Smart Blind Stick for Obstacle Detection

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ABSTRACT

The Smart Blind Stick for Obstacle Detection discussed here is mainly for visually impaired people. In this system, we have developed a stick which consists of ultrasonic sensor, Arduino uno, buzzer, vibration motor, RX-TX transistor which will help blind people to detect obstacle and water present on their path to their destination. The main drawback with blind individuals is to travel a way to their destination where they require to travel. Such individuals would like help from others with sensible sight. As represented by World Health Organization, 10 percent of the visually impaired don't have any practical sight in the least to assist them move around while seeking no help. This work proposes a new technique for designing a smart stick to help visually impaired people that will provide them obstacle free navigation. The proposed system intended to provide low cost and efficient navigation aid for the blind. It gives a sense of artificial vision by providing information about the environmental scenario of objects around them with the help of sensors working in a manner to avoid obstacle, warn the blind person about the water in front of him/her and locate the stick in emergency situation. In this technology controlled world, where people strive to live independently, this project proposes an ultrasonic stick for blind people to help them gain personal independence with most efficient and effective algorithms which make it very helpful for the visually impaired people.

Keywords : ultrasonic sensor, Arduino uno, buzzer, vibration motor, RX-TX transistor

I. INTRODUCTION

Visually impaired people find it difficult to recognize the smallest detail without healthy eyes. Survey by World Health Organization carried out in 2011 estimates that in the world, about 70 million people is visually impaired and, about 7 million people fully blind and about 63 million people with low vision. The problem with blind people is to navigate their way to wherever they want to go. People need assistance from others. As visually impaired have no functional eyesight at all to help them move around without assistance and safely. This study proposes a technique for designing a smart stick to help visually impaired people that will provide them navigation. The conventional navigation aids for persons with visual impairments are the walking cane and dogs which are characterized by many imperfections.

Shortcomings of these include: training phase, range of motion, and very insignificant information communicated been communicated. Our approach modified this cane with some electronics components and sensors, the electronic aiding devices are designed to solve such issues. The

ultrasonic sensors, humidity sensor, buzzer, and vibration motor are used to record information about the presence of obstacles and water on the road. Therefore whenever there is an obstacle in its range it will alert the user by sensors. Humidity sensor is used to detect water in path of the user. Blind guidance systems use ultrasound because of its environmental noise. With modern technology both in hardware and software it has become easier to provide intelligent navigation system to the visually impaired. Much research effort have been focused on design of Electronic Travel Aids to aid successful and free navigation of the blind. Also, high-end technological solutions have been introduced recently to help blind person navigate on their own. Another reason why ultrasonic is prevalent is that the technology is cheap. Moreover, ultrasound emitters and detectors are portable components that can be carried out without the need for complex circuit.

Whenever user wants to locate it, such a person will press a button on remote control and buzzer will ring, then the person can get the idea of where the stick is placed. Vision is most important part of human physiology as information human being gets from the environment is via sight. The 2011 statistics by the World Health Organization (WHO) estimates that there are 70 million people in the world living with visual impairment, 7 million of which are blind and 63 million with low vision. The conventional aids for persons are characterized with many limitations. Some inventions require separate power supply. These bulky designs will definitely make the user to be exhausted. The objective of research: is to style a technology for visually impaired folks that observe obstacles and different routes for blind; to alarm the user through vibration to see the obstacles; and to help the user finding his stick when he cannot remember where is was kept. Several attempts have been made to design obstacle avoidance devices for the blind using components with limited number of applications. This section will discuss some of these attempts and their shortcomings. In the system, ultrasonic sensor, water sensor, Buzzer, vibrator and battery were used.

II. OBJECTIVE

The main objective is to assist visually impaired folks to navigate with ease with help of advance technology. In this technology controlled world, we are trying to help the blind people match up the pace with the normal people and do not feel left back, this project proposes associate in detecting and alarming stick for blind folks to assist them gain personal independence. Since this is economical and not bulky, one can make use of it easily.

III. BLOCK DIAGRAM

The microcontroller then processes this knowledge and calculates if the obstacle is within the range. If the obstacle isn't in the range then the circuit will do nothing. If the obstacle is within the range of the microcontroller then it sends a symbol to sound a buzzer. It also detects and sounds a different buzzer if it detects water within that range and alerts the blind. Following **fig: 1** is the block diagram of our proposed model depicting the input and output of the system. The input will be consisting of the sensors we are including in the model and output is the senses that can be felt by the blind person which are in the form of vibration or buzzer depending on the type of obstacle coming in front of the blind person that can be of any solid material or can be water.
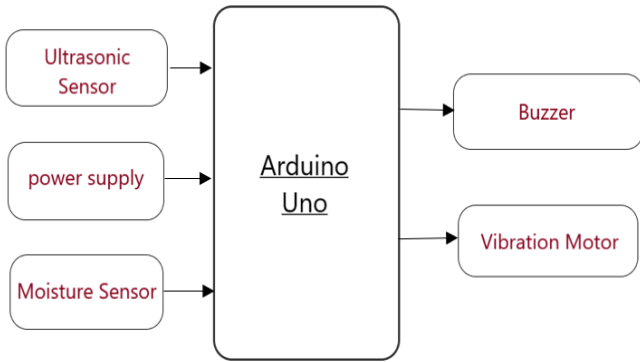
Fig-1: Block Diagram of the Model

IV. BLIND STICK IMPLEMENTATION

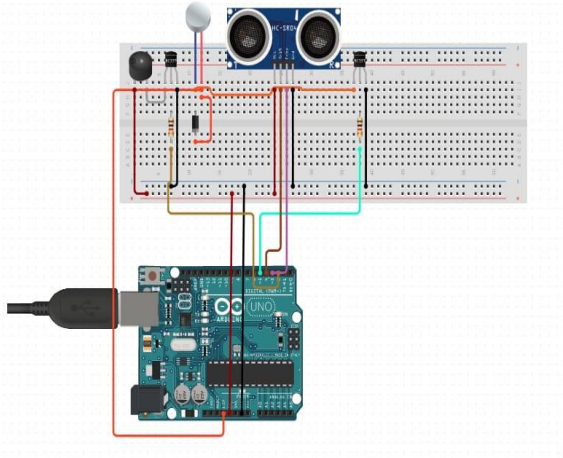The implementation of the smart blind stick is started with the circuit diagram which is shown below.

Fig-2: Circuit Diagram

After the circuit diagram below is the animated picture of the smart blind stick and all of its sensors, buzzers and vibration motors combined.
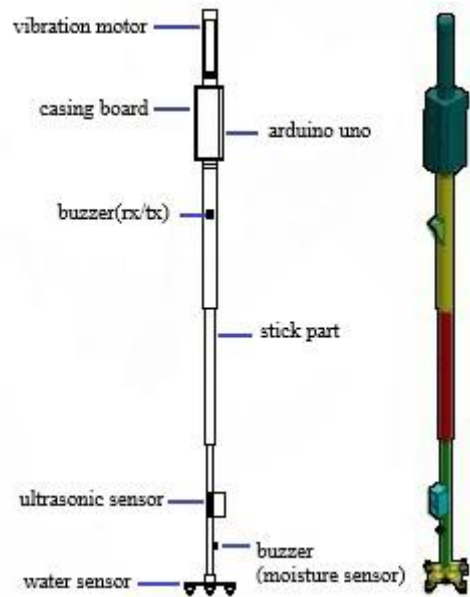

Fig-3: Animated Picture of Smart Blind Stick

V. COMPONENTS

➤ **Arduino Uno**- Arduino can control the environment by receiving input signals (Digital/Analog) and can effects its surroundings by controlling lights, relays and other devices. The microcontroller on the board is programmed using Arduino software.
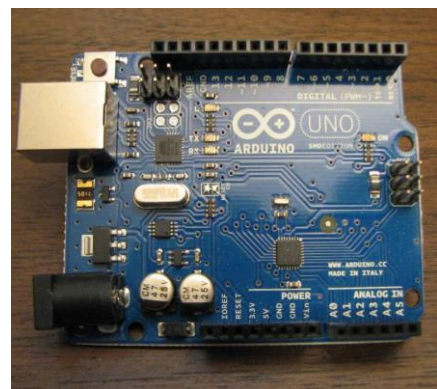

Fig-4: Arduino Uno

➤ **Ultrasonic Sensor-** Generating, detecting & processing ultrasonic signals Ultrasonic is the production of sound waves above the frequency of human hearing and can be used in a variety of applications such as, sonic rulers, proximity detectors, movement detectors, liquid level

measurement. Ultrasonic Ranging Module HC - SR04.

Fig-5: Ultrasonic Sensor

➢ **Buzzer-** A transducer (converts electrical energy into mechanical energy) that typically operates. A buzzer is in the lower portion of the audible frequency range of 20 Hz to 20 kHz. This is accomplished by converting an electric, oscillating signal in the audible range, into mechanical energy, in the form of audible waves. Buzzer is used in this research to warn the blind person against water.
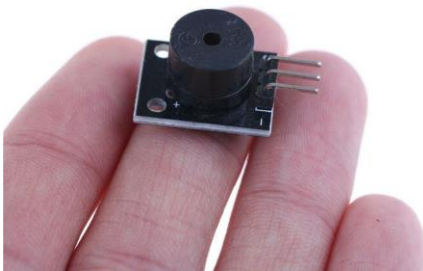

Fig-6: Buzzer

➢ **Vibration Motor-** A vibration motor is included to enhance the overall feedback for the person who receives the warning against obstacle's closeness in different frequency of vibrations
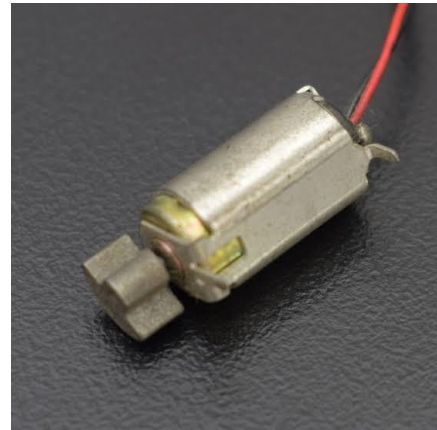

Fig-7: Vibration Motor

➢ **Rx/Tx Transistors-** TX and RX are low cost transmitter modules Pair which are based on RFIC which minimizes the board size and improve the stability against interferences. The transmitter modules work in very wide voltage range so they are very suitable for battery-driven applications. RX is a type of high sensitive receiver which works at 3.6~5.5V. It can be used together with TX to construct simple and short range wireless control system.
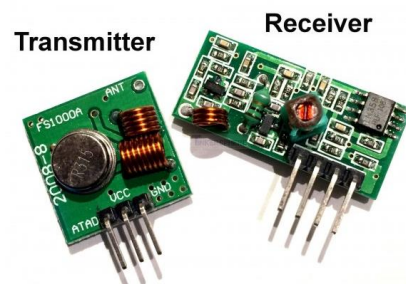

Fig-8-Rx/Tx Transistors

➢ **Water Sensor-** It is actually not a proper sensor, but two wires left open at the bottom of the stick and when moisture is detected it completes the circuit

and the buzzer is alarmed. The buzzer is programmed to be executed not for a long time at a sequence.

VI. ALGORITHM

A) For Ultrasonic Sensors:

- Trigger the ultrasonic sensor for sending waves.
- Collect the echoes reflected from the obstacle.
- Calculate the distance.
- Check whether the distance is less than safe distance or not.
- If yes, alert the user by switching on the vibration motor.
- If the user doesn't change the direction and the distance between obstacle and user decreases then increase the frequency of vibration.

B) For Moisture Sensor:

- Read the value from moisture sensor.
- Process the value.
- Compare the calculated value with minimum threshold.
- If the value is greater than threshold, then activate the buzzer.

C) For Rx/Tx transistor:

- Identifies the signal from the watch.
- The buzzer (different from the moisture sensor) will activate on the stick.
- Blind person will able to find the stick by the buzzer sound.

VII. RESULT

The below table shows the result produced by the smart blind stick by each sensor and describes the output of the same.

Input	Function	Output
Distance(Ultrasonic Sensor)	Obstacle Detection	Alert By Vibration
Humidity Sensor	Water	Alert By

Input	Detection	Buzzer
Signal From the Watch(Rx/Tx)	Locating the Stick	Buzzer (different from humidity sensor)

VIII. ADVANTAGES

- Obstacle detection when the obstacle is in the range of the ultrasonic sensor which will be the safety distance pre-programmed in the circuit.
- Water present on the path information with indication alarm.
- Simple to use and develop, low cost as the hardware used in this model is of very low cost which overall keeps the budget of the stick to the minimum
- If the stick is lost, the blind person is able to locate it with Rx/TX Transistor Wrist Watch.

IX. LIMITATION

The working of the stick is difficult on rainy season because of two reasons, first it is not waterproof and second the moisture sensor will always be active and the buzzer will not stop.

X. FUTURE WORK

The aim of this model is to style and implement a smart walking stick for the blind which is absolutely achieved. It came up with good results in detecting the obstacles on the path of the user to a certain range. Further aspects of this project will be improved with wireless property between the system parts, thus, increasing the range of the ultrasonic sensor and implementing a technology for determining the speed of approaching obstacles. In the future, necessary modifications will be added to enhance the performance of the system. These include: A global

positioning method to find the position of the user using the GPS, and GSM modules to communicate the location to a relative or care giver. It ought to conjointly accommodate with variable grips for versatile handling.

XI. ACKNOWLEDGEMENT

XII. REFERENCES

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