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Sensor Based Assistive Device for Visually Impaired People

Dr.Sreeja Mole S.S., C.H.Ramya, L.Anusha, K.Soumya and K.Purnachander

Department of ECE, CJITS, Janagon, India.

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ABSTRACT

The smart blind stick can assist with walking alone in new environments by taking inputs through an obstacle sensor and providing feedback to the person through vibration motor. One day while we were walking to our home, a blind person has seen walking through the street. He was facing difficulty in walking in through that busy street. Fortunately, we helped him at that time and realized to use technology to assist people like him. It was that evening that I came up with this idea about the Smart blind stick. Using this Smart blind stick, a visually impaired person can walk without anyone's help. The stick can automatically detect the obstacle in front of the person and give them a feedback response by vibrating the walking stick and giving a warning sound. Through this tool, the blind person can be aware of the obstacles in front of them. Blind stick is an innovative stick designed for visually disabled people for improved navigation. This paper proposes an advanced blind stick that allows visually challenged people to navigate with ease using advanced technology. The blind stick is integrated with ultrasonic sensor 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 close the circuit does nothing. If the obstacle is close the microcontroller sends a signal to sound a buzzer and the vibrator vibrates. Thus this system allows for obstacle detection for visually disabled people.

Keywords: Blind Stick, Obstacle, Microcontroller.

1. INTRODUCTION

According to the World Health Organization (WHO) statistics, around 30 billion people are blind on the earth. This project proposes to design and develop a portable unit (stick) for them for easy usage and navigation in public places. The blind stick is integrated with ultrasonic sensor. Here ultrasonic sensors are used to detect obstacles ahead using ultrasonic waves and the sensor passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close or not. If the obstacle is close the microcontroller sends a signal to sound a buzzer and alerts the blind. There are approximately 37 million people across the globe who are blind, over 15 million are from India. Even for the non-visually impaired the congestion of obstacles is sometimes problematic, it's even worse for the visually impaired. People with visual disabilities are often dependent on external assistance which can be provided by humans, trained dogs, or special electronic devices as support systems for decision making. Existing devices are able to detect and recognize objects that emerge on the floor, but a considerable risk is also includes the objects that are at a sudden depth, or obstacles above waist level or stairs.

Thus we were motivated to develop a smart white cane to overcome these limitations. The most common tool that the blind currently use to navigate is the standard white cane. We decided to modify and enhance the walking cane, since blind are only able to detect objects by touch or by cane. The user sweeps the cane back and forth in front of them. When the cane hits an object or falls off of the edge of a stair, the user then becomes aware of the obstacle – sometimes too late. We accomplished this goal by adding ultrasonic sensors at specific positions to the cane that provided information about the environment to the user through audio feedback. The main component of this system is the sensor. In this paper Ultrasonic Blind walking Stick is integrated with Ultrasonic sensors. This paper is organized as follows. In section 3, prototype of stick is discussed. The LBP operator is explained in section 3. In

section 4, Unsupervised Entropy based LBP operator segmentation algorithm is reviewed. Experiments results are shown in section 5 and finally conclusion is on section 6.

2. ULTRASONIC BLIND WALKING STICK

The block diagram of Ultrasonic Blind Walking Stick is as shown in Fig 1.1. The Ultrasonic Blind Walking Stick consists of the following components

1. ARDUINO UNO ATMEGA 328
2. Ultrasonic sensor GH311
3. Batteries
4. Buzzer
5. Vibrator

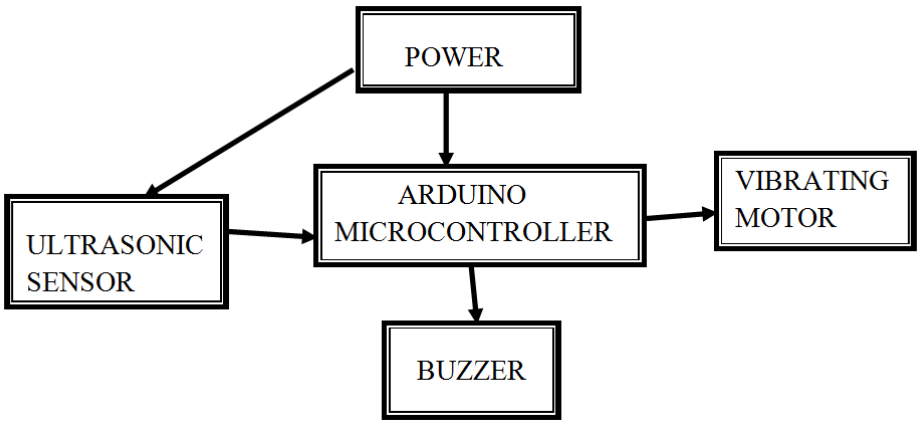

Fig 1.1: Block Diagram of Ultrasonic Blind Walking Stick

ARDUINO UNO ATMEGA 328 is a single chip microcontroller board based on the ATMEGA 328 created by ATMEL in the mega AVR family. Ultrasonic sensor used is GH 311 and it is designed to measure the distance of any object by using an ultrasonic transducer. GH 311 sensor detects objects by emitting a short ultrasonic burst and then receives the echo. Battery is an electronic device consisting of one or more electrochemical cells with external connections provided to power electrical devices. Buzzer or beeper is an audio signaling device which may be mechanical electromechanical or piezoelectric. Vibrator is a mechanical device to generate vibrations. It contains a small internal mass attached to a spring which creates a force when driven.

3. PROTOTYPE OF STICK

Sensor interfaced to the controller functions are discussed as

1. Ultrasonic sensor is used for obstacle avoidance .The vibrator vibrates when an obstacle is encountered which helps in alerting the blind person and allows enough time to change their path.
2. Vibrator and buzzer are used as output devices.

Figure 1.2 shows physical structure of smart stick. Sensor is used to detect ranges from obstacles, GH 311 ultrasonic sensor is used at bottom of the stick. ATMEGA 328 is microcontroller reads the sensor and drives a buzzer and vibrator.

Fig 1.2: Prototype of stick

This system can be used in both indoor and outdoor navigation. It Detects obstacles and alerts the blind person through vibration alert and speech output. The cost design is efficiently low and power consumption is very less. The system developed here is a moderate budget navigational aid for visually Impaired people and minimization in cost leads to compensation in performance. Actually it works as navigation device for the blind people and the system can be used to navigate by everyone not only visually impaired under certain circumstances, like foggy mornings with low visibility in winter, then this system can be used. This can be modified into more sophisticated version of itself by using high Intensity ultrasonic waves to be used as a navigation system for geological Explorations and also used by patients suffering with eye ailments like cataract, Exophthalmia, post eye operative situations.

4. PROPOSED APPROACH OF BLIND WALKING STICK TICK

ARDUINO can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the ARDUINO programming language (based on Wiring) and the Arduino development environment (based on Processing). ARDUINO projects can be stand-alone or they can communicate with software on running on a computer**.** The Smart stick will have an Ultrasonic sensor to sense distance from any obstacle. All the feedbacks will be given to the blind man through a Buzzer. Of course you can use a vibrator motor in place of Buzzer and advance a lot more using your creativity as shown in Fig 1.3.

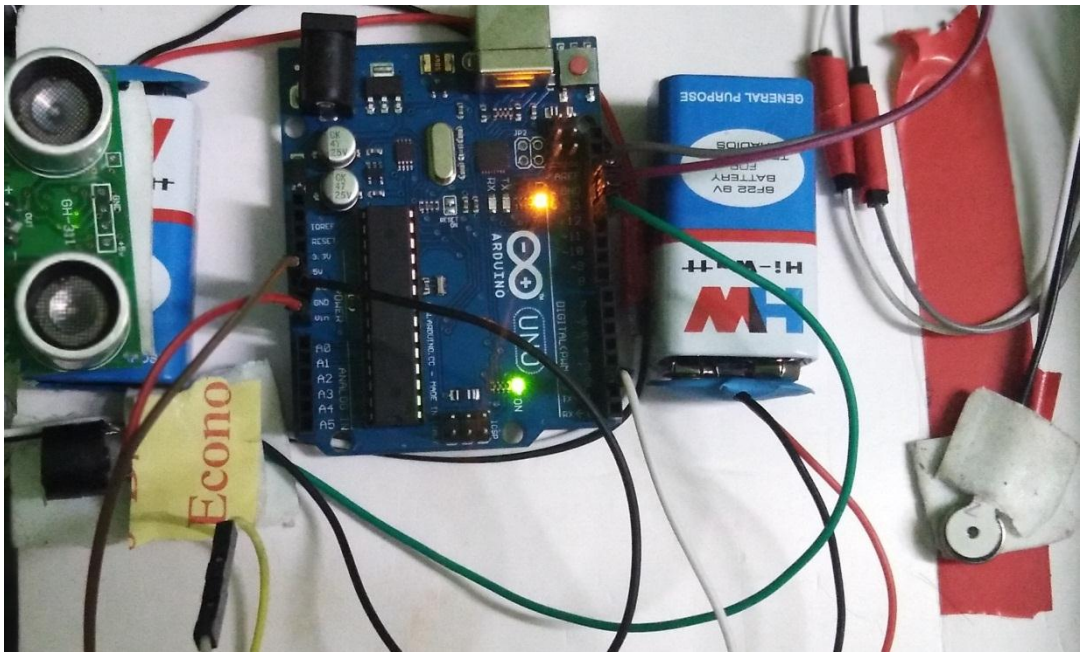

Fig 1.3 Proposed diagram of blind walking stick

The components required are ARDUINO UNO (AT MEGA 328), Ultrasonic Sensor GH-311, Vibrator, Buzzer, Soldering Kit and 9V batteries. ARDUINO UNO is used to control all the sensors. The complete board is powered by a 9V battery which is regulated to Vin. The Ultrasonic sensor is connected to positive of 9V battery and the Echo pin is connected to negative of 9V battery . The output of the board is given by the Buzzer. The proposed schematic diagram of ultrasonic blind walking stick is shown in Fig 1.4

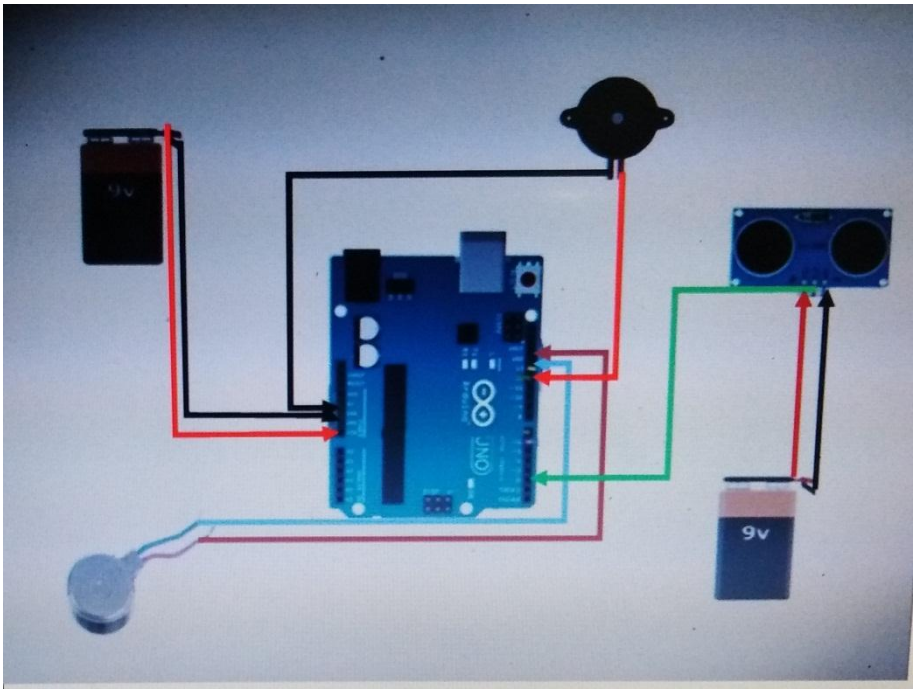

Fig.1.4 Schematic diagram

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1) Make sure the connections are done as per the circuit diagram and the program is successfully uploaded. Now, power both the circuits using a 9V battery and you should start to see results. Move the Ultra Sonic sensor closer to object and you will notice the Buzzer beeping and ***this beeping frequency increases as the stick goes closer to object*** *the buzzer will beep. If everything is normal the buzzer will not beep. The person with blind stick is shown in below Figure 1.5.*

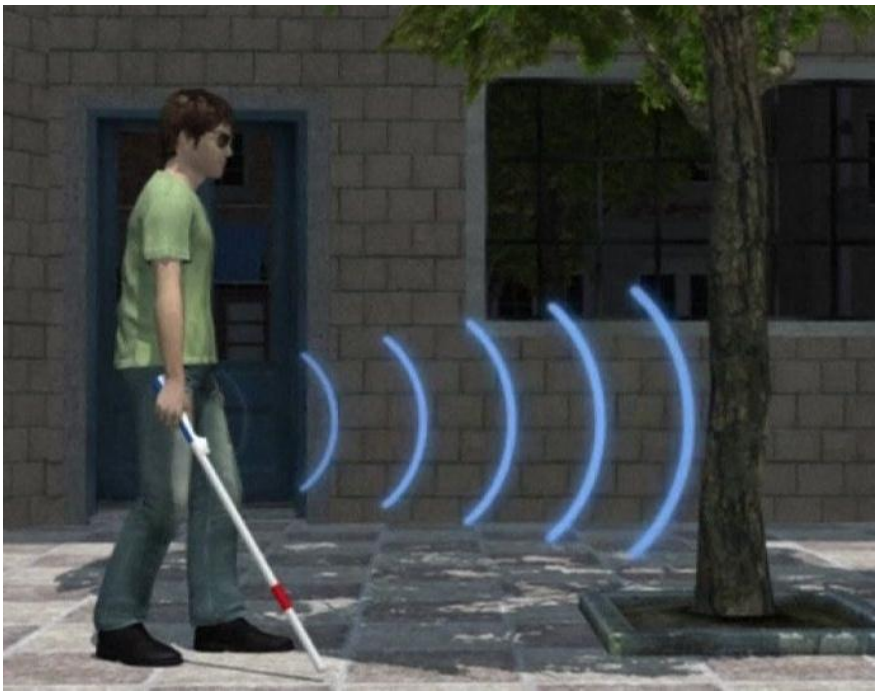

Fig 1.5: Blind stick in action

5. CONCLUSION

There are a number of techniques for making an ultrasonic blind walking stick for blind people. The advantage of the system lies in the fact that it can prove to be a very low cost solution to millions of blind person worldwide. The smart white cane is a practically feasible product and convenient to carry around like any other walking stick. This could also be considered a crude way of giving the blind a "SENSE OF VISION". The system can be supplemented with actual GPS MODULE used in cars, so it can Direct blind through speech. It can be further enhanced by using VLSI technology to design the PCB unit. This Makes the system further more compact. A wall following function can also be added so that the user can walk straight along a Corridor in an indoor environment. The Usage of infrared sensor, water sensor can also be used to make stick more efficient and of RF module which contains transmitter and receiver sections that it helps the blind to find position of the stick.

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