International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES)
Impact Factor: 3.45 (SJIF-2015), e-ISSN: 2455-2585
Volume 4, Issue 5, May-2018

Haptic Feedback System For Visually Impaired People

Prof. Sachin R Kokane[1] Alankar Muley[2], Chaitanya Saraf[3], Shraddha Taru[4]

[1]*Professor Electronics and telecommunication engineering, AISSMS Institute of Information, Technology,Pune,India*
[2]*Electronics and telecommunication engineering, AISSMS Institute of Information Technology,Pune,India*
[3]*Electronics and telecommunication engineering, AISSMS Institute of Information Technology,Pune,India*
[4]*Electronics and telecommunication engineering, AISSMMS Institute of Information Technology,Pune,India*

Abstract— ***Visually impaired people find difficulties detecting obstacles in front of them, during walking in the street, which makes it dangerous. The smart stick comes as a proposed solution to enable them to identify the world around. In this paper we propose a solution, represented in a smart stick with infrared sensor to detect stair-cases and pair of ultrasonic sensor to detect any other obstacles in front of the user, within a range of four meters. Moreover, another sensor is placed at the bottom of the stick for the sake of avoiding puddles. Speech warning messages and the vibration motor are activated when any obstacle is detected. This proposed system uses the microcontroller ATmega embedded system, vibration motor .The stick is capable of detecting all obstacles in the range 4 meter and gives a suitable respect message empowering blind to move twice his normal speed because she/he feels safe. The smart stick is of low cost, fast response, low power consumption, light weight and ability to fold.***

Keywords- Visually impaired, ultrasonic sensors, GPS, localization, navigation system, mobility, RFID, indoor navigation ,outdoor navigation, distance measurement

I. INTRODUCTION

About 285 million people are visually impaired worldwide ;a report from World Health Organization (WHO) Prevention of Blindness and Deafness Program out of which 39 million are blind and 246 million have low vision (severe or moderate visual impairment). About 90% of the world's visually impaired people live in developing countries. Cataract is the leading cause of blindness. In the world uncorrected refractive errors are the main cause of visual impairment. Although the age group comprises only 20% of the world population ,65% of visually impaired, and 82% of blind people are over 50 years of age,.Top causes of blindness are cataracts and glaucoma ,refractive errors .Top causes of blindness: cataracts, glaucoma and age-related macular degeneration The number of people visually impaired from infectious diseases has greatly reduced in the last 20 years[1].

II. MARKET ANALYSIS

Visually impaired people are the people who can't identify smallest detail with healthy eyes. As described in 10% of blind have no usable eyesight at all to help them move around independently and safely. The electronic aiding devices are designed to solve such issue. To record information about the obstacles presence in a road, active or passive sensors can be used. The sensors which are known as passive sensor, the sensor just receives a signal. It detects the reflected, emitted or transmitted electro-magnetic radiation provided by natural energy sources. In case of using an active sensor, the sensor emits a signal and receives a distorted version of the reflected signal. It detects reflected responses artificially . These types of active sensors are capable of sensing far and near obstacles. In addition, it is able to find an accurate measurement of the distance between the blind and the obstacle overall, in the obstacle detection domain, four different types of active sensors may be used: infrared, laser, ultrasonic, in addition to radar sensors.

The captured images are modified in size, processed further and converted to speech, audio,or vibrations, musical sounds . In such systems, the frequency of warning sound signal is correlated with the orientation of pixels. Some advanced systems use Global Positioning System (GPS) integration with the main system.. Some solutions are already available in the market such as: UltraCanne , Isonic , and Teletact and others . Information is collected by these products whichnavigate blind people with the help of sensors and vibration or sound message to the user. These products are from all over the globe. Now let us go through various options available to us in India. Most famous one is LECHAL footwear which helps to navigate hands-free, hassle-free and head-up. Lechal claims to have made world's first interactive footwear, this costs up to $100(INR 6000).

Advantages of our system are: Low production cost. This system is applicable for both the indoor and outdoor environment. Appropriate messages can be delivered to the users. This system is capable of using in public places. The stick is compact and light weight. Power consumption is less. Wet surfaces, water pits, puddles can be easily detected.

III. SYSTEM ARCHITECTURE

3.1.Description

This project tells that the system is designed in such a way that it collect data regarding the environment via

ultrasonic sensors and extracts the visual information . This visual information is then transformed into an audio signal immediately and the blind pedestrian can recognize the environmental information through binaural sound generated by the system. The whole operation of the project can be described by using block diagram which is given in the figure 1.. Figure 1 represents the basic block diagram of the whole system of project

3.2 Ultrasonic sensor:

Ultrasonic sensor gives maximum results and efficiency for close obstacles unlike laser one, when an object is so

close the laser sensor (less than 15 cm) can't get an accurate reading. We use a pair of ultrasonic sensor. An upper one to detect upper obstacles and another sensor at a lower height to detect low obstacles.

Detection using ultrasonic sensor is based on two factors:

1. Time of flight (TOF), the amount of delay between the emission of a sound and the arrival of an echo depending on the distance of an obstacle.

2. Beam size: Obstacle size is depending on amount of reflected wave. Obstacles whose dimensions are larger than he beam size, all of the sound waves will be reflected to receiver. If the obstacle size small as compared to the

beam size, the part of the ultrasonic sound wave will be reflected to the receiver and the rest will be lost.

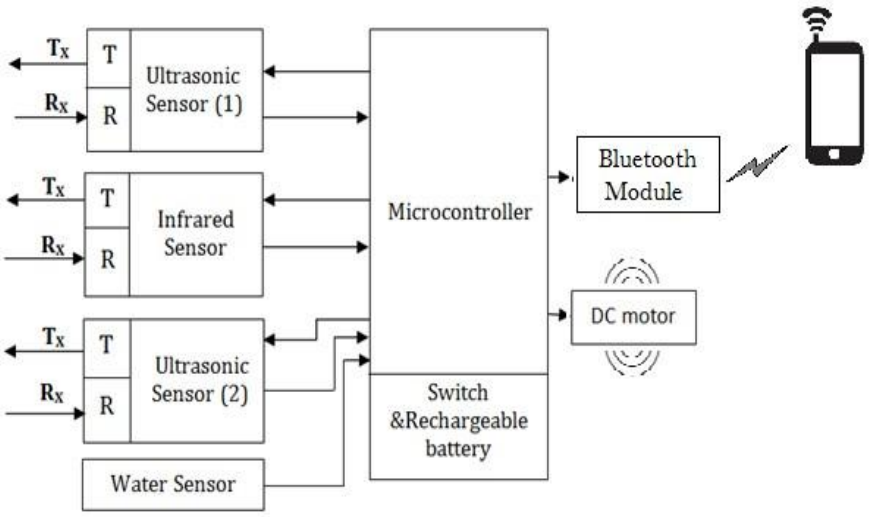


Fig.1 block diagram of smart stick

3.3Water sensor: Water sensors available are used to detect water levels inside tanks and very expensive. Our objective is to detect water existence regardless its level. So we used a costless alternative. Two wire probes. They fit at the bottom of the stick to sense obstacle like water pits, puddles and water spread. Once wires touch water, the circuit is shorted, this interrupts the microcontroller, activates the vibration motor and play warning message saying: "Attention there is water".

3.4 Bluetooth Module: The Bluetooth module is used to communicate with mobile. All the warnings related to the obstacles will be transmitted from the stick to smartphone. This messages will be read using text to speech convertor of smartphone. The Bluetooth module will also be used to locate the stick via Smartphone by simple tapping on the mobile screen.

3.5 Vibration Motor: This is the type of DC vibration motors used in mobile phones. It requires a voltage supply of 3V to 5V with current around 125 mA. This type of motors can be programmed to control its speed by using the PWM (Pulse Width Modulation) method.

3.6 Project Specifications

The smart stick, is an embedded system integrating pair of ultrasonic sensor which is use to find the obstacles in front of the blind from ground level height to head level height in the range of 100 cm a head, infrared sensor to detect upward and downward stairs. Ultrasonic sensors and infrared sensor collect real time data and send it to microcontroller. Water sensor is used to detect water spreads. After processing this data, the microcontroller actives the motor to vibrate and invokes the right speech warning message via mobile using Bluetooth.Rechargeable battery is used to power the circuits.

Mechanical Specification
Made-up of special grade of Aluminium
Height: 115 cm
Weight: 500 gm
Diameter: 3-4 cm
Electrical Specifications
Sensitivity: 1 cm
Voltage: 5 V
Current: 400 mA
Range: 2 meter

Table 1 Stick Proposed Specifications

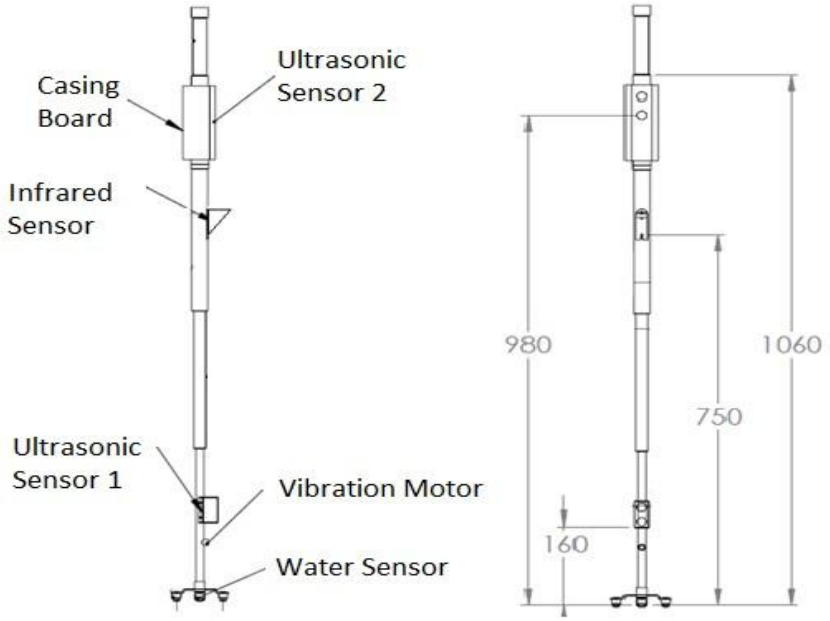


Fig.2 Proposed look of stick

3.6 Details of Ultrasonic sensors

This module includes ultrasonic transmitter, ultrasonic receiver and its control circuit.

- **VCC** – 5V, positive of the power supply
- **TRIG** – Trigger Pin
- **ECHO** – Echo Pin
- **GND** – -negative of the power supply .

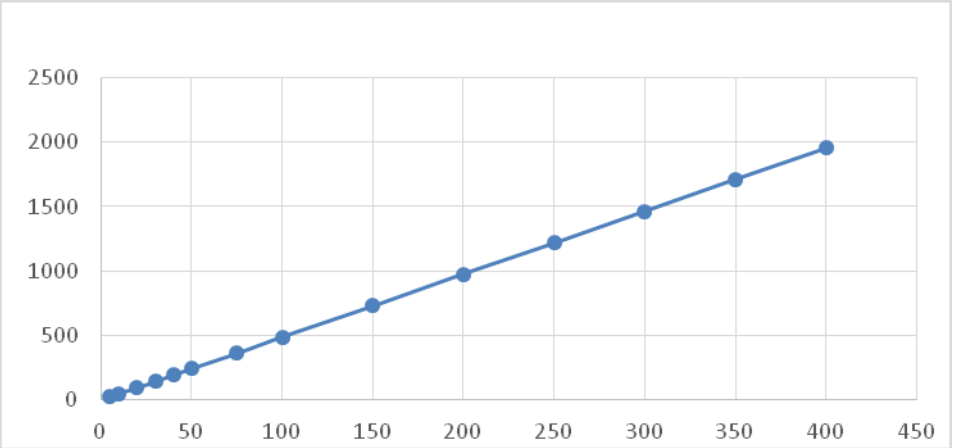
Ultrasonic Module Operation:

- Provide TRI+GGER signal, at least 10μS High Level (5V) pulse.
- The module will automatically transmit eight 40KHz ultrasonic burst.
- If there is an obstacle in-front of the module, it will reflect the ultrasonic wave
- If the signal is back, ECHO output of the sensor will be in HIGH state (5V) for a duration . Pulse width ranges from about 150μS to 25mS and if no obstacle is detected, the echo pulse width will be about 38ms.

IV TEST AND RESULTS

Observation: Reading obtained from ultrasonic sensor. The output voltage is linearly increasing w.r.t distance between sensor and obstacles. **Table No.1 Observation table**

Distance (cm)	Analog value measured (mV)
10	48.8
20	97.6
30	146.4
40	195.3
50	244.15
75	366
100	489
150	732
200	976.6
250	1220.7
300	1464.9
350	1709
400	1953.2



Distance (cm) v/s Analog Value Measured (mV)

V CONCLUSION

A system which having multiple sensors that scans floor surfaces and detects the presence of stairs was developed. It is effective and affordable. It leads to good results in detecting the obstacles lying ahead of the user in a range of four meters, detecting stairs and water pits. This system is hard-wired with sensors and other components, light in weight. While developing such an empowering solution, visually impaired and blind people in all developing countries were on top of our priorities.

REFERENCES

[1] World Health Organization, "Visual Impairment and Blindness," Fact sheet N "282", Oct 2014.

[2] National Disability Policy: A Progress Report - October 2014, National Council on Disability, Oct 2014.

[3] T. Terlau and W. M. Penrod, "K'Sonar Curriculum Handbook", Available from: "http://www.aph.org/manuals/ksonar.pdf", June 2008

[4] L. Whitney, "Smart cane to help blind navigate", Available from:"http://news.cnet.com/8301-17938_105-10302499-1.html", 2009.

[5] Chaitali K. Lakde and Prakash S. Prasad, "Review Paper on Navigation System for Visually Impaired People", *International Journal of Advanced Research in Computer and Communication Engineering*, vol. 4, no. 1, 2015

[6] M. Nie, J. Ren, Z. Li et al., "SoundView: an auditory guidance system based on environment understanding for the visually impaired people," in Proceedings of the 31st Annual International Conference of the IEEE Engineering in Medicine and Biology Society: Engineering the Future of Biomedicine (EMBC '09), pp.7240–7243, IEEE, September 2009.

[7] P. Meijer, "An Experimental System for Auditory Image Representations,"IEEE Transactions on Biomedical Engineering, vol.39, no 2, pp. 112-121, Feb 1992.

[8] G. Balakrishnan, G. Sainarayanan, R. Nagarajan and S. Yaacob, "Wearable Real-Time Stereo Vision for the Visually Impaired," Engineering Letters, vol. 14, no. 2, 2007.