IOSR Journal of Electronics and Communication Engineering (IOSR-JECE)
e-ISSN: 2278-2834,p- ISSN: 2278-8735.
PP 11-15
www.iosrjournals.org

Ultrasonic Smart Stick for Visually Impaired People

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Abstract: *Today's world is moving very fast and in this fast world we should walk together and no one should left behind. But there are some parts of society which are lagging behind because of some disabilities. One of them is blindness. Blind people have to rely on others for travelling and other activities. So to solve this problem to some extent we are introducing Ultrasonic Walking Stick for Blind People.*

This paper discuss about how this stick is built and how it will help blind people. There are various methods to do it and we are using helpful concepts from each paper.

Keywords: *Ultrasonic sensor, water sensor, Bluetooth module, buzzer.*

I. Introduction

The survey of WHO (World Health Organisation) carried out in 2011 tells us that in world about 1% of the human population is visually impaired and amongst them about 10% is fully blind.

The main problem with blind people is mobility. This paper proposes a tool for visually impaired people that will provide them navigation. Long white cane is a traditional mobility tool used to detect obstacles in the path of a blind person. We are modifying this cane with some electronics components and sensors so that cane can become smart cane.

In this project we are using ultrasonic sensors, water sensor, buzzer, Bluetooth module. Ultrasonic sensor is used to detect any obstacle. It has Detection Distance of 2cm-450cm so whenever there is some obstacle in this range it will alert the person. Water sensor is used to detect if there is water in path. So person can be aware of it. Bluetooth module will help person to find the stick which is placed away. If person want to find it, he/she will press a button on remote control and buzzer will ring and person can get idea where the stick is placed.

II. Literature survey

2.1 Section 1

Sylvain Cardin, Daniel Thalmann and Frederic Vexo [1] used stereoscopic architecture to develop new obstacle sensing abilities. First they determine from which direction the obstacles are coming from. There are vibrators on left and right shoulder of user. With these vibrators he can detect the position of the obstacle. Then user in this system will be able to position himself.

Osama Bader AL-Barrm, JeenVinouth [2] proposed that detects the obstacles in the path of the blind using ultrasonic sensors. It consists of these sensors to scan three different directions, a microcontroller, buzzer and DC vibration motor. The buzzer and vibration motor is activated when any obstacle is detected. In addition, the stick is equipped with GPS and SMS message system.

B.Mohan Sitaramaiah, M.Naganaik [3] this system has ability of overcoming the drawbacks with the existed technologies like guide cane and talking signs that they are only giving a support while they are walking, but not avoiding the accidents due to some vehicles and man holes. The existed systems are also failed in information sending in case of emergencies. This system enhances blind system assistance with ultrasonic sensors. The system consists of two ultrasonic sensors modules, voice playback module, and a vibration motor. The ultrasonic sensors will monitor the objects in front of them. The sensor placed in front direction to the system will detects if any obstacles are present in front of the blind person path. Another sensor placed in back direction of the system will measure the distance from the objects to the blind person. The voice module will play the corresponding voice for intimating the blind person about the danger happening. The vibration motor is useful in case of person is in traffic and if the voice output is not audible in busy areas. In an addition, there is a GSM module connected to the system, for providing the information exchanging from the blind people.

F. van der Heijden, P.P.L. Regtien [4] this paper describes the system architecture for a navigation tool for visually impaired persons. The major parts are: a multi-sensory system comprising stereo vision, acoustic range finding and movement sensors, a mapper, a warning system and a tactile human-machine interface. There are three main sensors in this project stereovision, optical flow, and sonar

Srirama Divya, B. Navya, P. Suma manasa, S. Chitra [5] the paper presents a theoretical model and a system concept to provide a smart electronic aid for blind people. The system is intended to provide overall measures – Artificial vision and object detection. The aim of the overall system is to provide a low cost and efficient navigation aid for blind which gives a sense of artificial vision by providing information about the environmental scenario of static and dynamic objects around them. Ultrasonic sensors are used to calculate distance of the obstacles around the blind person to guide the user towards the available path. Output is in the form of voice which the blind person can hear e.g., right, left etc. The hardware consists of Arduino Uno board, ultrasonic sensors and speaker.

Ankit Agarwal, Deepak Kumar, Abhishek Bhardwaj [6] this paper proposes an economical ultrasonic stick for visually challenged people, so as to gain a personal independence and free from the external help. A portable user friendly device is developed that can identify the obstacles in the path using ultrasonic sensors and Camera. Ultrasonic sensors can scan three different directions (at 180o). Camera can be used as an alternative tool in the places that surrounds with the low signal coverage, a microcontroller, buzzer and vibrating motor. The buzzer and vibration motor is activated when any obstacle is detected. GPS system provides the information regarding to his current location. SMS system is used by the blind to send SMS message to the saved numbers in the microcontroller in case of emergency.

Jayant Sakhardande, Pratik Pattanayak, MitaBhowmick [7]This project aims at the design and implementation of a detachable unit which is robust, low cost and user friendly, thus, trying to aggrandize the functionality of the existing white cane, to concede above-knee obstacle detection. The designed obstruction detector uses ultrasound sensors for detecting the obstructions before direct contact. It bestows haptic feedback to the user in accordance with the position of the obstacle.

This project consists of a battery and ON/OFF switch, charging circuit and USB adaptor, ATMEGA328P controller, vibrators.

RAYMOND S. FRENKEL [8] this research focused on a new approach. A coded pulse was transmitted and correlation techniques were used to identify echoes and determine time of flight. Compared to the prior effort this new approach was more sensitive, had greater noise immunity, and provide greater spatial resolution for obstacle detection. The first step in the coded pulse approach was to generate a transmit pulse with an embedded binary code that is highly distinguishable. A transmit pulse generated by phase modulating a 40 kHz carrier signal with a 13-bit Barker code word, with each bit consisting of 4 cycles of the 40 kHz carrier was used.

Digitized representative echoes were used as reference vectors for correlation to account for the effect of the impulse responses of the transducers, the air, and the reflection, on the transmitted pulse. In a detection cycle, the coded pulse was transmitted; the A/D converters took 2600 samples at the 150 kHz sampling rate to capture any echoes from objects between 1 and 4 meters in front of the cane. The receiver data was cross-correlated with the stored echo image to find echoes in the received signal. The correlation peak positions from the upper receiver were then compared to the peak positions from the lower receiver and if they collaborated within the synthetic aperture, the range and height were calculated annunciation was made by a synthesized voice. The new obstacle detection system described above was designed and a prototype was constructed and embedded into the shaft of an 18 mm diameter body of a long cane.

2.2 Section 2

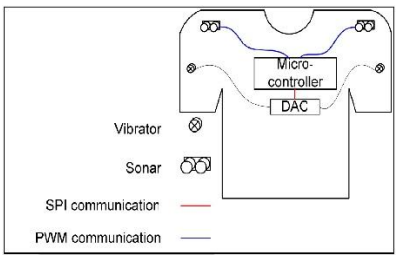

Fig.[1]-A

Fig.[1]-A Shows architecture where components are attached to a jacket. This wear cloth provides a natural way of carrying that facilitate its use. The components we integrate are: two sonar sensors, a microcontroller, and two vibrators. The sensors are fixed on the shoulders to increase the field of sensing and side determination.

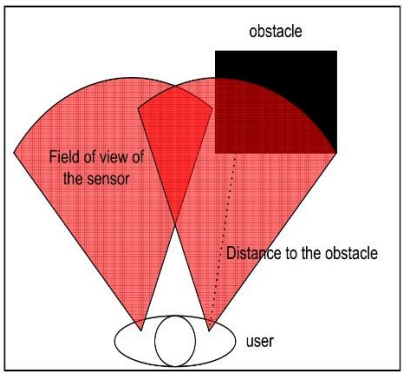

Fig.[1]-B

Above Fig.[1]-B shows horizontal sensing map

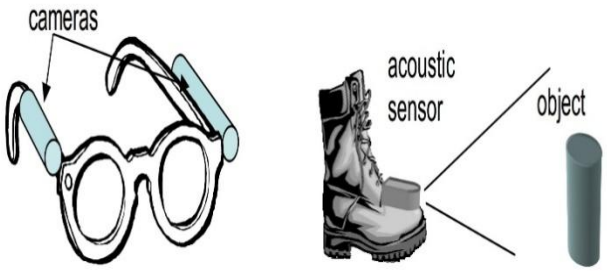

Fig.[4]

Fig.[4] shows sensor systems: left: dual camera system for stereo vision, worn as glasses; right: acoustic sensor system worn on top of a shoe.

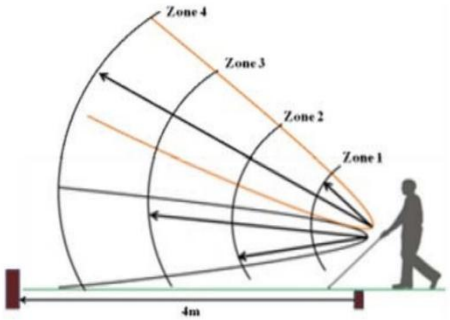

Fig.[7]-A angular coverage of the detection zone

The sensor output is provided to an Arduino which calculates the distance based on the program. The obtained value is compared with the fixed value and a vibratory pattern is generated according to the zone.

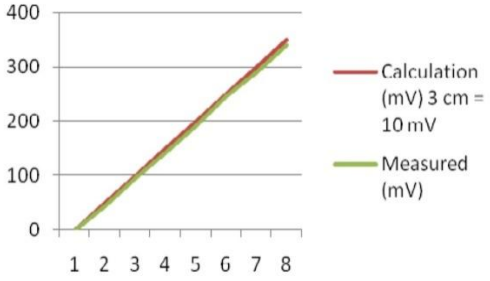

Fig.[7]-B

Fig.[7]-B Shows difference between the calculation value and the measured value in the analysis of ultrasonic range finder.

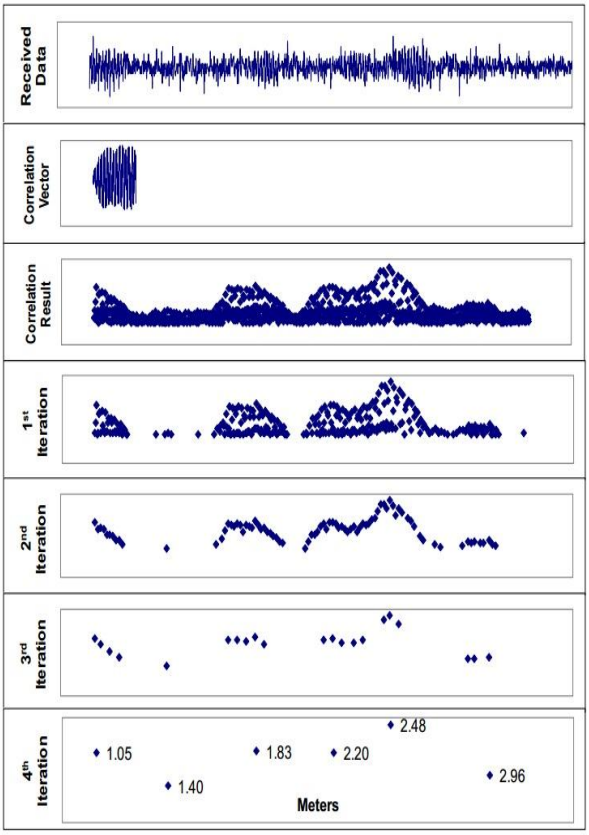

Fig.[8]

Fig.[8] shows the iterative peak location process

III. Proposed work

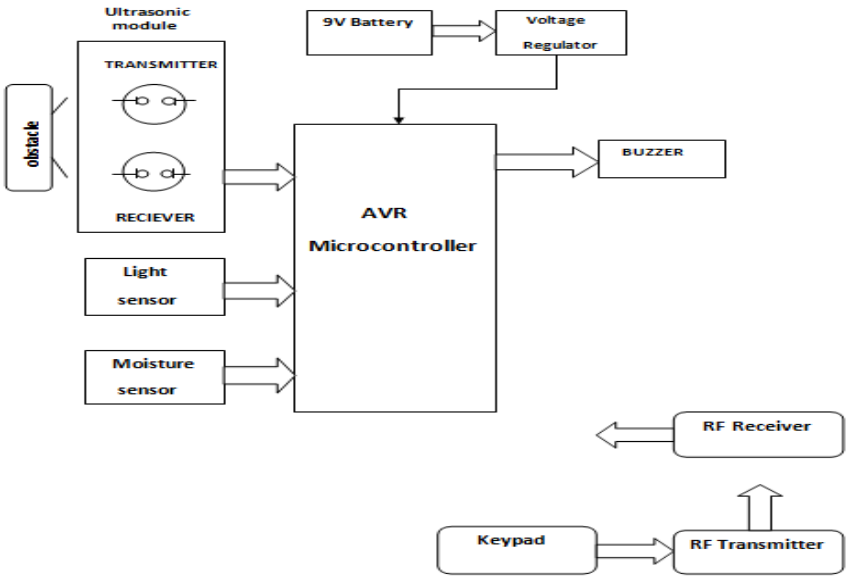

Fig. Proposed block diagram

Blind stick is an innovative stick designed for visually disabled people for improved navigation. We here propose an advanced blind stick that allows visually challenged people to navigate with ease using advanced technology. The blind stick is integrated with ultrasonic sensor along with light and water sensing. Our proposed project first uses ultrasonic sensors to detect obstacles ahead using ultrasonic waves.

On sensing obstacles the sensor passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is close the microcontroller sends a signal to sound a buzzer. It also detects and sounds a different buzzer if it detects water and alerts the blind. One more feature is that it allows the blind to detect if there is light or darkness in the room. The system has one more advanced feature integrated to help the blind find their stick if they forget where they kept it.

A wireless RF based remote is used for this purpose. Pressing the remote button sounds a buzzer on the stick which helps the blind person to find their stick. Thus this system allows for obstacle detection as well as finding stick if misplaced by visually disabled people.

IV. Conclusion

The aim of this paper is to get familiar with the work done in making walking stick smart and more helpful. The literatures related to this topic were reviewed and analysed. As technology improves these smart sticks need to be modified. The simulation results are expected for the ultrasonic sensors, water sensor and Bluetooth model in one microcontroller. So in this paper wide survey of the work related to this project is done and we have shortlisted some useful aspects from each project. This will also help to decide designing approach.

Acknowledgements

I would like to thank our guide, Mrs. V.S. Kulkarni for her great guidance and support. I am thankful to HOD Mr. D.G. Bhalke and faculty members of E&TC department of JSPM's Rajarshi Shahu College of Engineering, Tathawade, Pune.

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