International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 4 Issue 02, February-2015

Enhancement of Smart Cane To Detect And Notify Obstacles

J. Gnana Jeslin[1] ,A.Vaishnavi[2], J. Nivedha[3]
Department of Information Technology
Jeppiaar Engineering College
Chennai, India.

***Abstract* -Visually impaired people find it difficult to move from one place to another, as they are unaware of the dangerous obstacles in their path. This paper proposes a method that includes the use of a smart cane which can detect and notify the obstacles to the user via earphone. It works by using an application in the user's mobile phone. This smart cane consists of sensors that measure the distance between the user and obstacles or objects on the user's path. It includes GPS to keep track of the user's current location. The design and operation of this idea is to be implemented in such a way that it yields very high efficiency.**

Keyword: Electronic white cane; ultrasonic sensor; infrared sensor; compass ;GPS; Triaxial accelerometer; Smartphone.

I. INTRODUCTION

Visual impairment is a term used to describe any kind of vision loss, whether its someone who cannot see at all or partial vision loss. Normally, people might suffer from visual impairment, which decreases the ability to see the objects such as movable and motionless (eg.car, person, stone).

According to 2014 census, there are 285 million people are estimated to be visually impaired worldwide and 39 millions are blind where 246 have low vision. People mostly above 40 years are affecting by this vision loss.

These people are facing lots of troubles in their daily life activities mostly moving from one place to another. To support and guide them, this paper proposes the method using smart cane that can detect and inform about the obstacles to the user by means of mobile phone.

II. RELATED WORKS

A. Using Gadget:

This system aims at increasing the mobility of visually impaired people by offering new gadget for indoor use which can warn them at any time when any obstacle comes in his path. This equipment is designed with objective of low cost as to reach large part of economy. It is also easy to use and maintain this model [1]. Drawback of this paper is that it cannot sense the stairs in its path and also limited to very small distance range of the environment

B. STEREOSCOPIC SONAR SYSTEM:

This method implemented a system that allows visually impaired users to detect only the obstacles as they walk around the room. It uses two sonar sensors to detect obstacles in front of users and inform the users through voice or vibrators.Those devices are small which is easy to use. Its prize and power consumption is also really low [2]. It increases the field of sensing by fixing the sensors in the jacket shoulders. Due to the usage of sonar sensors, it does not produce accurate measurements and it also not applicable for uneven paths or steps.

C. Wearable system:

This method implemented a system that allows visually impaired users to detect and avoid obstacles as they walk around. It uses eight ultra sonic sensors to detect obstacles in front of users and inform the users through voice commands. These sensors are arranged by three in rows where top row has two sensors to detect object hazardous to user's head, the middle has four sensors to compute safe path to target point, and bottom row has two sensors to recognize small obstacles. This system helps the user to solve local minima problems and gives effective results in flat regions only [3]. It is difficult to detect descending staircases and drop-offs in front of the user.

D. Smart cane:

This paper proposes the method that can detect only dangerous obstacles and places correctly also inform the user effectively. It installs various components and sensors into the smart cane. This method gives the effective result in finding the obstacles through 1m of distance but not in the case of very thin objects[4]. Only trial version of this system is implemented.

III. PROPOSED METHODOLOGY

Earlier system consists of ultrasonic sensor in the stick which will only detect obstacles and gives feedback to buzzer and vibrator or by voice commands to change the path way. But our proposed system puts forward an idea of using smart cane to detect the obstacles and hurdles in the path and also helps to determine the position and location of the user. The smart cane equipped with ultrasonic sensor, infrared sensor, compass, Triaxial accelerometer and also GPS navigation system in which each component performs

separate task to provide safety and support to visually impaired person.

The ultrasonic sensor are used to determine the distance between a user and an obstacles i.e. it determine types of obstacles whether a person, car, tree etc and inform to the user. An infrared sensor is used for detecting distance between infrared sensor and reflecting uneven place; consider the way of swinging a cane. To identify uneven path or steps triaxial accelerometer are used to measure the angle between cane and floor, so that user can avoid accident. The direction of obstacles can be obtained by using compass. GPS also included which provide accurate location and position to the visually impaired person through GPS receiver. The data are collected from sensor are transferred to a Smartphone and then finally inform to user via a earphone .Every user should have Smartphone since it act as a backbone for the above process.

Block Diagram:

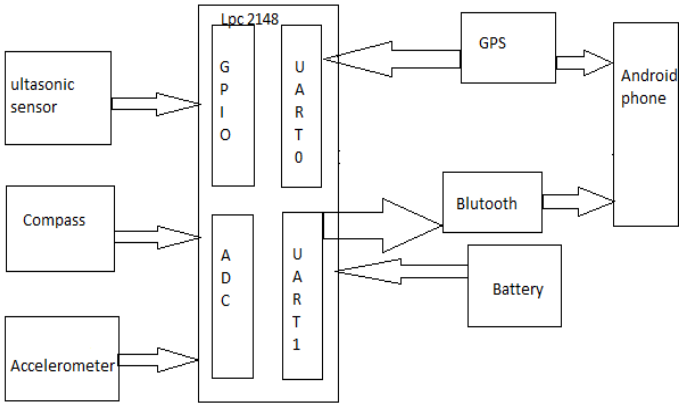


Figure 1 Operation Of a Smart Cane

The project consists of two nodes such as transmitter node and receiver node. The controller is connected with the ultrasonic sensor which is used to detect and estimate the obstacle and its distance.GPS is used to trace the current location of the user and compass is used to know the direction of the user and accelerometer is used to find out the current position of a cane. All the above values are transmitted to the Bluetooth via UART communication and it will be transmitted to android mobile phones. By using earpiece above values can be heard to the user from smart phone.

In our approach the data can be received and transmitted using LPC2148 controller. The controller can be used to manage overall function of the process. The below pin diagram shows the different features used in it.

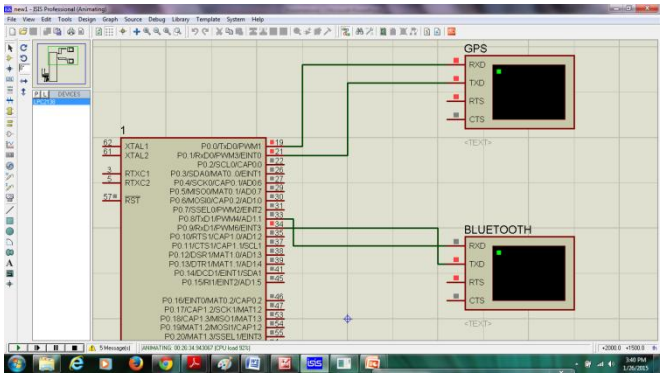


Figure 2 LPC2148 Controller pin diagram

UART protocol used to transmit or receive messages. It is further divided as UART0 and UART1.
The operation present in UART0 which consist of TX pin is connected to RX pin in the GPS,where RX pin in the UART0 is connected to TX pin in the GPS.

UART1 transmit the information to the receiver side of the Bluetooth and then this received information are transmitted to mobile phone.

Similarly Bluetooth transmit information to the user via earphone.

IV. RESULT AND DISCUSSIONS

In order to determine the effectiveness of the proposed methodology, below diagram shows the calculation of the angle between cane and stairs. The distance of various obstacles are also found to be above 90% which is represented in the graph

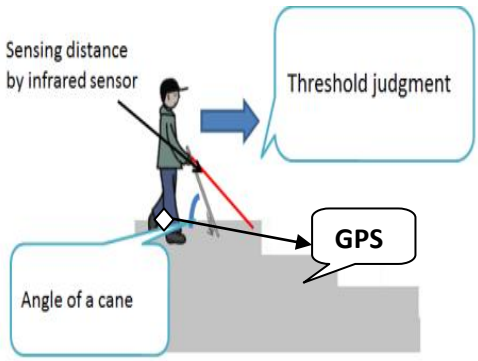


Figure 3 Operation of the detection method of uneven steps

Table 1 Cdr_Ua and Cnr_Ar Value

CDR_UA	80.0%
CNR_AR	93.3%

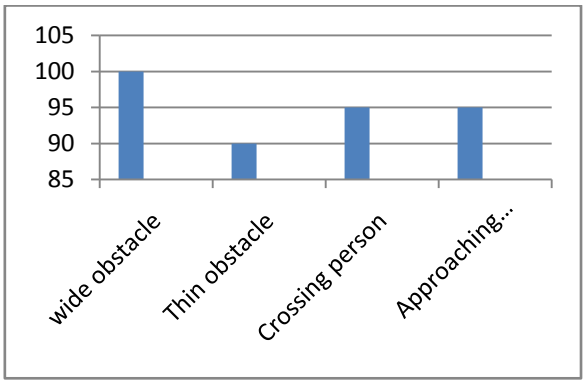
Table 2 Cdr_Do Values of Each Kind Of Dangerous Obstacle

Experimental objects	CDR_DO
Wide obstacles	100%
Thin obstacles	90%
Crossing persons	95%
Approaching persons	95%

Table 1 show the approximate results of the detection method of uneven step and that of notification method of angle adjusting request.CDR_UA represents inaccurate distance due to cane swing speed or angle of infrared. CDR_AR are also represent inaccurate timing of angle calculation.

Table 2 shows the approximate results of the decision method of dangerous obstacles CDR_DO represent correct decision ratio for each experimental object. In this result thin obstacles only have lower bit value. The reason is ultrasonic wave reflection at a circular cylindrical obstacles is inferior as compared with others.

The below chart diagram represents the values of dangerous obstacles



EVALUATION RESULTS

a) Ultrasonic sensor

It covers the users obstacles distance from 250cm in length.

b) Obstacles

The range of the obstacles can be found within 75-100 cm.

- Wide obstacle

More than 1 meter in length, width and height. For example consider walls and luggage.

- Thin obstacles

About 5 cm in diameter; tree branches and poles etc.

- Crossing persons

Crossing about 2 m before a user; person who crosses the road from the side.

- Approaching persons

A person who comes close to a user and alters course right before about 2 m in order to avoid a user

V. CONCLUSION

This method overcomes the limitations of the existing systems by finding the distance between stairs and the user location through ultrasonic sensor. In our hardware representation everything is embedded in a light weight circuit. The stick is relatively low cost easily affordable and portable, Light weight, and provide safety, support and location. No training is required. Our proposed methodology given a new opening for and expand the area of operation for the visually impaired person by taking outside world as functional area. The above result shows the approximate value which are implemented in trial version. We are also looking forward to implement this trial version system into practical.

REFERENCES

1. K. Sudhakar, Priyank Saxena, Sudhanshu Soni" Obstacle Detection Gadget for Visually Impaired Peoples" International Journal of Emerging Technology and Advanced Engineering , ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 2, Issue 12, December 2012.
2. Sylvain Cardin, Daniel Thalmann and Frederic Vexo," Wearable Obstacle Detection System for visually impaired people" Virtual Reality Laboratory (VRlab)Ecole Polytechnique Fédérale de Lausanne (EPFL)CH-1015 Lausanne, Switzerland{sylvain.cardin, daniel.thalmann, frederic.vexo}@epfl.ch
3. Byeong-Seok Shin and Cheol-Su Lim" Obstacle Detection and Avoidance System for Visually Impaired People". Oakley and S. Brewster (Eds.): HAID 2007, LNCS 4813, pp. 78–85, 2007.© Springer-Verlag Berlin Heidelberg 2007
4. Kouichiro Kawashima, Toshiki Taniguchi,Yoshihiro Niitisu (2014), "Detection and Notification of Dangerous Obstacles and Places for Visually Impaired Persons Using a Smart cane", Seventh International Conference on Mobile Computing and Ubiquitous Networking (ICMU)
5. NaseerMuhammad, Engr.Qazi Waqar Ali (2012)"Design of Intelligent Stick Based on Microcontroller with GPS Using Speech", International Journal of Electrical and Computer Engineering (IJECE) Vol.2, No.6, December 2012, pp. 781~784 ISSN: 2088-8708
6. Hashino.S Ghurchian.R. (June 2010), "A blind guidance system for street crossings based on ultrasonic sensors", IEEE International Conference on Information and Automation

Authors

First author- Mrs. J.Gnana Jeslin is working as an Assistant Professor in the Department of Information Technology at Jeppiaar Engineering College in Chennai, Tamilnadu.

Second author- A Vaishnavi is currently doing her Final year B.Tech Information Technology at Jeppiaar engineering college, Chennai, Tamil Nadu .She has presented a paper based on energy management in national level conference and has attended many workshops.

Third author – J. Nivedha is currently doing her Final year B. Tech Information Technology at Jeppiaar Engineering College in Chennai, Tamil Nadu.She has presented a paper based on energy management in national level conference and has attended many workshops.