https://africanjournalofbiomedicalresearch.com/index.php/AJBR
Afr. J. Biomed. Res. Vol. 27(4s) (November 2024); 891- 896
Research Article

A Smart Walking Stick With Ultrasonic Sensor For Supporting The Visually Impaired People

Ushus.S.Kumar[1*], Pushpa.B[2],PadmaPriya[3] L.Manoharan[4], Banupriya.D[5],R.Thangam[6]

[1*,2,3]Assistant Professor, Biomedical Engineering Department, SRM Institute of Engineering and Technology, Ramapuram Campus, Chennai

Assistant Professor[4], Department of Electronics and Communication Engineering, Hindustan Institute of Technology and Science, Chennai-603103

Assistant Professor[5], Bio Technology Department
SRM Institute of Engineering and Technology, Ramapuram Campus, Chennai-89

Assistant Professor[6],Electronics and Communication Engineering Department
SRM Institute of Engineering and Technology, Ramapuram Campus, Chennai-89

***Corresponding Author :** Ushus.S.Kumar
*E mail : ushusj@srmist.edu.in

Abstract
The purpose of the device is to support the visually impaired people in their day-to-day life. The module consists of walking stick connected by an ultrasonic sensor, processing unit and a buzzer supported by Arduino uno. The device supports the visually impaired people for finding out any obstacles in their path. The device consists of a pair of glasses, an obstacle detection module which includes an ultrasonic sensor, a central processing unit, an output device a buzzer and a power supply. The ultrasonic sensors identify the information of the obstacle present in front of the man and sends the output through the buzzer. The ultrasonic glasses helps the blind people to avoid obstacles. Using this blind stick, a person can walk more confidently. The smart stick will have an ultrasonic sensor to sense distance from any obstacle and a RF remote using which the blind man could remotely locate his stick.

Keywords— Smart Glasses, Ultrasonic Sensors, visually impaired people, Obstacle detection module, RF Module

***Author for correspondence:** **E mail:** *ushusj@srmist.edu.in*

Received: 31/10/2024 Accepted: 06/11/2024

DOI: https://doi.org/10.53555/AJBR.v27i4S.3356

1.INTRODUCTION

According to World Health Organization (WHO), 30 million people are permanently visually impaired and 2.85 million people with partial visual impairment. The research depends on developing a walking stick for the visually impaired person which support them in their day-to-day life without depending on others. Development of the device supports the visually impaired people for finding out any obstacles in their path and crossing the road in traffic signal. The device is equipped with a camera which helps them to get the image of the obstacle and conveyed the information to the person through sound. It will also convey the whereabout of the visually impaired people to the bystander which helps for the safety of the person without direct interference. This will help them to improve their confidence level also. The research is planning to processed with machine learning algorithm, image processing, GPS and wireless internet. In the circuit, a buzzer is attached as a warning signal, whose beep frequency changes depending on the distance of the target. The smaller the obstacle gap, the more frequent is the buzzer sound. There are two ultrasonic sensors used in the device. One ultrasonic sensor transmits a sound pulse at high frequency, and the other sensor calculates the period which the sound echo signal receives back. The time difference between sound pulse propagation and reception determines the distance between the object and the target.

The proposed research concentrates on energy saving and supporting visually impaired people. So, its risk factor is very less. The transducers and sensors used are not harmful. The work helps the visually impaired persons to avoid the use of walking stick. The wearable device is like a bracelet. The convenience of using this device is also more compactable. The camera can save the image of the obstacle in their path and it ensure the safety of the concerned person. The person can analyse the traffic signal colours through image processing and this helps them to ensure their safety.

2. LITERATURE REVIEW

Emmanuel *et al* proposed a smart Walking Stick for Visually Impaired People Using Ultrasonic Sensors and Arduino[1] . They placed ultrasonic sensors to the cane at precise locations, which activated the buzzer sound and supplied information about the environment to the user. The system is made up of obstacle and moisture detection sensors that receive, process, and send signals to an alarm system, which then warns the user. Nadia *et al* introduced an intelligent walking stick for visually impaired people [2]. This study offers an Arduino Nano-based obstacle detection walking stick for visually impaired people. This strategy assists the blind person in learning about the surroundings and present situation of the path they are walking on.

Zhmud *et al,* proposed a method for Ultrasonic device for measuring distances [3]. The HC-SR04 ultra sound rangefinder is quite easy and uncomplicated and can be used to deal with sensors without having to link them with the microcontroller. Smart Blind Stick Using Ultrasonic Sensor was implemented by Tirupa *et al* [4]. This project will work to assist all visually impaired people on the earth by making it easier for them to walk anywhere they need to go. Padmapriya *et al* did a Study on text Recognition and Obstacle Detection Techniques [5]. The goal of this report is to explain several object detection techniques and weigh their advantages and disadvantages.

Christofer *et al* analysed of Obstacle Detection Using Ultrasonic Sensor. As a model of a large-scale vehicle, an EV3 Lego Mindstorm equipped with an ultrasonic sensor was employed in this investigation. When EV3 Lego Mindstorm gets a specific distance away from an obstruction, it is programmed to slow down and then stop when it is 15 cm away. They concluded that the ultrasonic sensor's classification performance was low, implying that it could not successfully classify the sorts of impediments based on distance measurements [6].

3.BLOCK DIAGRAM

The device includes an ULS, buzzer, vibrator and IR screen. The ultrasonic sensor provides an extremely cost-efficient remote measuring device. Vibrator and buzzer run using the sensor data. Water sensor module is connected for the identification of water and for the warning against water damage. On discovery of the stream, buzzer is triggered. Even supplying vibrator to show obstacles. If the blind person misplaces his stick, an IR board is included in the stick. The IR module transmits the signals and records the radio transmissions. The block diagram (Fig 1) and circuit diagram of the proposed system is given below (Fig 2).

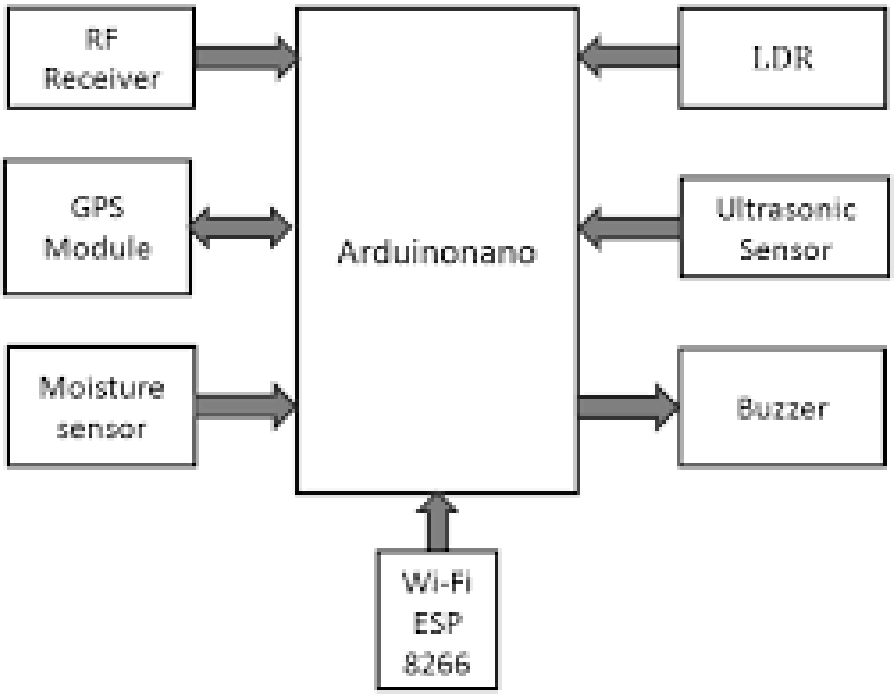


Fig 1 : Block Diagram of the proposed system

4.CIRCUIT DIAGRAM

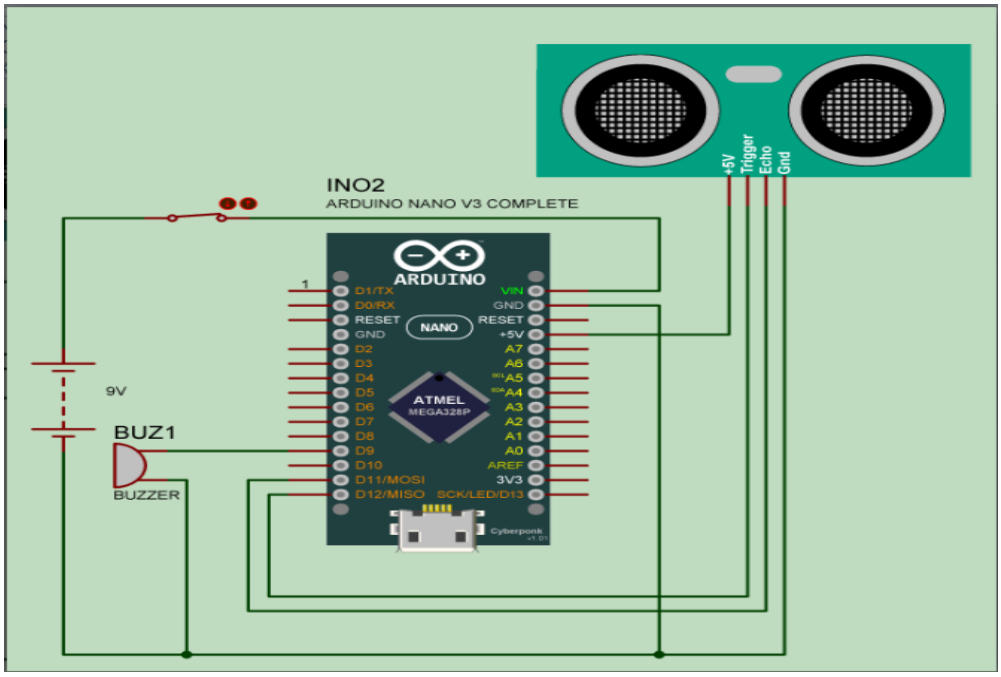


Fig 2: Circuit diagram of the proposed system

5.FLOW CHART

The conceptual device pattern consists of a circuit with an ultrasonic sensor and a water detector interfaced by Arduino Uno. The stick is designed to detect obstacles within 100 cm and increase the frequency of buzzing, when the object reaches the stage. The flow chart of the proposed system is given in Fig 3.

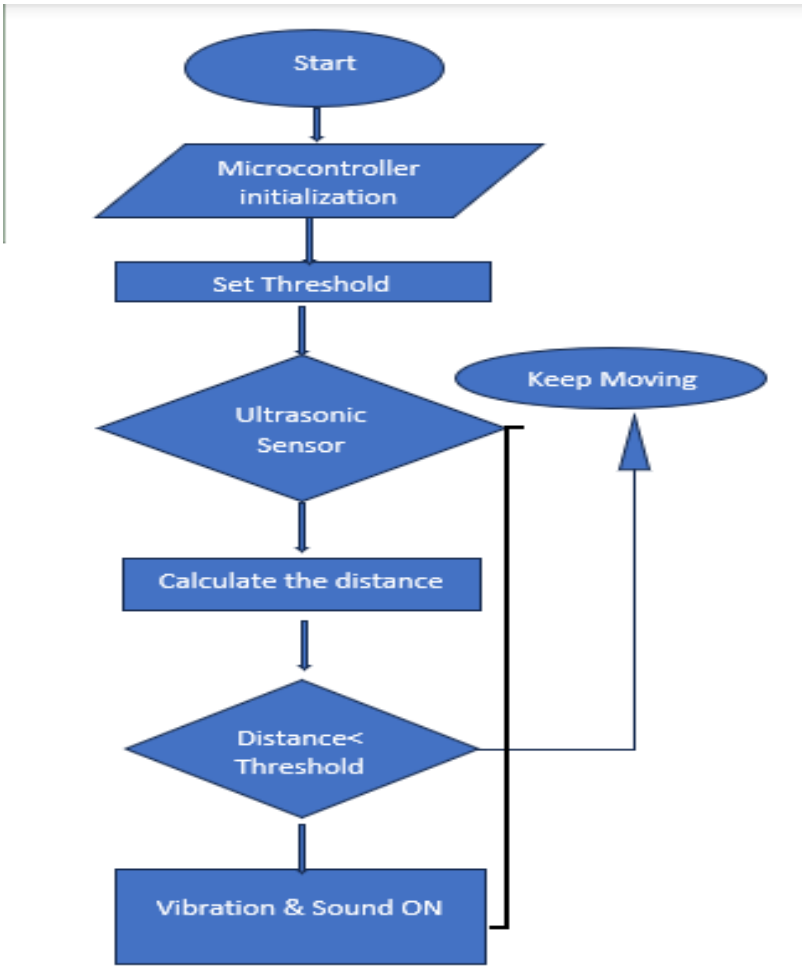


Fig 3:Flowchart of the proposed system

6.SOFTWARE IMPLEMENTATION

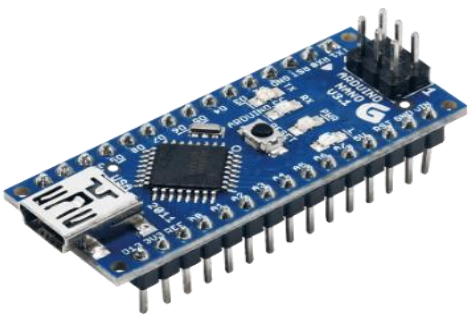
6.1 ARDUINO

Arduino is an open-source electronics platform based on easy to-use hardware and software. Arduino boards are able to read inputs, light on a sensor, a finger on a button, or a Twitter message, turn it into an output, activate a motor, turning on an LED and publishing online.

7.HARDWARE IMPLEMENTATION

7.1 ARDUINO NANO

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3. x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. Getting Started.



7.2 ULTRASONIC SENSOR

Ultrasonic sensors and water sensors detect water on the surface, collect the data and send it to the microcontroller. The microcontroller triggers the buzzer after processing certain details.

7.3 BUZZER

A buzzer is a small yet efficient component to add sound features to the system. It is very small and compact 2-pin structure hence can be easily used on breadboard. Perf Board and the PCBs which makes this a widely used component in most electronic applications.

8 RESULTS & DISCUSSIONS

The smart blind stick prototype has successfully designed and analysed. The newly designed stick complies with the human ergonomics. The blind stick prototype is tested for finding the obstacles in different heights and the obstacles nearby. In this work, two ultrasonic sensors are used to detect a different height of obstacles whether it is high or low and one laser ranging sensor is used to detect a front obstacle. The smart blind stick is able to detect the obstacles with the height below 40cm, is considered low obstacle detector, on the other hand, if the detection height is more than 40cm, it is considered high obstacles detector. Additionally, the laser ranging sensor has successfully tested for obstacle detection. The blind stick is able to detect the front obstacle, while the stick is around 21.5cm far from the obstacle. Therefore, this novel blind stick is capable to assist a blind person to move independently.

9 CONCLUSION AND FUTURE SCOPE

It should be noted that this work has been thoroughly carried out in order to design and implement an articulate walking bolt for the blind. The Smart Stick acts as a versatile interface for easy and comfortable internal and external mobility for visually impaired people in the next phase of more supportive apps. It's safe and affordable. This results in effective obstacle detection within three meters of the user's direction. It offers low cost, reliable, lightweight, low power and efficient navigation with fast, quick response times. The computer is hardwired, but light weight, with sensors and other features. Wireless connectivity between components of the device will enhance the additional features of this instrument and increase the range of ultrasound sensors and incorporate technologies to measure the intensity of obstacles approaching. With this approach, our targets in all of the developing countries were particularly addressed towards visually impaired and blind people. In this analysis the machine built can only sense obstacles and humidity.

REFERENCES

1. Emmanuel Gbenga Dada, Arhyel Ibrahim Shani and Adebimpe Lateef Adekunle, Smart Walking Stick for Visually Impaired People Using Ultrasonic Sensors and Arduino, International Journal of Engineering and Technology (IJET),vol.9, issue no.5,pp-3435-3447,2017.DOI:10. 21817 / ijet /2017/v9i5/170905302.
2. Nadia et al, An Intelligent Walking Stick for the Visually-Impaired People, International Journal of Online and Biomedical Engineering, vol.13.issue no.11, pp.94-101, 2017. DOI: https://doi.org/10.3991/ijoe.v13i11.7565.
3. Zhmud. V A, Kondratiev. N O, Kuznetsov. K A, Trubin. V G and Dimitrov L V, Application of ultrasonic sensor for measuring distances in robotics, Journal of Physics: Conference Series, Vol 1015, Issue 3, 2018.DOI: 10.1088/1742-6596/1015/3/032189
4. Tirupal. T, Venkata Murali. B, Sandeep. M. et.al., Smart Blind Stick Using Ultrasonic Sensor, Journal of Remote Sensing GIS & Technology, vol.7.no.2, pp.34-42,2021.
5. Padmapriya. V, Archana. R, Lavanya. V and Sri. C V., A Study on text Recognition and Obstacle Detection Techniques, International Conference on System, Computation, Automation and Networking (ICSCAN), Pondicherry, India, 2020, Pp.1-6, DOI:101109/ICSCAN49426.2020.9262368.
6. Christofer N Yalung and Cid Mathew S.Adolfo, Analysis of Obstacle Detection Using Ultrasonic Sensor, International Research Journal of Engineering and Technology (IRJET),vol.4.no.1, pp.-1015-1019,2017.e-ISSN:2395-0056
7. Mallini.P, Ushus. S. Kumar, Vijayakumari. G, Thirukkumaran. R, Lakshme. S. Hanne and Karpagam. S, "Deep Learning and Fuzzy Decision Support System for visually impaired persons," in 8th International conference on Advanced Computing and Communication Systems*(ICACCS)*, Coimbatore, India, 2022, pp.305-309, doi:10.1109/ICACCS 54159.2022.97 8532.