iWALK: An IoT Based Electronic Baton

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Abstract **Blind is the ophthalmological term used to indicate the total visual impairment. Blind people depends on traditional stick as a part of identifying obstacle and navigate. In the view of providing an efficient way for navigation, several electronics based sticks were developed. These electronic device helped to certain extent compared to basic stick, it posed it's the problems in its own way. Large size of boards, power issues, navigation issues, tracking issues, portability and number of sensors being used posed problems towards the practicality. To overcome these issues, an IOT based electronic stick that can easily integrated a stick and also can be tracked remotely using a mobile app has been developed. It makes use of two ultrasonic sensors, a buzzer, Global Positioning System (GPS) module, ESP 8266 as a part of controller and for Internet of Things (IOT) application. The components are compact and provides the details of the person having the stick in real time. The performance of the device is expected to be better than existing competitors. The prototype is providing the data as per the design and being verified for its practicality.**

Keywords — Arduino, Electronic device, ESP8266, GPS, IOT, Ultrasonic sensor.

I. INTRODUCTION

According to the report of the world health organization 2018, about 1.3 billion people in the world are having some type of vision impairment. Among them 188.5 million are with mild vision impairment, 217 million with moderate to severe vision problems and about 36 million people are completely blind [1][2]. For completely blind people, it is an embarrassing to depend always on another person fPr day to day work. Self-reliance, even though it is difficult, but necessary as a part of today's fast world. To walk around in Public Street, in general, a foldable fiber/plastic stick is used in common. Even though it has simple build and foldable, its performance is very much limited. It does not provide the presence of obstacle in prior, not capable of identifying obstacle above chest level, no navigation facilities and also no panic button to provide security. Even though, some of the electronic sticks are available for usage, it poses issues with cost and portability. Hence it is necessary to prepare a home grown device that can overcome most of the existing problems with the blind stick. In this paper, we are proposing one such stick that can satisfy necessary requirements and also provides IOT capability for precise tracking.

The organization of the paper is as follows: Section 2 provides a detailed literature survey about existing concepts. The problem definition is presented in section 3. The proposed approach in detail is explained in section 4. Conclusion and Future developments are described in section 5 and 6 respectively.

II. LITERATURE REVIEW

In last one decade, due to the availability of development kits and compaction of electronic components led to the development of various electronic based blind sticks. Kher et al., [3] proposed a navigation device that makes use of infrared sensor, RFID and an android device. The android app is used in congestion with RFIT to help navigation and to update the person's location over a server. Ayat et al., [4] developed a stick that made use of infrared sensor to detect stairs and a pair of ultrasonic sensors to identify obstacles. Speech warning system and vibration motors are used to indicate the obstacle. To control all these, PIC18F46K80 embedded system is used. Mithiles et al., [5] proposed a low cost blind stick that is helpful than conventional one. They made use of voice instruction and alarm system to inform about hurdles. They used distance limitations to start voice instruction/alarm and will intensify as the distance between obstacle and stick decreases. Naveen Kumar and Aravinda [6] proposed a smart cane that made use of an ultrasonic sensor to detect obstacle, an accelerometer to identify the falling, a camera to identify the possible objects in front and all these are being controlled by a Raspberry Pi. A simplified and a light weight smart walking stick using Arduino [7] is proposed by Dada et al. It made use of ultrasonic senor and a buzzer connected to the Arduino board which makes it a simple design. Sathya et al.,[8] realized a smart walking stick that made use of ultrasonic sensor, camera, water sensor, voice synthesizer and all these devices are interfaced to Raspberry Pi. Here, the ultrasonic sensor used to detect the distance of the obstacle.

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The camera is used to identify the possible type of the obstacle along with its size. The voice synthesizer to inform the user about the possible wrong instance in front. Uruba et al., [9] proposed an intelligent stick that makes use of ultrasonic sensors. This approach is provided with the facility of audio which keeps informing to the person about the obstacle in front. Along with this, it also directs the person to move to the left or right to avoid obstacle. Hence, it is said to have artificial intelligent capacity. Another smart blind stick is proposed by Manikanta et al., [10]. It utilized ultrasonic sensor, buzzer, vibrator, GSM module and all these interfaced to Arduino nano. Also it made use of water sensor, light sensor and stick locator. Nivedita et al., [11] proposed a stick that consists of ultrasonic sensor, camera, micro phone and all are controlled by Raspberry Pi. The ultrasonic sensor is used to detect an obstacle. Whereas the camera is used to identify the type of the obstacle and inform the same to the user.

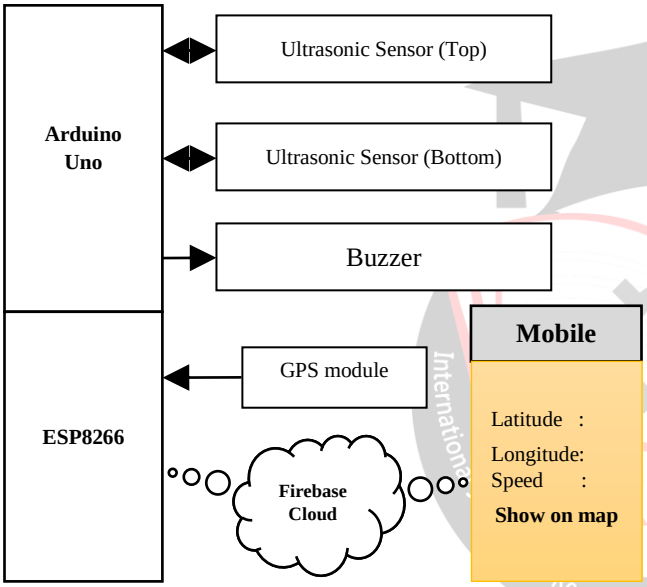

Figure 1: Block diagram of the proposed system

Summing up the disadvantages from the literature survey; most of the devices use one ultrasonic sensor and hence locates the obstacle just above the ground level. But no methods suggested to locate a possible obstacle at a height of four feet or more. Some of the methods proposed to use cameras along with powerful processor; these will increase the hardware requirements and also the complexity. Also use of head phones increases the complexity and adds up the weight. This paper is intended to provide a possible yet practical solution.

III. Problem Formulation

It has been found from the literature survey that, the basic purpose of the ultrasonic sensor is to identify the obstacle. But it is achieved only at the ground level and at the same level towards left and right. But if the obstacle is above four feet (above chest level) then it will go undetected and will be damaging and reduces the confidence of the user. Also, it is important to know about the location of the person having the stick. But most of the methods won't provide real time tracking of the visually impaired person. This may keep the blind person and their nearest once about the actual present location. This will also affect the confidence level of the user. In the present sophisticated world, it is a necessary to have a device that can address and solve these as a basic issue.

IV. Proposed System

Here, a simplified yet an efficient system is proposed that can help blind people as well as their nearest ones by providing necessary information. The system makes use of ultrasonic sensor to identify the obstacle from a good distance, buzzer to indicate the presence of obstacle (both at bottom and above four feet from ground), GPS to provide location of the person having the stick. As a part of controlling, Arduino and ESP 8266 is used. A cloud environment is incorporated to send and receive the location information. A mobile app is developed to observe the location and observe it on Google maps. Over all, the complexity of the hardware is reduced but still it accompanies all the requirements of an electronic blind stick. The Fig. 1 shows the proposed system block diagram.

Figure 2: Android app showing Lattitude, Longitude and Speed. "Show On Map" is the interface to the Google map

V. Implementation Details

The proposed system makes use of two ultrasonic sensors, buzzer, GPS module, ESP 8266 and Arduino Uno. The components list is simplified in-order to reduce the hardware and design complexity. On the other hand, the device must not miss out with its actual application. In the first part of the design, Arduino and its interface with the necessary hardware is described. Further, it will be taken a step ahead that connects to IOT platform.

The Arduino Uno consists of interface with ultrasonic sensor and buzzer. Here, two ultrasonic sensors are being used and its usage is to identify the presence of an obstacle along with its distance from the stick. The purpose of using dual ultrasonic sensor is of two fold advantage. One is placed at the bottom and another is placed at the top of the stick. The one placed at the bottom is useful to identify the obstacle having greater than or equal to 0.25 feet from the

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ground level (distance range set to 180cm). While walking in residential areas, there is a possibility that a window might have opened towards outside or a metal/wooden objects may present. These cannot be identified from the sensor place at the bottom of the stick. Hence the sensor at the top of the stick does this job. The ultrasonic sensor has the capacity to get the information from an elevation of up to 15^0. This capacity of the sensor is utilized to identify the obstacles above four feet and which will origin from the ground (distance range set to 100cm).

In order to indicate the presence of obstacle, a buzzer is used a part of simplification and reduced hardware. For both that is, at the ground level as well as above four feet, obstacle same buzzer is used as indicator. If the obstacle is detected at the bottom, a long, split beep is used. If the obstacle is detected the top, a short duration beep is enabled. Since the buzzer is loud enough, the user can easily identify the location of obstacle. Also, by just moving the stick to the left/right, one can identify the further path to move with. This simplified design reduces the overall hardware and also computational complexity of the processor/controller.

One more concept that is implemented in this is the real time remote tracking. This is enabled by the use of inbuilt Wi-Fi device ESP 8266 and GPS module. The ESP 8266 can be used as an interface to the Arduino Uno or can be deployed independently. In this paper, we propose to use it independently in order to avoid the delay due to processing and to increase the efficiency of the device. It means, the interface of Arduino Uno, Ultrasonic sensor and buzzer is one part; whereas ESP 8266 and GPS is another interface. Even though they are kept as separate, they are kept under same roof. The GPS module provides huge details, of which, latitude, longitude and speed are extracted. The latitude and longitude are sufficient to identify the location precisely and the speed parameter is used to identify the speed of movement. The values of these parameters will be available in real time. In order to track the person with stick, one needs to have these GPS position values. For this purpose an Android app is developed which is interfaced to the Firebase cloud. The latitude, longitude and speed values are also made to reach to the Firebase cloud through the ESP 8266. The values sent by the ESP 8266 are read by the Android app and can observe the values of latitude, longitude and speed. Through an interface developed in the app (Fig. 2), it will be linked to the Google maps where we can clearly locate the person and also make out the directions to reach to the person. To achieve the connectivity through the cloud environment, on both sides the internet must be available. It is considered that, now a days the quantity of internet data facility available per day is huge enough and this application makes uses in terms of Kb. Hence, it is not at all burden and does not adds to the cost. The person having stick, must have a smart phone which will have hotspot through which the ESP 8266 will send the data to the cloud.

VI. Conclusion

In this paper, an electronic blind stick is proposed that has capacity to detect the obstacle at two different levels of height and also has an IOT capability that enables to tracking. The obstacle can be identified by a specific distance both at the ground level and above the chest level. The location will be available to the nearest once in real time which makes the tracking of the person. These specifications will increase the confidence of the user and also their nearest once. Also it feels more secured to the user.

VII. Future Developments

The device is electronic and waterproofing is a necessary issue. In the future work, we are intended to develop a waterproof device that can be made very practical and can reach up to manufacturing level. In the Android app, it is possible to obtain latitude, longitude and speed. Using an interface created in the backend of the app, it is linked to Google maps. An effort will be put to provide direct tracking position over the map directly and to introduce panic notifications in the mobile.

References

[1] Bourne R R A, Flaxman S R, Braithwaite T, Cicinelli M V, Das A, Jonas J B, "Vision Loss Expert Group. Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis", *Lancet Glob Health*, 2017.

[2] https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment

[3] Kher Chaitrali S., Dabhade Yogita A., Kadam Snehal K., Dhamdhere Swati D, Deshpande Aarti V, "An Intelligent Walking Stick for the Blind", *International Journal of Engineering Research and General Science* Vol. 3, No. 1, 2015.

[4] Ayat Nada, Samia Mashelly, Mahmoud A. Fakhr, and Ahmed F. Seddik," Effective Fast Response Smart Stick for Blind People", *Second International Conference on Advances in Bio-Informatics and Environmental Engineering – ICABEE*, 2015. DOI: 10.15224/978-1-63248-043-9-29

[5] Mithiles Kumar, Faysal Kabir, Sahadev Roy, "Low Cost Smart Stick for Blind and Partially Sighted People", *International Journal of Advanced Engineering and Management (IJOAEM)*, Vol. 2, No. 3, pp 65-68, 2017.

[6] Naveen Kumar V and Dr. Aravinda C V, "Multi-Objective Smart Cane for Blind People Navigation with Color Sonification Technique", *International*

 DOI : 10.35291/2454-9150.2019.0410

Journal of Science and Research (IJSR), Vol. 6, No. 5, pp 1759-1763, May 2017.

[7] Dada Emmanuel Gbenga, Arhyel Ibrahim Shani, Adebimpe Lateef Adekunle, "Smart Walking Stick for Visually Impaired People Using Ultrasonic Sensors and Arduino", *International Journal of Engineering and Technology (IJET)*, Vol. 9, No. 5, pp 3435- 3447, 2017. DOI: 10.21817/ijet/2017/v9i5/170905302.

[8] D. Sathya, S. Nithyaroopa, P. Betty, G. Santhoshni, S. Sabharinath, M. J. Ahanaa, "Smart Walking Stick For Blind Person", *International Journal of Pure and Applied Mathematics*, Vol. 118, No. 20, pp 4531-4536, 2018.

[9] Uruba Ali, Hoorain Javed, Rekham Khan, Fouzia Jabeen, Noreen Akbar, "Intelligent stick for blind friends", *International Robotics & Automation Journal*, Vol. 4, No. 1, pp 68-70, 2018.

[10] K. S. Manikanta, T. S. S. Phani, A. Pravin, "Implementation and Design of Smart Blind Stick for Obstacle Detection and Navigation System", *International Journal of Engineering Science and Computing (IJESC)*, Vol. 8, No. 8, pp 18785-18790.

[11] A. Nivedita, M. Sindhuja, G. Asha, R. S. Subasree, S. Monisha, "Smart Cane Navigation for Visually Impaired", *International Journal of Innovative Technology and Exploring Engineering (IJITEE)*, Vol. 8, No. 6S, pp 190- 192, April 2019,

 DOI : 10.35291/2454-9150.2019.0410