International Journal of Engineering Inventions
e-ISSN: 2278-7461, p-ISSN: 2319-6491
Volume 9, Issue 1 [Jan. 2020] PP: 09-14

An IoT based Voice Controlled Blind Stick to Guide Blind People

Abhijit Pathak[1*], Md. Adil[2], Taiyaba Shadaka Rafa[3], Jannatul Ferdoush[4], Abir Mahmud[5]

[1,2,3,4,5] *Department of Computer Science and Engineering, BGC Trust University Bangladesh, Chattogram, Bangladesh*
Corresponding Author: Abhijit Pathak*

ABSTRACT: *Visually impaired people find it difficult to identify objects in front of them while walking down the street, which makes it risky. The smart stick comes as a way to define the world around them. In this paper, we propose a solution, presented in a smart stick with an infrared sensor to detect staircases and a pair of ultrasonic sensors in order to detect any other obstacles in front of the user, within four meters. Furthermore, another sensor is placed at the bottom of the stick to prevent puddles. Speech warning message is triggered upon identification of any obstacle. About 39 million people are permanently blind and about 285 billion are visually impaired. Blind person, who doesn't walk alone, struggles to do his own job. There's always fear of getting injured and getting into an accident. How can we solve those problems? Indeed, this paper has provided a solution which can relieve the blind from this problem. Which is "Blind Stand with voice control to guide blind people" This is essentially a device consisting of Arduino UNO, Ultrasonic Sensor and Voice Module that informs and notifies the blind person of the hazards This will help a blind person to walk comfortably and keep themselves safe from danger.*

Keywords: *Blind, Intelligent Walking Stick, Physically Impaired, Ultrasonic Sensor, ISD 1820, Arduino UNO.*

Date of Submission: 28-02-2020 Date of Acceptance: 08-03-2020

I. INTRODUCTION

There are about 285 billion visually impaired people worldwide, of whom 39 million are completely blind. The number of blind people around the world will rise to double by 2020 according to WHO and IAPB. Blind people are having difficulty moving or surviving without support. Using Voice Controlled Blind Stick is therefore a gift for people with blindness. Using Arduino UNO, Ultrasonic Sensor, Voice playback module are used, we have built a Smart Voice Controlled blind button. Arduino is a microcontroller that can very easily do all the calculations with great precision. The new blind stick allowing visually challenged people to navigate using advanced technology with ease. In addition to voice module, the blind stick is combined with ultrasonic sensor. The ultrasonic sensor senses the barrier, and the user is warned by the voice module. Persons with visual impairments have difficulty communicating and sensing their surroundings. They have little contact with the surrounding countryside. Physical movement is a problem for visually impaired people, because determining where he is and how to get where he needs to go from one location to another can become difficult. He will carry a sighted family member or his companion to assist him in exploring unknown locations. More than half of the world's legally blind are unemployed. Because the types of jobs that they can do are minimal. We have less of a job rate. They rely on mobility and financial support for their families. They're opposed to their freedom from interacting with people and social activities. In the past, different systems have restricted functionality without a solid understanding of non-visual perception. Many devices are for indoor navigation only, and do not have any obstacle identification and position determination functionality in outdoor environments. Scientists have spent decades creating an interactive and responsive stick to support and warn visually impaired people from obstacles and provide knowledge about where they are. Work has been carried out over the last decades on new devices to develop a good and reliable system for visually impaired people to identify obstacles and alert them in areas of risk. There are certain devices that have certain shortcomings.

II. LITERATURE REVIEW

This segment discusses important related work on developing smart sticks for blind and elderly people -

The authors proposed using ultrasonic sensors that detect the obstacles in the blind's way. It consists of three different directions, a microcontroller, buzzer, and DC vibration motor, to scan these sensors. When any obstacle is detected the buzzer and vibration motor is triggered.

Ayush Wattal, Ashuthosh Ojha, Manoj Kumar suggested Smart Belt for Blind to use an ultrasound sensor embedded belt to detect the barrier. The belt also has a buzzer which vibrates when it detects an obstacle. The entire system is designed in such a way that the measured distance is sent to the blind person as an audio message,

in which he hears the distance calculated using a speaker.

Srirama Divya, B. Navya, P. Suma Manasa, S. Chitra the paper introduces a theoretical model and program definition for providing blind people with intelligent electronic assistance. The system is designed to provide artificial vision and object detection overall measures. The overall system seeks to provide low-cost and effective navigation assistance to the blind by providing information on the environmental scenario of static and dynamic objects around them. Ultrasonic sensors are used to measure distance of obstacles to direct the user to the accessible route around the blind person. Input is in voice format. That can be heard by the blind person e.g. right, left etc. The hardware is composed of system Arduino UNO, ultrasonic sensors and speaker.

Jayant, Pratik and Mita, 2012 proposed to give the visually impaired individual a smart stick assisted mobility. The system is based on standard ultrasonic sensors and a microcontroller with ATMEL. It operates with two rechargeable batteries which can be recharged with USB cable or AC adapter. The control unit is programmed using the microcontroller ATMEL AVR, ATMEGA328P. On detection of any obstacles, vibration will start and buzzer will start to alert the user. It has the potential to cover up to 3 meters in distance.

A smart Ultrasonic Sensor Stick was introduced. This stick gathered information on the user's pathway via the ultrasonic sensor. This knowledge is used to create an artificial smart that would be used to control the movement of the attached DC motor to avoid an obstacle. The user of the stick has little or no contribution to navigation, thus making the user look like a zombie and a less truck-pushed brake; Smart walking stick, which is designed to detect and alert the user in. This is similar to the one proposed in this paper, it contains voice and vibration alert, but the actual direction of the obstacles cannot be specified.

S. Gangwar created a smart blind stick that can give early warning of an obstacle using Infrared (IR) sensors. The stick warns visually impaired people using vibration signals after they recognize the obstacles. Nevertheless, the smart stick focuses only on the identification of obstacles, but it does not help the blind for emergency purposes. And the IR sensors are also not really effective enough because they can only detect the nearest obstacle in a short distance.

Benjamin et.al. had developed an intelligent stick with laser sensors to detect obstacles and curbs down. Obstacle identification was indicated using a microphone with a high pitch "BEEP." Laser cane concept is pretty simple and intuitive. The stick can only sense obstacles, but cannot have psychological and cognitive help. There is only beep sound which triggers any obstacle and there is no help to guide it.

Shruti and A. Dambhare Sakhare developed an artificial vision and object detection with real-time assistance through GPS to provide low cost and efficient navigation aid for blind people that gives a sense of artificial vision by providing information on the environmental scenario of static and dynamic objects around them.

III. SYSTEM CONFIGURATION

The intelligent stick, as shown in Fig. 1, is essentially an embedded device incorporating the following: pair of ultrasonic sensors for detecting obstacles in front of the blind from ground level height to keep head level height in the range of 400 cm ahead, an infrared sensor for detecting up and down stairs, water sensor for detecting puddles. The sensors capture the data in real time and forward it for processing to the microcontroller. Upon processing, the microcontroller uses a Bluetooth earphone to invoke the appropriate speech alert message. A rechargeable battery supplies the machine.

(a) Physical Structure of Stick (b) Prototype of the Stick

Figure-1: Physical Structure and Prototype of the Smart Stick

- This initiative is a vital tool for people with blind and vision impairments.
- This stick is also benefiting the elderly with their poor vision.

- By using this project form, people can use these tools in the door to know if there are any people coming.
- It can also be used in a vehicle when the car tries to park it system to warn the car or obstacle next to the car.
- It can also be used in the water tank to warn it system when the water is almost full and automatically switch off the motor.

IV. METHODOLOGY

We also introduced an innovative blind stick that allows visually challenged people to use advanced technology to navigate with ease. The blind stick is combined with an ultrasonic sensor as well as detecting light and water. Our proposed project initially uses ultrasonic sensors to detect more obstacles using ultrasonic waves. The sensor transfers the data to the Arduino UNO while detecting obstacles. Then the Arduino UNO processes the data and determines whether the obstacle is near enough. If the barrier is not closing the circuit, nothing will happen. If the obstacle is near the Arduino UNO sends a voice alarm. The Smart Stick block diagram is as shown in Fig.2.

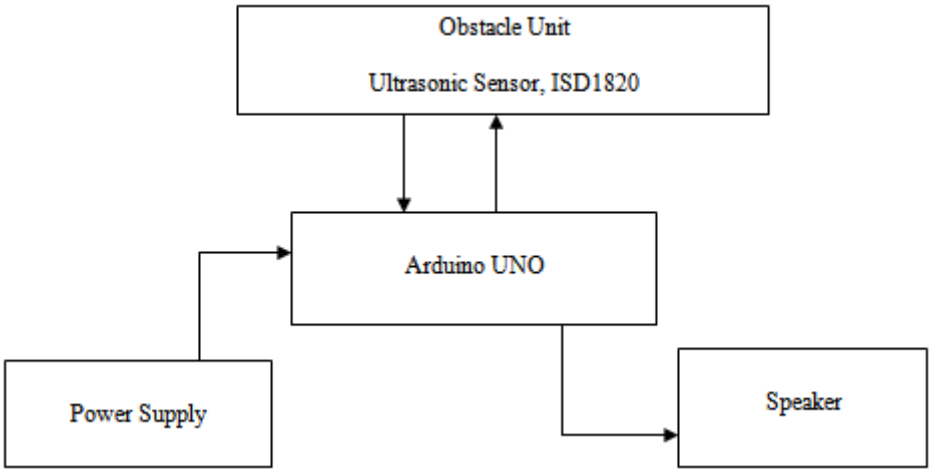

Figure-2: Block Diagram of the Smart Stick

A. Connection Diagram

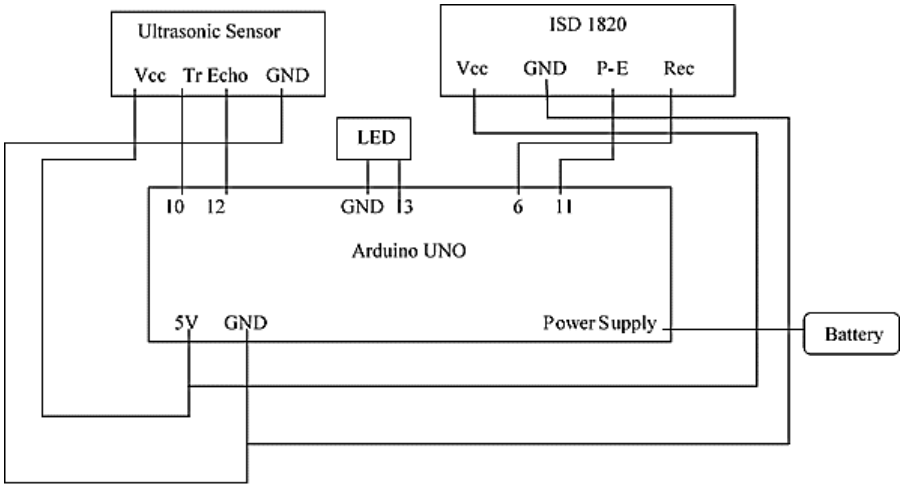

Figure-3: Connection Diagram of the Smart Stick

- The Vcc and ISD1820 Vcc sensors attach to the 5V Arduino.
- The Trig and Echo sensors attach to the Arduino digital pin 10 & pin 12.
- The GND and ISD1820 GND sensors bind with the Arduino GND.
- Now connect ISD1820 Rec (record) and Play-E (P-E) to digital Arduino pin 11 and pin 6.
- LED Long leg (+) and short leg-) (bind with pin 13 of Arduino and GND.

B. Arduino UNO

The Arduino UNO is an open-source microcontroller module, based on the microcontroller Microchip ATmega328P created by Arduino. The board has collections of digital and analog input / output (I / O) pins that can be interfaced with various expansion boards (shields) and other circuits.

Figure-4: Arduino UNO

C. Ultrasonic Sensor HC-SR04

The HC-SR04 Ultrasonic (US) sensor is an ultrasonic transducer with an interface of 4 pins named Vcc, Trigger, Echo, and Ground. It is very useful for exact distance measurement of the target object and operates primarily on the sound waves. For calculating the distance of the target, the formula follows.

Figure-5: Ultrasonic Sensor

D. Voice Module ISD 1820

A key feature of the ISD1820 Voice Recorder Module is that it can store messages in its non-volatile memory and can be configured to store messages from 8 seconds to 20 seconds in length. Below is the ISD1820 Voice Recorder Unit used in this project.

Figure-6: Voice Module ISD 1820

E. System Flow Chart

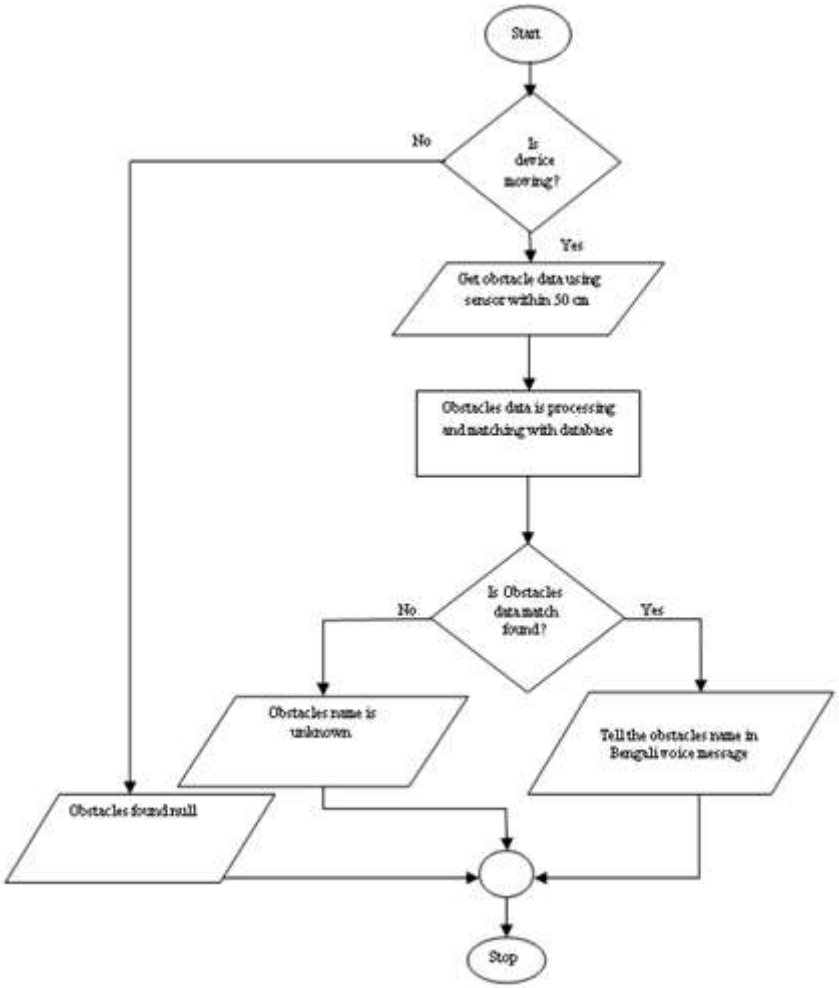

Figure-7: Flowchart of the Proposed System

V. RESULTS

This paper has been successfully developed and tested by the smart blind stick prototype. The newly designed stick is in line with human ergonomics, since it is intended for adult users. Blind prototype stick is tested for various obstacle heights and front door. Smart blind stick technology includes the use of ISD 1820 ultrasonic sensor and voice module. The function of voice module is to feed warning back. Here we use an ultrasonic sensor that alerts only one voice message when the distance of the barrier in any movement is detected in 50 c.m. If we use more sensors, the voice module warns by providing more voice messages that can provide more input and identify the obstacle in different c.m. The framework presented is planned for practical use and configured. The system can handle seven states which can challenge the blind. The device will respond to each state according to a specific program in the Arduino microcontroller which is coded and mounted. It is suggested that a simple, inexpensive, configurable, easy-to-handle electronic guidance system provide effective assistance and help for blind and visually impaired persons. The system is designed, put in place, checked and confirmed. The system's real-time findings are encouraging; it reported a 93 per cent accuracy in distance detection. The results show that the program is powerful and exceptional in its ability to define the source and distance of the objects that the blind may encounter. It can search areas left, right, and in front of the blind person whatever their height or size. Those who took part in the test also favored it. The ultrasonic sensor was extensively used to advance the independence of blind and visually impaired individuals in a healthy and independent manner.

VI. CONCLUSION

Finally, the blind walking stick was turned into a product that can be used to guide the blind. The goal is to solve the problems that blind people face in their everyday lives. The program is also taking the step to guarantee their safety.The study's main purpose is to develop a prototype in the forms of voice messages that can detect objects or obstacles in front of users and feeds alarm back. This program targets people with disabilities who are

blind to encourage movement and improve health. The second goal is accomplished using ultrasonic sensor and voice module to complete the design to investigate the nature of the smart blind handle. This is an Automatic System project. Allow people with disabilities to move around freely. The initiative will work to help all of our country's blind people make it easier for them to travel wherever they wish. This project is being done to help the blind man travel very well in front. This system provides a low cost, reliable, compact, low-power consumption and robust navigation solution with obvious short response time. Although the device with sensors and other components is hard-wired, it is light in weight. Additional aspects of this device can be enhanced by wireless connectivity between system components, thereby increasing the range of the ultrasonic sensor and introducing a technology to evaluate the speed of obstacles approaching. When creating such an effective solution, visually impaired and blind people were at the top of our priorities in all developing countries.

REFERENCES

[1] Ankit Agarwal, Deepak Kumar, Abhishek Bhardwaj- International Journal Of Engineering And Computer Science ISSN:2319-7242Volume 4 Issue 4(April 2015)

[2] Assistive Infrared Sensor Based Smart Stick for Blind People, Ayat A. Nada| Science and Information Conference 2015 July 28-30, 2015 London, UK

[3] AyushWattal, Ashuthosh Ojha, Manoj Kumar "Obstacle Detection Belt for Visually Impaired Using Raspberry Pi and Ultrasonic Sensors

[4] B.Hoyle, D.Withington, D.Waters,"UltraCane", Available from:"http://www.soundforesight.co.uk/index.html"'. June 2006.

[5] Benjamin and team members, "Smart Stick at Bionic Instruments Company Researches", 2011.

[6] Bouhamed, Sonda Ammar, Imene Khanfir Kallel, and Dorra Sellami Masmoudi. "New electronic white cane for stair case detection and recognition using ultrasonic sensor." International Journal of AdvancedComputer Science & Applications 4.6, 2013.

[7] Design of non-weighing type desert plant lysimeter observation system based on PIC18. In Information Management, Innovation Management and Industrial Engineering (ICIII), 6th International Conference on IEEE,Vol. 3, pp. 42-44, 2013.

[8] Direct mode ISD 1932. (2009, January 5) [Online]. https://www.futurashop.it/…PDF_ENG/7300-ISD1932.pdf

[9] E. Kee, "iSONIC cane for the virtually impaired", Available from:"http://www.ubergizmo.com/2011/01/isonic-cane-for-the-virtuallyimpaired/", 2011.

[10] G. P. Fajarnes, L. Dunai, V. S. Praderas and I. Dunai, "CASBLiP- a new cognitive object detection and orientation system for impaired people," Proceedings of the 4th International Conference on Cognitive Systems, ETH Zurich, Switzerland, 2010.

[11] Ulrich, and J. Borenstein, "The guide Cane-Applying mobile robot technologies to ssist the visually impaired," IEEE Transaction on Systems, Man, and Cybernetics-Part A: Systems and Humans, vol. 31, no. 2, pp. 131-136, 2001.

[12] International Journal of Engineering and Computer Science ISSN: 2319-7242 Volume 3 Issue 3 March, 2014 Page No. 4057-4061

[13] International Journal of Innovative Research in Advanced Engineering (IJIRAE) ISSN: 2349-2163

[14] Kang, Sung Jae, Young Ho, Kim and Moon, In Hyuk (2001) Development of a mechatronic blind stick.. Seoul, Korea :s.n., 2001. Proceedings of the 2001 IEEE International Conference on Robotics & Automation. pp. Pp 3209-3213

[15] L. Whitney, "Smart cane to help blind navigate", Available from:"http://news.cnet.com/8301-17938_105-10302499-1.html", 2009.

[16] Osama Bader AL-Barrm International Journal of Latest Trends in Engineering and Technology (IJLTET)

[17] Shantanu Gangwar, "Smart stick for Blind", New Delhi, Sept. 26

[18] Shruti Dambhare and Prof. A. Sakhare, G.H.R.C.E. Nagpur, "Smart stick for Blind: Obstacle Detection, Artificial vision and Real-time assistance via GPS", International Journal of Computer Applications (IJCA), No. 1, 31 – 33, 2011

[19] SMART BLIND STICK USING ARDUINO, R. Dhanuja1, F. Farhana2, G. Savitha3International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 03 | Mar-2018 www.irjet.net p-ISSN: 2395-0072

[20] Smart Cane Assisted Mobility for the Visually Impaired,World Academy of Science, Engineering and Technology International Journal of Computer, Electrical, Automation,Control and Information Engineering Vol:6, No:10, 2012

[21] Smart White Cane – An Elegant and Economic Walking Aid Rohit Sheth1, Surabhi Rajandekar2, Shalaka Laddha3, Rahul Chaudhari4, and American Journal of Engineering Research (AJER) e-ISSN: 2320-0847 p-ISSN: 2320-0936

[22] Su, B., & Wang, L."Application of Proteus virtual system modelling (VSM) in teaching of microcontroller". In E-Health Networking, Digital Ecosystems and Technologies (EDT), 2010 International Conference onVol. 2, pp. 375-378, 2010

[23] T. Terlau and W. M. Penrod, "K'Sonar Curriculum Handbook", Available from: "http://www.aph.org/manuals/ksonar.pdf", June 2008Volume 1 Issue 8 (September 2014)

[24] Wahab, Mohd Helmy Abd, et al. (2011),Smart Cane: Assistive Cane for Visually-impaired People. IJCSI International Journal of Computer Science Issues, Vol. 8

Abhijit Pathak, et.al. "An IoT based Voice Controlled Blind Stick to Guide Blind People" *International Journal of Engineering Inventions*, Vol. 09(01), 2020, pp. 09-14.