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Smart Stick for The Blind and Visually Impaired People

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ABSTRACT

Physical disability has affected many people's lives across the world. One of these disabilities that strongly affected some large category of people is visual lose. Blind people often face difficulties in moving around freely such as: in crossing the street, in reading, driving or socializing. They often rely on using certain aid devices to reach certain places or perform any other daily activities such as walking sticks. 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

There are modern technologies that help people to practice their activities easily. We focused on the special needs categories which are blinds people. The third blind eye is a stick that makes blind people life easier. It helps them to walk and carry out their daily activities in an easy way and safety by using Internet of Things (IOT) and Artificial Intelligence (AI). 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.

II. LITRECTURE SURVEY

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. SYSTEM ARCHITECTURE

To help visually Blind people this system will help with deployed microcontroller and sensors with the help of gsm based transmission and will detects the obstacle closest to the blind and activate the physical sense to them. 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 biomedical authentication stick for the visually impaired people. Also, this paper aims to develop emergency trigger alert system along with design.

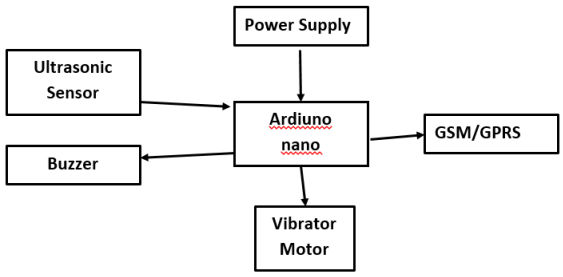

Fig.1 Block Diagram

3.1 Hardware

- Arduino Nano
- Ultrasonic Sensor
- GSM/GPRS Module
- Buzzer
- Moisture Sensor
- Vibrator Motor
- Adaptor Power Supply

3.2 Methodology

This smart stick is an electronic walking guide which has four ultrasonic sensors. Out of these four sensors are used for obstacle detection and are placed on the front and side of the stick. The smart stick gives the output through Vibrator Motor.

The ultrasonic sensor is used to detect the presence of obstacle and calculates the distance between the source and destination.

Moisture sensor is used to detect the presence of water. Real time location of blind people this is done using SIM800L GPS-GSM module.

We have also provided a panic button to help the blind person in case of an emergency. Hurdle warning through vibration.

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.

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IV. RESULTS

We implement three different sensors in our system that are two Ultrasonic sensor, Moisture sensor all this three sensor send data to Arduino Nano Microcontroller and it Activate the physical sensation to blind person through vibrator motor deployed near the handle of stick. Help blind people to easily walk from source to destination. Help blind people from obstacles and water or moisture. Also help getting real time location of blind people.

V. CONCLUSION

On our system, we read three different parameters for detecting Obstacle and moisture. A simple, cheap, configurable, easy to handle electronic guidance system is proposed to provide constructive assistant and support for blind and visually impaired persons. Based on the limitations in existing aids, this paper proposes an enhanced assisting electronic aid using latest technology like GPS, GSM and biomedical authentication stick for the visually impaired people. Also, this paper aims to develop emergency trigger alert system along with design.

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