Path Guidance System For Blind People

Badri Narayan Mohapatra, R. K. Mohapatra, P.Panda

***Abstract*—A smart device like raspberry Pi, which can be smartly programmed and provides the best guidance by providing necessary help to a blind person. This is a very safe and robust guidance system which helps many blind travelers with no worry about any obstacles on their moving path. So that it is easy for blind persons to travel and move independently to any unfamiliar environments. We have proposed one suitable device which warns the user regarding obstacles. Ultrasonic sensor plays an important role that it measures the distance from objects. This assistance device may help independent and more self-sufficient for impaired and blind people. It supports unfamiliar routes also for unknown destinations with the help of safe and effective navigation device, connection with GPS. The great potential with high reliability and its accuracy make a friendly environment to visually impaired people. Different types of navigations are there like acceleration based navigation and velocity based navigation as well as position based navigation. Here actually navigation refers one place to another for a purposeful process.**

***Keywords*—Raspberry Pi, Ultrasonic sensor, GPS, IOT Platform, Blind Stick.**

I. INTRODUCTION

Partial blindness and blindness are the state of lacking of both neurological and physiological factor. They face very difficulty while they are going on foot. For this they need special kind of stick with electronic adds on. To improve the mobility in their movement by their own in the safe sense by getting sense of obstacles around their environment. Raspberry pi based path guidance system technology will give a huge help to increase this mobility. As there are so many existing systems are their based on sonar system [1-3] and camera based system [4,5]. There are some different types of used systems like Assistive Infrared Sensor based Stick for Blinds [6]. Medico Stick helps blind to walk on streets fearlessly [7]. Appropriate location for the controls and native Voice Over Gesture navigations can be possible through Guide Cane [8]. Ultrasonic-based device, MOWAT Sensor that informs the user by means of tactile vibrations [9]. C-5 LASER CANE detects obstacles at head height range of 1.5 [9]. Many researchers have their interest to find the range for avoidance of obstacles. Infrared and ultrasonic sensor gives value added on this purpose of interesting and helpful topic.

All above strategies and different technologies are implemented on different years shown in the table 1 as guide to the blind society. There are millions of blinds and visually impaired peoples are there, basically the advancement of technology will help better on upcoming days. Nowadays, Android-based applications are very use full to Visually challenged people. Normally the stick is embedded with Raspberry Pi sensor, programmable interface controller and GPS module. Basically sensor help for detecting and informed to visually challenged people through buzzer sound. GPS coordinate track the location and send the data for the security for some extent to the relative of the blind persons.

Table 1 Different Electronic Aids for the blind.

Starting Year	Electronic Travel Aids	USE
1973	C-5 LASER CANE	Selectable range 6-12 feet [10]
1993	NAVBELT	Provide Panoramic view within 120 degree [11]
1997	MOWAT Sensor	Vibrates within target range [12]
2001	Guide Cane	Moved around easily via joystick [13]
2004-2009	Radio Frequency Identification Walking Stick	utilizing Radio Frequency Identification to avoid the risk like fallout from the sidewalk [14]
2013	Microcontroller based	Used Sonar sensor [15]
2015	Medico Stick	Add on sensor like Ultra sonic or pulse [16]
2015	Assistive Infrared Sensor based Stick for Blinds	Use IR sensor [17]
2015	Arduno	Decisions depending on the pattern matching [18,19]
2015 onwards	Raspberry based	Controls the process of the navigation [20]

Manuscript received February 21, 2019.
B. N. Mohapatra is with the AISSMS Institute of Information Technology, Pune, INDIA (corresponding author phone: 09437812746; fax: +91 (020) 26058877; e-mail: badri1.mohapatra@ gmail.com).
R. K. Mohapatra was with Mumbai University, Maharastra, INDIA. She is now with the Department of Electronics and communication, TCET, Mumbai University, INDIA (e-mail: mail2rashmita@gmail.com).
P.Panda is with the Computer Engineering Department, Bijupattnaik University, Odisha, INDIA. (e-mail: pp.panda@gmail.com).

Ear phone will be used by the blind people for the purpose of listen to the sound coming from the GPS and buzzer alarm due to navigation in direction.

The proposed system can be used for full of safety and navigation, when elderly and blind people are working to any familiar or unfamiliar area.

Walking stick is the key communication tool for navigation in several aspect and it is very helpful to blind and old age people. Somehow the proposed system lets them be in more safety while moving. It also increases the self-confidence and gives necessary help to the user for their movement by protecting him/her from hitting object/obstacles.

The purposed system alerts the blind about obstacles through sound. So that blind people develop their sense to localize them by hearing the sound. The overall system is a concept of IOT based a smart electronic aid for the blind people. One can also say as it is a real time assistance of the outside environmental scenario by providing information about objects around them.

II. Procedure for Proposed System

A. *Review Stage*

Ultrasonic sensor can be used as obstacle detections [21] and it can sense three different angles. The buzzer is activated on when any object detected within a range. Current location can be traced by GPS system and this information can be message to the saved relative person's phone number.

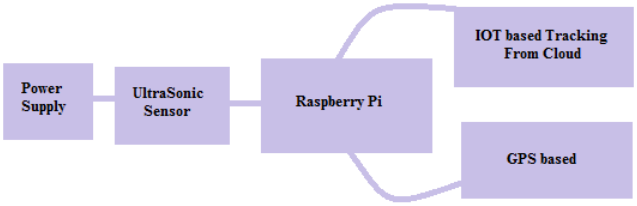

Fig.1. Block diagram representation

B. *Final Stage*

For HC-SR04 ultrasonic range sensor needs 3.3 voltage, so we have to reduce the 5 voltage to 3.3 voltage as per requirement.

The three main parameter of ultrasonic sensor are one as control ckt, secondly transmitter (one can say speaker) and last one is receiver. High frequency sound is transmitted by ultrasonic transmitter some of are reflected and received by sensor. Then the work of control ckt is started to calculate the received and transmitted time. So from that, distance can be calculated.

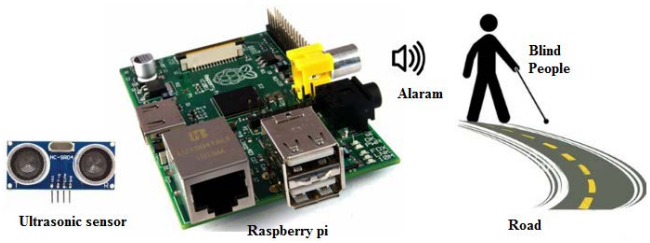

Fig. 2. Main parameters for assistance to a blind

Ultrasonic sensor is relatively good and accurate for short distance, so it is very preferable one. Normally in sound spectrum one can say acoustic which is audible to the human, low frequency sound named infrasound and high frequency sound is ultrasonic or ultrasound.

Actually the important configuration is when the output signal is 5v from ultrasonic HC-SR04 sensor and this will be input to the raspberry pi GPIO pin which is operated at 3.3 voltage. So for this we need a small voltage divider circuit which consists of two resistors to make the compatibility voltage for raspberry pi.

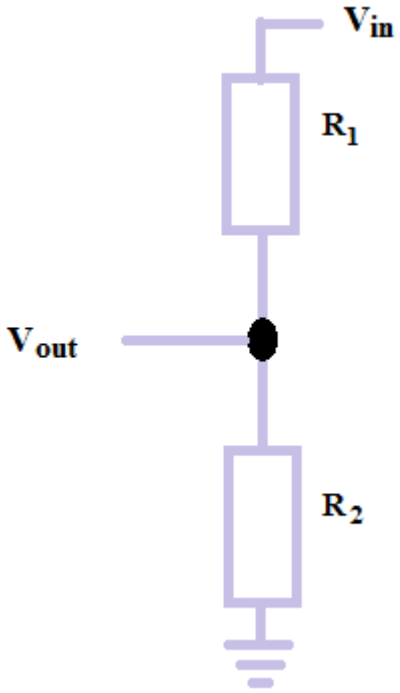

Fig. 3. Voltage divider circuit.

III. Math Calculation

So as the simple calculation we find the required resistors values.

As per voltage divider circuit

$$V_{out} = \frac{V_{in}}{(R_1 + R_2)} R_2 \qquad \ldots. \quad (1)$$

If we choose as one resistor 1 k then the other resistor R2 will be 2 k. So that almost we get 3.3 voltage to raspberry

Pi.

So while assembling to the connection with raspberry, one should have to use pin 6 GPIO GND 0volt, pin2 GPIO 5 volt (vcc) GPIO 24(pin-18) echo (input) GPIO and pin 16 GPIO 23 for trigger.

For sensing all the things, we have to run the python program.

IV. Software Implementation

Many challenges can be performed through IOT devices and IOT is the recent fast growing technology which extends the boundary and exploits every computing devices. Real time monitoring, localization and analyzing approach can be performed through application program in IOT.

There are some contextual information which play key role like physical environment, user activity about speed and orientation. As well as time of day, week or temperature and whether conditions. Normally GPS receiver takes a location compares and inform to the user, normally it compares with digital map. As there are different types of visual impairments like peripheral vision loss, central vision loss and totally blind. IOT based platform is more suitable and significant for exact human demand requirement.

As here we choose IOT platform because it is more effective, flexibility, serviceability and helpful for solving in any conditions. So through application gateways one can connect any device to IOT platform.

As there has been shift in research work like for future communication and computing through integration of concepts to internet of things. For this only three things are required, one as efficiently and specifying the implementing device properly next as handling and lastly managing the data. Moreover IOT platform approach is now just like ambient intelligence system.

A. IOT Based GPS Tracking

Combined systems like GPS and GIS assist to both blind people and their relatives. In the earth atmosphere, signals picked up and through mobile device to convert longitude and latitude to geographical location by using a digital map. GPS type of technology gives indoor and outdoor i.e. contextual information about the user. For this android application Fing and MQTT should be downloaded by the user. Large no of remote sensors can be controlled through MQTT light weight protocol. Python can be easily implemented in MQTT. Fing mobile app that discovers the device connected to the network or not. To enable the functionality delivered by Fing, one must first get API key and validate it. Fing is a free network scanner. For household and commercial appliances can be controlled by personal network nowadays. Fing can automatically recognize the best matching type, brand and model of each device.

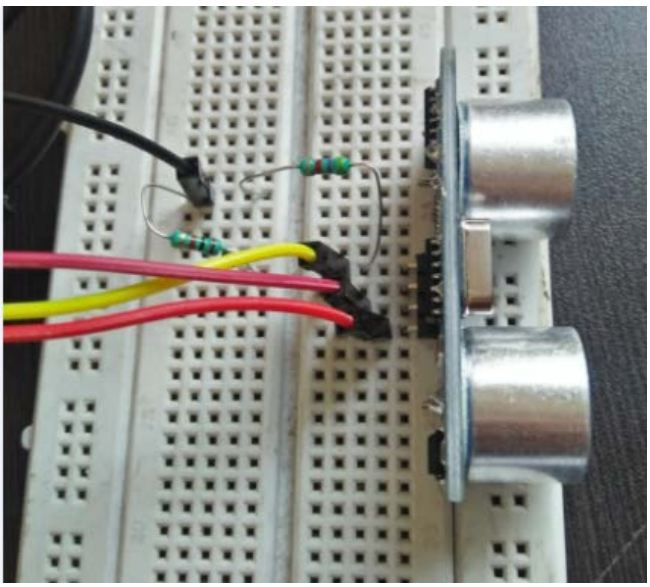

Fig. 4. Voltage divider circuit connected to ultrasonic sensor

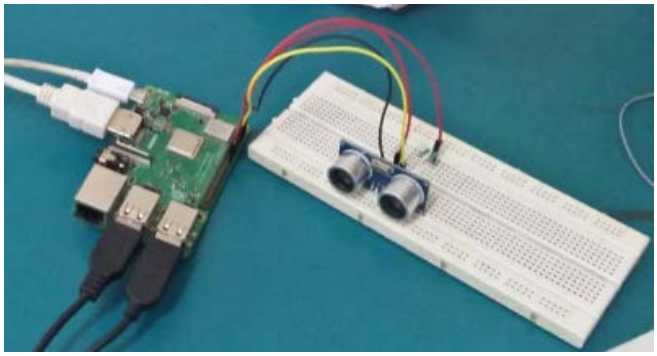

Fig. 5. Raspberry Pi connected to ultrasonic sensor

Figure 4 shows the voltage divider circuit connection to ultra sonic sensor and figure 5 shows the overall connection to the raspberry pi. While running of python program, measured and calculated distance can be easily displayed as it shown in figure 6.

B. Buzzer sounds

Obstacles can be anywhere in the surrounding. Actually one has to set a threshold range to the sensor with its specification guideline. Ultra sonic sensors are used in the front part so that it can detect the obstacles. Raspberry Pi reads the distance from the sensor and gives the commands accordingly to the buzzer. Buzzer will start alerting when the obstacle is within the range of the set limit.

There are number of factors influenced like ad1equate transmission range person should, mature and well understood the technology will give more satisfaction.

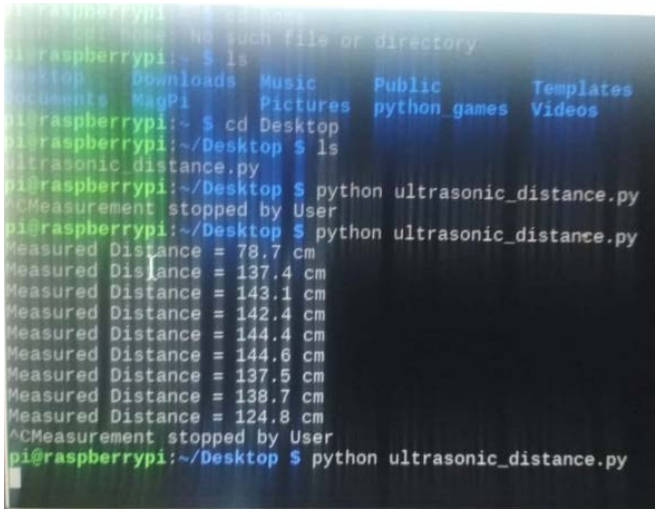

Fig. 6. Result from Python based program.

V. CONCLUSION

The proposed system is affordable and very effective and it acts as a basic platform for the coming generation of visually impaired people for both outdoor and indoor. This also offers portable, reliable and robust solution for navigation. To find the location of the blind person through GPS help a lot to the relative. So this is an empowering solution for all developing countries. It is very comfort, easy to handle and carefree navigation, also it provides GPS based real time assistance. Raspberry Pi based smart stick provides detection of object and warning back to the blind through buzzer sound. Wide survey of the proposed system will help to decide new approach to the existing system.

REFERENCES

[1] Ikbal, Md Allama, Faidur Rahman, Md Ripon Ali, M. Hasnat Kabir, and Hidemitsu Furukawa. "Smart walking stick for blind people: an application of 3D printer." In Nanosensors, Biosensors, Info-Tech Sensors and 3D Systems 2017, vol. 10167, p. 101670T. International Society for Optics and Photonics, 2017.

[2] Patel, Samir, Amit Kumar, Pradeep Yadav, Jay Desai, and Dipali Patil. "Smartphone-based obstacle detection for visually impaired people." In 2017 International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS), pp. 1-3. IEEE, 2017.

[3] Dhod, Rahul, Gurmohan Singh, Gagandeep Singh, and Manjit Kaur. "Low cost GPS and GSM based navigational aid for visually impaired people." Wireless Personal Communications92, no. 4 (2017): 1575-1589.

[4] Takizawa, Hotaka, Kazunori Orita, Mayumi Aoyagi, Nobuo Ezaki, and Shinji Mizuno. "A spot reminder system for the visually impaired based on a smartphone camera." Sensors17, no. 2 (2017): 291.

[5] Krishnan, Akhilesh, G. Deepakraj, N. Nishanth, and K. M. Anandkumar. "Autonomous walking stick for the blind using echolocation and image processing." In 2016 2nd International Conference on Contemporary Computing and Informatics (IC3I), pp. 13-16. IEEE, 2016.

[6] Mohapatra, Saurav, Sub ham Rout, Varun Tripathi, Tanish Saxena, and Yepuganti Karuna. "Smart Walking Stick for Blind Integrated with SOS Navigation System." In 2018 2nd International Conference on Trends in Electronics and Informatics (ICOEI), pp. 441-447. IEEE, 2018.

[7] Shrivastava, Prasun, Praveen Anand, Akash Singh, and V. Sagar. "Medico stick: An ease to blind & deaf." In 2015 2nd International Conference on Electronics and Communication Systems (ICECS), pp. 1448-1452. IEEE, 2015.

[8] Batterman, Jared M., Vincent F. Martin, Derek Yeung, and Bruce N. Walker. "Connected cane: tactile button input for controlling gestures of iOS voiceover embedded in a white cane." Assistive Technology 30, no. 2 (2018): 91-99.

[9] Vanitha, M., A. Rajiv, K. Elangovan, and S. Vinoth Kumar. "A Smart walking stick for visually impaired using Raspberry pi." International Journal of Pure and Applied Mathematics 119, no. 16 (2018): 3485-3489.

[10] Benjamin, J. Malvern, and Nazir A. Ali. "An improved laser cane for the blind." In Quantitative Imagery in the Biomedical Sciences II, vol. 40, pp. 101-105. International Society for Optics and Photonics, 1974.

[11] Shoval, Shraga, Johann Borenstein, and Yoram Koren. "The navbelt-a computerized travel aid for the blind." In Proceedings of the RESNA Conference, pp. 13-18. 1993.

[12] Shoval, Shraga, Johann Borenstein, and Yoram Koren. "The Navbelt-A computerized travel aid for the blind based on mobile robotics technology." IEEE Transactions on Biomedical Engineering 45, no. 11 (1998): 1376-1386.

[13] Kang, Sung-Jae, Young Ho, and In Hyuk Moon. "Development of an intelligent guide-stick for the blind." In Proceedings 2001 ICRA. IEEE International Conference on Robotics and Automation (Cat. No. 01CH37164), vol. 4, pp. 3208-3213. IEEE, 2001.

[14] Saaid, Mohammad Farid, Ismarani Ismail, and Mohd Zikrul Hakim Noor. "Radio frequency identification walking stick (RFIWS): A device for the blind." In 2009 5th International Colloquium on Signal Processing & Its Applications, pp. 250-253. IEEE, 2009.

[15] Mahmud, Mohammad Hazzaz, Rana Saha, and Sayemul Islam. "Smart walking stick-an electronic approach to assist visually disabled persons." International Journal of Scientific & Engineering Research 4, no. 10 (2013): 111-114.

[16] Shrivastava, Prasun, Praveen Anand, Akash Singh, and V. Sagar. "Medico stick: An ease to blind & deaf." In 2015 2nd International Conference on Electronics and Communication Systems (ICECS), pp. 1448-1452. IEEE, 2015.

[17] Nada, Ayat A., Mahmoud A. Fakhr, and Ahmed F. Seddik. "Assistive infrared sensor based smart stick for blind people." In 2015 Science and Information Conference (SAI), pp. 1149-1154. IEEE, 2015.

[18] Kartika, Linda, Gita Indah Hapsari, and Giva Andriana Mutiara. "Smart-Cane for The Blind with Wind Direction Position based-on Arduino." In ASAIS. 2015.

[19] Kalischewski, Kathrin, Daniel Wagner, Jörg Velten, and Anton Kummert. "Orientation and positioning with inertial sensors for walking frame guidance." In 2015 IEEE 9th International Workshop on Multidimensional (nD) Systems (nDS), pp. 1-5. IEEE, 2015.

[20] Sahoo, Nilima, Hung-Wei Lin, and Yeong-Hwa Chang. "Design and Implementation of a Walking Stick Aid for Visually Challenged People." Sensors 19, no. 1 (2019): 130.

[21] Dey, Naiwrita, Ankita Paul, Pritha Ghosh, Chandrama Mukherjee, Rahul De, and Sohini Dey. "Ultrasonic Sensor Based Smart Blind Stick." In 2018 International Conference on Current Trends towards Converging Technologies (ICCTCT), pp. 1-4. IEEE, 2018.

[22] Mohapatra, Badri Narayan, Rahul Bhite, and Abhishek N. Mehendal. "DESIGNING AN IOT BASED EMERGING MECHANISM GENERATING ELECTRIC ENERGY THROUGH SPEED BREAKER."

Badri Narayan Mohapatra started his research on communication in Centurian University, Odisha. He did his B.E. from Berhempur University and M.Tech from Biju Pattnaik University of Technology, Odisha. His research area covers Light propagation, Digital Signal and Image Processing. Currently he is working in AISSMS IOIT, Pune.