IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)
e-ISSN: 2278-2834,p- ISSN: 2278-8735.Volume 10, Issue 3, Ver. II (May - Jun.2015), PP 07-11
www.iosrjournals.org

Multitasking Stick for Indicating Safe Path to Visually Disable People

Ankita R.Pawar[1], M.M.Mahajan[2]
[1](*VLSI Student, G.H.Raisoni Institute of engineering and Technology for women Nagpur, India*)
[2](*Department of telecommunication engg, G.H.Raisoni Institute of engineering and Technology for women Nagpur, India*)

Abstract: *The main work of this paper is based on abating the disabilities of blindness by constructing a micro-controller based automated hardware that can corroborate a blind to detect obstacles in front of her/him instantly. This system easily navigate the blind person in desired arena .The hardware consists of a micro-controller incorporated with ultrasonic sensor, voice play back module and additional equipment .Ultrasonic waves are used to detect obstacle. To detect fire/high temperature area, temperature sensor is employed. Water is detected using current sensing principle .Acknowledgement of sensing obstacle through voice play back module. This system can be provided a new dimension RF module used for finding the stick in case of misplaced stick.*
Keywords: *Microcontroller, ultrasonic sensors, voice play back module, temperature sensor and water sensor, RF module.*

I. Introduction

Vision is the most important part of human physiology as 83% of information human being gets from the environment is via sight. The oldest and traditional mobility aids for persons with visual impairments are guide dogs and the walking cane (also called white cane or stick). Necessary skills, training phase and range of motion are the most important drawbacks of these aids and very little information conveyed. With the modern technology both in hardware and software front have brought potential to provide intelligent navigation capabilities. Freshly there has been a lot of Electronic Travel Aids (ETA) designed and devised to help the blind navigate independently and safely. In addition, high-end technological solutions have been introduced recently to help blind persons navigate independently. However, compare to other technologies many blind guidance systems use ultrasound because of its immunity to the environmental noise. Another reason for ultrasonic popularity is that the technology is relatively inexpensive, and ultrasound emitters and detectors are small enough to be carried without the need for complex circuitry. This project is based on a theoretical model and a system concept to provide a smart electronic aid for blind people. Beside from the conventional navigation systems, blind aid systems can provide a new RF dimension module used for finding the stick along with dedicated obstacle detection circuitry incorporate ultrasonic sensor is depth measuring circuitry helps to measure the depth in case of dealing with the stairs and on stick voice play back module is used for acknowledgement of obstacle. The identification of blind person or owner of the stick is also considered in this proposed project by incorporating his/her contact details in the memory of device. During first power on device automatically scrolls the contact details on the LCD. Battery present in the system is used to give power to all the units present in the system.

System uses ultrasonic sensor and it can detect any object that lies on the ground situated a distance of certain meters from the user. The minimum size of the obstacle that can be detected should not be less than 3 cm width (or diameter). In operation a beam of ultrasound of frequency 40 KHz is transmitted at a regular interval in the forward direction. The ultrasound will be reflected back from a nearby object, if any. The sensor will then detect the presence of any object that lies within that meters by detecting the reflected sound beam. The time intervals at which the transmitter will transmit ultrasound depend on the walking speed of the user. Here two ultrasonic sensors are used, one for obstacle detection and another to measure depth. For water indication electrodes are fitted at the bottom of the stick these electrodes are sensing water and conveying information to blind people. To detect fire or high temperature area, temperature sensor is used which is used to detect the fire around that visually disable people. The figure below depicts the proposed design of an embedded multitasking walking stick. The system elements consist of various sub systems.

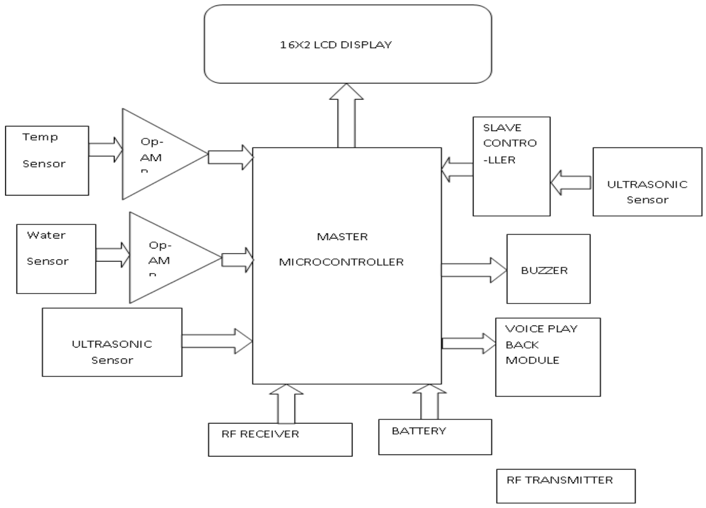


Fig 1.1 Block Diagram

II. Hardware Used

1.1. Ultrasonic Sensor:

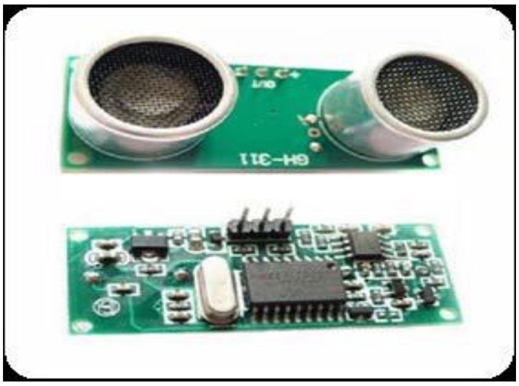
The proposed device in fig 2.1 uses ultrasonic sensor and it can detect any object that lies on the ground situated a distance of certain meters from the user. The minimum size of the obstacle that can be detected should not be less than 3 cm width (or diameter). In operation a beam of ultrasound of frequency 40 KHz is transmitted at a regular interval in the forward direction. The ultrasound will be reflected back from a nearby object, if any. The sensor will then detect the presence of any object that lies within that meters by detecting the reflected sound beam. The time intervals at which the transmitter will transmit ultrasound depend on the walking speed of the user. Here two ultrasonic sensors are used, one for obstacle detection and another to measure depth. For water indication electrodes are fitted at the bottom of the stick these electrodes are sensing water and conveying information to blind people. To detect fire or high temperature area, temperature sensor is used which is used to detect the fire around that visually disable people.

Ultrasonic sensors generate high frequency sound waves and evaluate the echo that is received back by the sensor. It calculates the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be helpful for measuring tank or channel level and direction (anemometer), wind speed, and speed through air or water. For measuring direction or speed a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure channel level or tank, the sensor measures the distance to the surface of the fluid. The sensor provides stable, precise, non-contact distance measurements from about 2 cm to 4 meters with very high accuracy. Its higher range, compact size and easy usability make it a handy sensor for mapping and distance measurement. The board can easily be interfaced to microcontrollers RX pin (USART). Every 500 ms, the sensor transmits an ultrasonic burst and sends out ASCII value of distance (***through its signal pin at 9600 baud rate***) that corresponds to the time required for the burst echo to return to the sensor. This sensor is suitable for any number of applications that require you to perform measurements between moving or stationary objects. The diagram related to working of ultrasonic sensor is given in fig 2.2.

But some practical consideration required for proper output which are as follows

The ECHO sensor cannot accurately measure the distance to an object that:

- Is more than 4.3 meters away
- That has its reflective surface at a shallow angle so that sound will not be reflected back towards the sensor (Angle $\theta < 90°$)
- Is too small to reflect enough sound back to the sensor.
- In addition, if your ECHO sensor is mounted low on your device, you may detect sound reflecting off the floor.



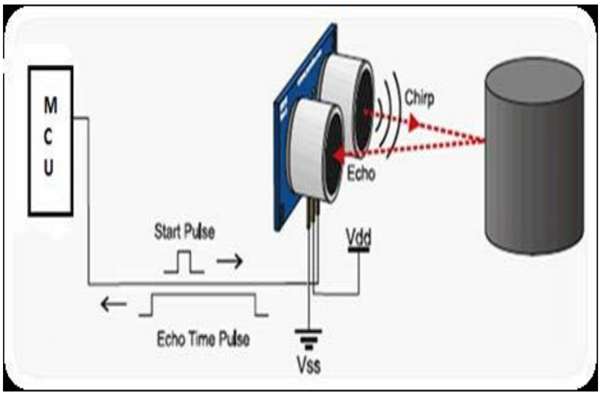


Fig 2.1 Ultrasonic Sensor **Fig 2.2** Working Principle of Ultrasonic Sensor

1.2. Temperature Sensor:

The LM35 series are precision integrated-circuit temperature sensors and its output voltage is linearly proportional to the Celsius (Centigrade) temperature. Thus LM35 has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. Low cost is assured by calibration and trimming at the wafer level. The LM35's linear output, low output impedance and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can also be used with minus supplies and single power supplies or with plus supplies. As it draws only 60 µA from its supply, it has very low self-heating which is less than 0.1°C in still air. The LM35 is rated to operate over a −55° to +150°C temperature range, while the LM35C is rated for a −40° to +110°C range (−10° with improved accuracy). Temperature has an effect on the speed of sound in air that is measured by the ECHO sensor. If the temperature (degree Celsius) is known, the formula is

$$C_{air} = 331.5 + (0.6 * T_c) \ m/s$$

1.3. Voice Play Back Module:

The aPR33A series are powerful audio processor along with high performance audio analog-to-digital converters (ADCs) and digital-to-analog converters (DACs).The aPR33A series incorporates all the functionality required to perform demanding audio/voice applications. The aPR33A series can be implemented with High quality audio/voice systems with lower bill-of-material costs because of its integrated analog data converters and full suite of quality-enhancing features such as sample-rate convertor. Also aPR33A series C2.0 is specially designed for simple key trigger and user can record and then playback the message averagely for 1, 2, 4 or 8 voice message(s) by switch. Users can let the chip enter power-down mode when unused which leads to effectively reduce electric current consuming to 15uA and increase the using time in any projects powered by batteries.

Features of voice play back module is given below

- Operating Voltage Range: 3V ~ 6.5V
- Development & Programming Systems Not Required
- No Battery Backup Required
- For Power Saving supports Power-Down Mode
- Averagely 1, 2, 4 or 8 voice messages record & playback.

Fig 2.3 Voice Play Back Module

1.4. RF Module:

RF module is used for finding the sticks in case of misplace. The range of RF module is approximate 100m. The transmitter operating voltage 3-12V and the receiver operating voltage is fixed i.e. 5V. Modulation technique of both transmitter and receiver is Frequency Shift Keying (FSK).The operating temperature of RF module is -20°**C** to 70°**C**.the receiver frequency is 315/433.92MHz. The typical sensitivity is -105dBm.One receiver is mounting in the hardware placed on stick and one transmitter is with that blind person. Whenever blind person presses the button located at the transmitter unit, the built-in circuits transmit the encoded data using HT12E and RF Module. On the other hand receiver unit receive that encoded data and decode the original data with the help of HT12D and RF receiver module, the decoded data is further send to controller unit to initiate the buzzer. For point-to-point proper communication the device address should be same.

III. Observation

The test results for the blind stick in different scenario is given below

3.1 Indoor Situation:

Common obstacle found in indoor conditions is chairs, tables and concrete wall. While testing the performance of ultrasonic sensor, we have placed that sensor at certain distance and observe the electronic output. Simultaneously measures the actual distance with the help of measuring tape. Similarly we took four to five readings for different object having different distances. Observed outputs are given below in graphical form in fig 3.1.

3.2 Outdoor Situation:

Most of the IR Sensors which employed in blind stick changes the output behaviour in outdoor conditions. The main reason behind such behaviour is because of sunlights. Sunrays consist of different frequency waves which matches with IR frequencies, Due to this IR receivers get activated and gives false output. So that it is necessary to test the ultrasonic sensor in sunny condition.

To test our blind stick at outdoor conditions, we placed the stick at same distance as considered in indoor conditions. The distances remain same but the surrounding conditions was different. At outdoor condition we have taken 4-5 readings. The graphical representation of our observation are given below in fig 3.2

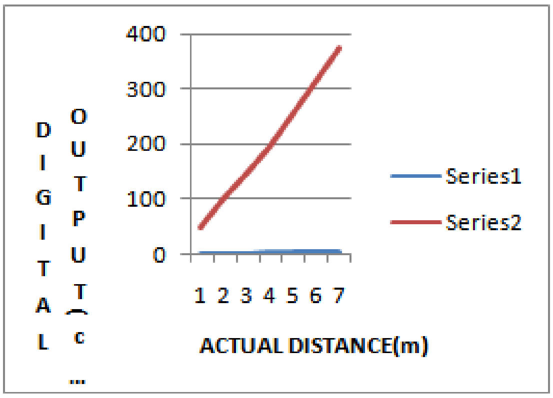


Fig 3.1 Graphical Representation (Indoor)

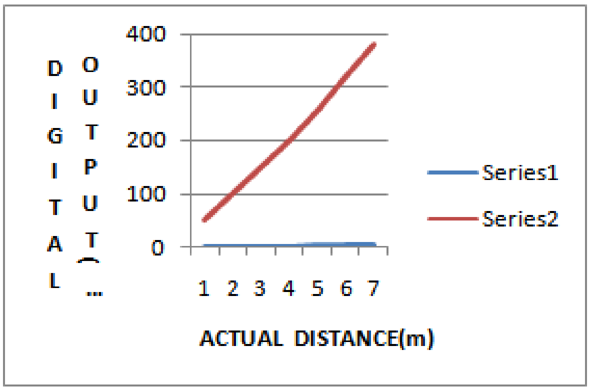


Fig 3.2 Graphical Representation (Outdoor)

At first glance, both the observations look alike. We have not found any such a difference in output of ultrasonic sensor. Finally we have concluded that the performance of ultrasonic sensor remain same in all conditions. This feature of ultrasonic sensor makes it superior as compare to IR sensor. Accuracy and sensitivity is also good.

IV. Test Conditions

Objects having different physical properties like backlit, plastic, glass etc. placed at a distance apart and measure the distance with the help of digital radar. We have taken three different readings for each object. As per the observation table, output remains almost same for all objects. this feature of ultrasonic sensor make it superior as compare to IR or other sensors. Initially we have placed blind stick in front of obstacle and monitored the digital output which is shown in the test table. In second observation, we have replaced that obstacle by reflective objects like glass and backlit. these obstacles having a light reflective property which affects the output but our sensor is based on ultrasonic principle.

Obstacle Plastic Glass Plywood

Fig 4.1 Different Test Conditions

To evaluate the performance of sensor with different objects, we have conducted an axperiment over different objects placed at certain distances as mentioned in the below table.

SR NO	OBJECT	TEST 1	TEST 2	TEST 3
1.	OBSTACLE	150cm	66cm	39cm
2.	PLYWOOD	151cm	62cm	38cm
3.	PLASTIC	140cm	54cm	29cm
4.	GLASS	185cm	61cm	36cm

Fig 4.2 TEST TABLE

V. Conclusion

With the proposed architecture, the blind people will able to move from one place to another without others help. This system will act as a basic platform for the generation of more such devices for the visually impaired in the future which will be cost effective. It will be real boon for the blind. The developed model gives good results in detecting obstacles paced at distance in front of the user. The result developed is a moderate budget navigational aid for the visually impaired. However minimizing cost leads to compromises in performance. It is advised that the design be improved before commercial production.

References

[1]. Joseline Villanueva and Rene Farcy, Student member IEEE,"Optical Device Indicating safe free path to blind people", Vol 61 No.1, January 2012.

[2]. Mohammad ShorifUddin and Tadayoshi Shioyama," Technical Correspondence", Vol. 6, No. 4, December 2005.

[3]. Mohammad Hazzaz Mahmud, Rana Saha, Sayemul Islam ,"Smart walking stick - an electronic approach to assist visually disabled persons ",International Journal of Scientific & Engineering Research, Volume 4, Issue 10, October-2013

[4]. G.Gayathri, M.Vishnupriya, R.Nandhini, Ms. M.Banopriya , "Smart Walking Stick For Visually Impaired "International Journal Volume 3 Issue 3 March, 2014**.**

[5]. M. Naveen Kumar, K. Usha,"Voice Based Guidance and Location Indication System for the Blind Using GSM, GPS and Optical Device Indicator "International Journal of Engineering Trends and Technology (IJETT) - Volume4 Issue7- July 2013.

[6]. VISTAC. [Online]. Available: http://www.vistac.de/

[7]. PRIMPO ISONIC: State of the Art Electronic White Cane.

[8]. [Online].Available: http://www.primpo.com/eng/products/isonic.html

[9]. U. Roentgen, G. Gelderblom, M. Soede, and L. de Witte, "Inventory of electronic mobility aids for persons with visual impairments: A literature review," *J. Vis. Impairment Blindness*, vol. 102, no. 11, pp. 702–724, 2008.

[10]. 6. R. Kowalik and S. Kwasniewski, "Navigator—A talking GPS receiver for the blind," in *Computers Helping People with Special Needs*,K. Miesenberger, J. Klaus, W. Zagler, and D. Burger, Eds. Heidelberg, Germany: Springer Berlin, 2004, ser. Lecture Notes in Computer Science. 626.

[11]. M. E. Peck, "RFID tags guide the blind," IEEE Spectrum, New York, Tech. Rep., Jan. 2008.

[12]. M. Saaid, I. Ismail, and M. Noor, "Radio frequency identification walking stick (RFIWS): A device for the blind," in *Proc. 5th Int. CSPA*, Mar. 2009,pp. 250–253.

[13]. L. A. C. C. Instrumental. [Online]. Available: http://www.lac.upsud.fr/teletact/index-teletact.htm

[14]. Gismag Ultracane Uses Ultrasonic Echoes to Offer Spatial Awareness to the Vision-Impaired. [Online]. Available: http://www.gizmag.com/go/3827/

[15]. http://www.performancepanels.com/acoustical-properties

[16]. http://www.acoustic.ua/st/web_absorption_data_eng.pdf