Volume 6, Issue 10, October 2016 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

See the World with Sound

K. S. Thivya, K. Suriyakrishnaan
Assistant Professor, Department of ECE, Easwari Engineering College, Chennai,
Tamil Nadu, India

Abstract— the word blindness is referred to full or nearly full vision loss. As of 2012 there were 285 million people who were visually challenged of which 246 million had partial vision and 39 million were completely blind. For a normal person the vision is possible by the rays of light emanated from the eyes to illuminate the world around. When it was dark, the air became murky so the rays could not go through, but a candle could burn off the opacity in the air, allowing sight to penetrate. If a person is visually impaired then Echolation helps to see without their eyes. This work aims at being blind is not that different from not being blind. Echolocation technique is used to detect the distance and the objects which are near. In this work a Ultrasonic Distance Sensor-PWM Out is used to detect the objects and the distance. The ultrasonic sensor is interfaced to Atmel microcontroller where the triggering and measurement can be done using two I/O pins.

Keywords— Echolocation, Ultrasonic Distance Sensor-PWM Out, microcontrollers.

I. INTRODUCTION

The sound sharp clicks which bounces back off nearby objects by picking up the echoes we can precisely locate where the things are. Each echo sound differs depending on the materials, for example the echoes can be gentle signifying the metals, intense representing wood or pointed (glass).judging by how loud or faint they are we can calculate the distances. This way of judging the object and distance is called echolocation. Mostly bats and dolphins use this technique to get around. Only a handful of people use this echolocation as a supplement to more traditional methods such as walking with a cane or a guide dog. The same echolocation technique is used in this work. To date there are no statistics available about how many blind people use echolocation, perhaps between 20 and 30% of totally blind people may use it.

A. What is Echolocation

For finding the targeted distance Echolocation is used. A sound is emitted and if there is an object nearby, it will reflect the sound back to the echolocator. The time difference between the sound emission and the echo informs the distance of the object, since sound requires time to travel. Echolocation makes use of active sonar, using sounds . Ranging can be calculated by taking the time delay into account between the sound emission and any echoes that comes back from the nearby surrounding environment.

B. Echolocation used by animals

Echolocating animals have two ears positioned slightly apart. The echoes returning to the two ears vary in times and vary in loudness levels, depending on the position of the object generating the echoes. In order to get the direction and distances the two parameters, time and loudness differences are considered by the animals. The animal which use echolocation can not only judge where it is going but also can find how big another animal is, what kind of animal it is, and other features. Owls have ears that are positioned differently on each side of the head, but they don't echolocate. They use hearing to target their prey even in the dark, and by considering the slight difference of the echo reaching time between left and right ears the direction and distance are calculated. Echolcation is used by bats and dolphins (and some birds), but they do not have asymmetrical ear placements. Echolocation calls are usually ultrasonic whose frequency ranges from 20 to 200 kilohertz (kHz), whereas human hearing normally ranges at 20 kHz. Even so, we can hear echolocation clicks from some bats. These noises resemble the sounds made by striking two round stones together. Echolocation calls are generally differentiated by their frequency, intensity and duration. In terms of loudness, bats emit calls as down as 50 dB and as sharp as 120 dB, which is louder than a smoke detector 10 centimeters from your ear. That's not just loud, but damaging to human hearing. The ears and brain cells in bats are especially designed to the frequencies of the sounds they emit and the echoes that result.

II. RELATED WORKS

In order to help the visually impaired people many research work has been conducted. The major problem faced by the blind people is to travel on their own without anyone's help. The solution consists of two parts. The first part includes the software running on a Windows Phone based mobile phone, and the other one is the custom built DRAC1 hardware. The hardware contains two infrared sensors and an ultrasound sensor which detects the distance between the

objects and the phone, and then the software works on the signal and notifies the user [1]. Even though the blind people use a cane for guidance, the cane cannot detect the objects over their waist level. To overcome this problem a white-cane attachment provides feedback to the user by finding objects present at the upper level of the bottom level tip of the white-cane. The sensor hat helps to find the objects in front and to the left, and right of the user. The feedback mechanism occurs through a glove containing vibrating motors corresponding to each sensor [2].when a blind person is travelling in an unknown environment there are lots of probability for an accident. To avoid this situation, recent innovations in day to day electronic sensors, touch sensing and microcontroller technology is used and the system helps the visually challenged person in routing via audible messages and haptic feedback, helping them localize where they are and to improve their mobility [3]. The Haptic Alerts for Low-hanging Obstacles (HALO) system measures the distance of the objects acquiring data from an ultrasonic range sensor with vibration feedback sent by an eccentric mass motor, the device aims to alert users of low-hanging obstacles without interfering with the standard functionality of a white cane[4]. Wearable navigation system for the blind uses Simultaneous Localization and Mapping (SLAM) from mobile robotics. Once a map is created the user can be guided efficiently by a route selecting method [5]. RFAIDE – is a system utilizing Radio Frequency Identification (RFID) which incorporates a mobile RFID reader module with an Integrated ZigBee transceiver for transmitting the tag's information. Utensils and other objects in the house or building are embedded with passive RFID tags (transponders) along with an audio file, recorded for and unique to each object, residing on the server. This system further takes in the way finding technique by employing an RFID tag grid using an ample separation area. The reader reads the tags and transmits the data wirelessly to the server PC which in turn scans for the particular ID in the database and plays the corresponding audio file. A self designed coordinates system with a server side routing application is used for routing the person to a particular room requested, based on his current tag coordinates. The audio playback is relayed wirelessly using an

FM transmitter to either a headset with FM receiver or a Smart Phone's FM radio[6]. The Electronic long cane is an assistive technology device signalizes obstacles above waistline and warns about potential collisions [7].

III. BLOCK DIAGRAM

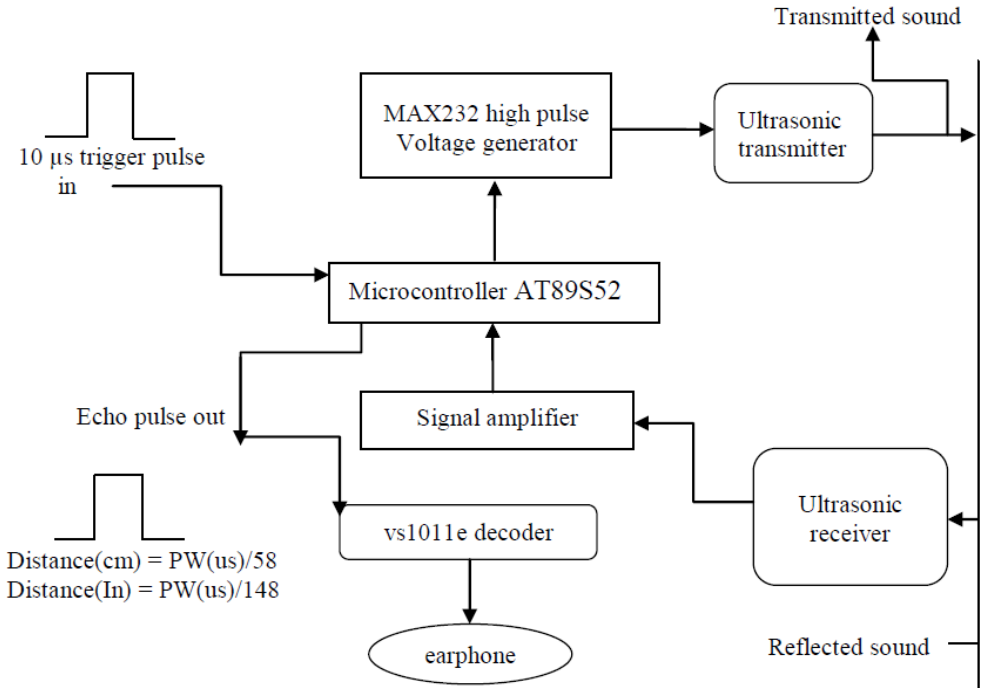


Figure 1: Block diagram of echo based obstacle detector

IV. METHODOLOGY

The work starts with an Ultrasonic Distance Sensor .It varies range from 2 cm to 5m for applications in detection .The sensor provides exact and constant noncontact distance scaling from about 2 cm to 5 meters . The ultrasonic sensor interfaced to microcontrollers where the triggering and measurement can be done using two I/O pin. There are 4 pins out of the module: VCC, Trig, Echo, and GND .The sensor transmits an ultrasonic wave and generate an output pulse in connection to the time required for the burst echo to return to the sensor. The echo pulse width is calculated in order to find the distance between the targets. For every 0.6 2 metre the pulse width is calculated and if there is any obstacle it is identified and by the audio voice using earphone the person can figure out the obstacle. Since the whole circuit is fitted in a cane considering the angle where the obstacle is present is not considered. This circuit is very cost effective and affordable.

A. Sequence Chart

(i) A short ultrasonic pulse is transmitted at the time of 10uS trigger input pulse.
(ii) The pulse is reflected by an object.

(iii) The senor receives this signal and converts it to an electric pulse of variable duration. When the echo is faded away the next pulse is transmitted and this time period is referred as cycle period. The recommend cycle period must lie above 50ms. If a 10µs width trigger pulse is passed to the signal pin, the Ultrasonic module will generate 40 kHz ultrasonic signal output at eighth pin and detect the echo back. The echo pulse width is directly proportional to the calculated distance and the formula for calculating this value is given in the below figure. A high level signal (38ms) can be obtained in the output pin, if there is no obstacle is detected.

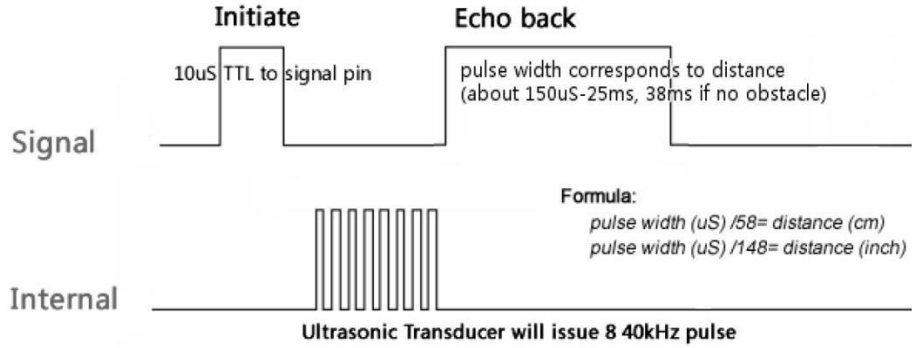
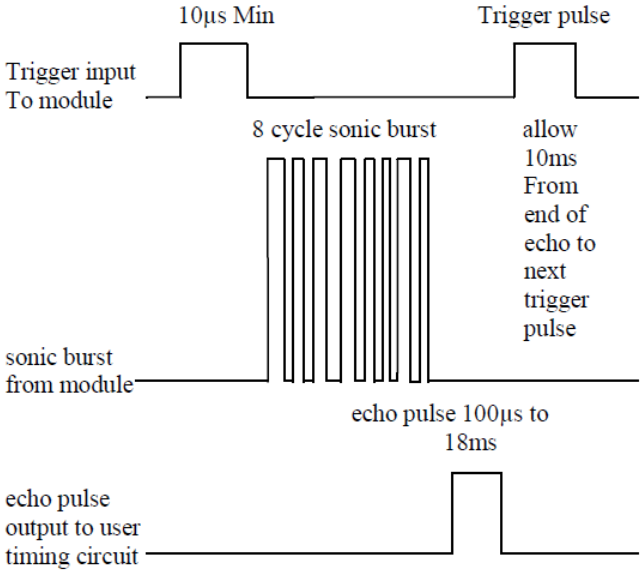


Figure2: Sequence chart diagram[17].

(iv) In Timing Diagram, The sensor requires a short trigger pulse from the microcontroller and it provides an echo pulse as output. The controller only has to measure the length of the echo pulse to find the range



note: echo pulse is approx 36ms if no object is detected

Figure 3: Timing diagram [17]

(v) AT89S52 Microcontroller Description: The AT89S52 Microcontroller provides the standard features such as 256 bytes of RAM, 8 kilobytes of flash, Watchdog timer, 32 I/O lines, two data pointers, three 16-bit timer/counters, a full duplex serial port, a Six-vector two-level interrupt architecture, on-chip oscillator, and clock circuitry.

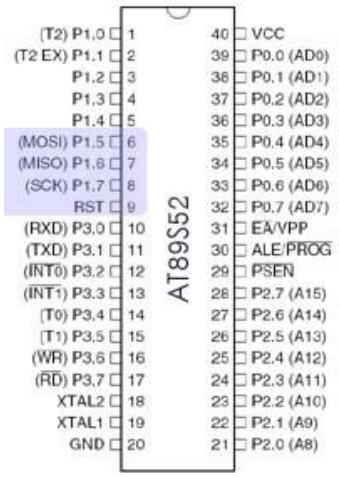


Figure 4: PIN diagram of AT89S52 [16]

V. CONCLUSIONS

The work aims to design a simple and cost effective circuit for the visually impaired person based on the echolocation concept. In this work the input pulse is given and if suppose there is an obstacle the echo pulse received by the sensor calculates the pulse width for every 0.62 meter and indicates the obstacle by audio version. This whole circuit is placed in a cane so according to the position and angle where the cane is positioned the object at that angle and position is detected.

VI. FUTURE WORK

In this work only one parameters was taken in to consideration. In connection to it only the echo pulse width was calculated to find the distance where the object is located but to make the work more effective the cane does not detect the objects above the cane tip.so sensors that will detect the objects above the cane can be used. when the person is in an unknown environment the route map and navigation via audio message can be provided by using modern days sensors and micro-controllers. Effective map and route creation software helps the work to be effective and user friendly. The temperature sensor can be used to provide automatic light on facility indicating that a blind person is crossing the road or presented in that location. If all the above mentioned parameters are taken in to consideration and a circuit is designed providing solutions for all the problems then it would help to give a complete independent life to them

REFERENCES

[1] Zuban, E. ; Coll. of Appl. Sci., Subotica Tech, Subotica, Serbia ; Labadi, H. ; Balogh, I. ; Kovacs, K. (2012), "Digital Radar Aided Cane", Intelligent Systems and Informatics (SISY), IEEE 10th Jubilee International Symposium.

[2] Kenneth Chee, Xyrus Ferriol, Edmund Ing, Jeffrey Leung, William Yiu,(2011) "Radar for the Blind", California Polytechnic College of Engineering, Issue 2,Vol 8.

[3] V.Ramya, Laxmi Raja , B.Palaniappan , (2013), "Voice Assisted Embedded Navigation System for the Visually Impaired" International Journal of Computer Applications (0975 – 8887) Volume 64– No.13.

[4] Katherine J. Kuchenbecker, (2012)"HALO: Haptic Alerts for Low-hanging Obstacles", White Cane Navigation Departmental Papers (MEAM).

[5] Esteban Bayro Kaiser, Michael Lawo,(2012)"Wearable Navigation System for the Visually Impaired and Blind People", IEEE.

[6] Sin Murad, Abdullah Rehman, Arif Ali Shah, (2011)"RFAIDE – An RFID Based Navigation and Object Recognition Assistant for Visually Impaired People", IEEE.

[7] A. R. García, R. Fonseca. A. Durán,(2011). "Electronic long cane for locomotion improving on visual impaired people. A case study", IEEE.

[8] Mohd Helmy Abd Wahab, Amirul A. Talib, A. Kadir, Ayob Johari, A.Noraziah, Roslina M. Sidek, Ariffin A Mutalib, (July 2011)"Smart cane: Assistive cane for the visually impaired people", International Journal of Computer Science Issues, Vol. 8, Issue 4, No 2.

[9] Mihai Emanuel Basch, Robert Istvan Lorincz, David George Cristea, (2011)"A Bio-inspired Collision Avoidance System Concept for People with Visual Disabilities", International Journal Of Systems Applications Engineering & Development, Issue 6, Volume 5.

[10] R. Fonseca Livramento da Silva, L. S. Gómez,(2010) "Design of product integrated to the urban project: evaluation of the assistive technology design and its contribution for the inclusion of visual impaired people in open urban spaces," 10º Ergodesign congress international deergonomia e usabilidade de interfaces humanotecnologia, pp. 195.

[11] S.Sai Santhosh, T. Sasiprabha, R. Jeberson,(2010) "BLI –NAV Embedded Navigation System for Blind People" ,IEEE.

[12] H.Fernandes, P.Costa, V.Filipe, L.Hadjileontiadis, J.Barroso, (2010)"Stereo Vision In Blind Navigation Assistance", World Automation Congress, pp.1-6.

[13] P.Jae-Han, B.Seung-Ho, B.Moon-Hong,(2007) "An intelligent navigation method for services robots in the Smart Environment," International Conference on Control, Automation and Systems, pp. 494.

[14] Andreas Hub Tim Hartter Thomas Ertl., (2006)"Interactive Tracking of Movable Objects for the Blind on the Basis of Environment Models and Perception-Oriented Object Recognition Methods", ASSETS'06.

[15] Tsung-Hsiang Chang, Chien-Ju Ho, David Chawei Hsu, (2005)" I Cane – A Partner for the Visually Impaired", International Conference on Embedded and Ubiquitous Computing, pp. 393-402.

[16] www.atmel.com

[17] http://www.sunrom.com

