

Construction of Smart Shoe System for Visually Impaired People

Pooja S. Koli & Nikita Sunil Chavan & Shraddha Gajanan Gaikar

Dept. Students of Computer Engineering, Pillai HOC College of Engineering

Received: January 22, 2019

Accepted: March 05, 2019

ABSTRACT: *Smart shoe is a system which is designed for visually challenged people to guide them to finding an obstacle free path so as it helps to gain personal independence and be free from external help. Initially, a white cane was used as a walking tool for people with eye disabilities, which helped them to detect obstacles, which was lightweight and inexpensive. The white cane detected obstacles upto the height of users knee, covering only little distance from obstacles. Also the user needed to remain active to continuously test the surrounding environment for detection of obstacle free way. To overcome these errors, this paper proposes a system called a Smart Shoe System which is a low powered system consisting of sensors, speaker, battery and micro-controller. This system collects the surrounding data which detects obstacles present at left, right, front sides of user, from knee level and ground level and also detects the staircase. The system helped the user by providing different audio tones to different obstacle conditions as defined by the system. The performance of the system is tested in different environments like corridors, controlled indoor and outdoor environment.*

Key Words: *Visually impaired people, Smart shoe system, IM- Input Module, PM- Processing Module, OM – Output Module*

I. INTRODUCTION

For living a life independently the vision is must. Without having the vision the living life is nothing because vision is must in our day to day life. Vision give the ability to think about or plan the future with the imagination. So every person should be able to think or imagine their own life. But some people have the problem of blindness. Blindness means the person is in the state where he or she couldn't able to see anything. Some people's also suffers from the problem of the night blindness. During night time they are unable to see. Vision plays an important role to travel independently.

From the statistics given by World Health Organization [1] around 285 million people were calculated into the count of visually impaired people. Globally, with 39 million blind about 246 million have low vision. The vision is must for everyone in their day-to-day life. The visually challenged people need the help to travel anywhere. Mostly to cross the road, travelling by train.

Some of the peoples use the guided dogs to travel. Guide dogs can guide the peoples about the obstacles, crowd, staircases. Guide dogs give the right way to travel but it is misconception that guide dogs indicates when it is safe to cross the road, because guide dogs don't know about the traffic signals, they don't know about the indicating lights. So travelling by using the dogs will be dangerous.

There are certain researchers who have developed the walking stick for the blind to their make navigation easier. Gayathri[2] proposed a smart walking stick that can detect the obstacles, water, pit. But using the stick will not be safe because stick can get the break easily. Stick is difficult to carry, it's also a heavy.

Another work is[3] Virtual eye for the visually challenged peoples in the some specific area. This virtual eye give only the directions which are stored in it. It doesn't give all the directions. So it will be helpful only in the some area. But development of all these aids are not satisfying because, World Health Organization founded 285 million people who got suffered from the blindness disease. So these aids doesn't fulfill the requirements of all the blind people's.

To address the limitations of previous methods we developed a smart shoe which will help the blind people's to detect the obstacles from the front, back, right and left, and it will also help to detect the knee level obstacles. Smart shoe is made up of the ultrasonic sensors which will detect the obstacles. So this smart shoe will help the blind people to travel the independently.

II. PROPOSED SYSTEM

The proposed Navguide system is constructed using various hardware components like :

- shoe : whose size is upto knee level
- ultrasonic sensors : to detect obstacles in surrounding

- micro controller arduino mega : for controlling all the other hardware components attached to the system
- speaker : to provide audio feedback to the user
- connecting wires : to connect all hardware components together
- battery 9 volt : to give power supply to all above hardware components.
- step-down power module: for adjusting the external supplied output voltage.



Fig 1.Smart shoe system showing arrangement of system components

III. DESIGN OF PROPOSED SYSTEM

The designed system aims to help the visually challenged people to travel independently. The proposed system system is constructed accordingly by taking into consideration various parameters that would help the visually challenged people.

The Smart shoe system consists of total 4 ultrasonic sensors which are named as higher sensor, lower sensor, left sensor and right sensor along with a micro-controller unit and power module. The higher sensor is placed at top part of the shoe to detect the knee level front obstacle whereas the lower sensor is at the down part of the shoe to detect the ground level front obstacle as shown in fig 1.The left and right sensor are placed at the left and right side of the shoe at middle area of shoe to detect the obstacles at the left and right side from the user. The micro-controller placed on the system is used to control all these sensors. The source module is also controlled by the processor which is used to supply power to all these connected devices designed on the used. The speaker is used to provide the feedback response to user via

headphones which is too controlled by the processor.

$$\text{Distance} = (\text{duration}/2)/29.1 \quad (1)$$

IV. PROPOSED SYSTEM ARCHITECTURE

The proposed system includes three different units i.e. IM- Input Module, PM- Processing Module, OM- Output Module.

IM – This module consists of ultrasonic sensors to detect the obstacles present in the working environment at knee and ground level and also detect the staircase. Initially a trigger pin of sensor is kept low for 2 microseconds and for 10 microseconds it is kept high after this time elapses, the sensor transmits the ultrasonic waves and on hitting waves from the object, this reflected wave is then provided to receiver. The main function of the sensor is to calculate the time upto which the echo pin of sensor remains high which is equal to the time taken by the reflected wave to return back to the sensor.

PM- This module consists of micro controller unit i.e. arduino mega processor and a source module. The time for echo pin remaining high calculated by IM module is provided as input to this module which then calculates the actual distance of the obstacle object from the system by using standard formula given in equation 1. The source module is comprised of battery for supplying power source to the system connected devices and step down power converter for adjusting the output voltage.

OM- This module consists of speaker which is used to provide audio feedback to the user according to specifies obstacle distance conditions. After satisfying the specified condition, the audio bits are played via headphones of the user and gives the final output in the form of audio response to the user.

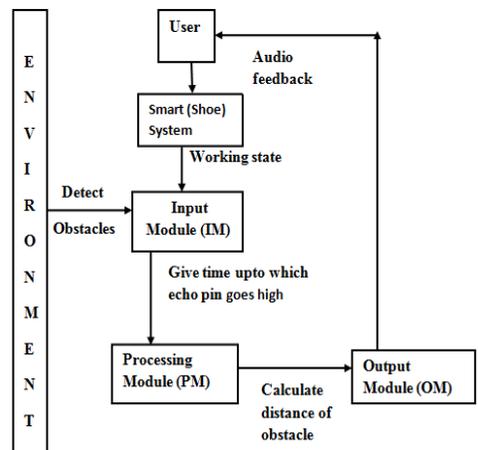


Fig.2 Proposed system architecture

V. FEATURES OF PROPOSED SYSTEM

- This proposed system detects the obstacles present in the surrounding at knee level and ground level.
- Detecting obstacles at left, right, bottom sides of the user.
- It also helps to detect the staircase .
- Audio response is given back to the user with help of speakers.

VI. RESULTS

The Smart shoe system after successful implementation provides the audio feedback to the visually impaired people in different conditions as shown in the following given table I.

Sr. No.	Conditions	Audio Feedback
A	Presence of obstacles to front side of user	Pirates
B	Absence of obstacles to left side of user	Frog
C	Absence of obstacles to right side of user	Mario
D	All Sides Blocked	Titanic

Fig.3 Table I

VII. CONCLUSION

Thus, detailed design of Smart shoe system constructed helped blind person to travel independently. The Smart shoe system thus collected the information from the environment by detecting the obstacles with the help of input unit and according to the conditions provided the feedback in form of audio tones to the user through use of headphones.

In future the Smart shoe system must itself guide the directional obstacle-less way to reach to the destination according to user by using GPS module.

VIII. REFERENCES

1. Vision impairment and blindness, World Health Organization, 2017. [Online]. Available: <http://www.who.int/mediacentre/factsheets/fs282/en>. [Accessed: 12- Oct-2017].
2. G. Gayathri, M. Vishnupriya, R. Nandhini and M.M. Banupriya, "Smart walking stick for visually impaired", International Journal Of Engineering And Computer Science (IJECS), vol. 3, no. 3, pp.4057-4061, 2014.
3. P. Sharma and S.L. Shimi, "Design and development of virtual eye for the blind", International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, vol. 3, no.3, pp. 26-33, 2015.
4. K. M. Lee, M. Li, and C. Y. Lin, "Magnetic tensor sensor and way finding method based on

geomagnetic field effects with applications for visually impaired users,"IEEE/ASMETrans.Mechatronics,vol.21,no.6,pp.2694-2704,Dec.2016.

5. L.B.Neto et al., "A kinect-based wearable face recognition system to aid visually impaired users," IEEE Trans.Human Mach.Syst.,vol. 47,no. 1, pp.52-64, Feb. 2017.
6. S. Shoval, J. Borenstein, and Y.Koren, "The Navbelt-A computerized travel aid for the blind based on mobile robotics technology." IEEE