existing aids, this paper proposes an enhanced assisting electronic aid using latest technology like GPS, GSM and bio-medical authentication stick for the visually impaired people. Also, this paper aims to develop emergency trigger alert system along with design.

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