Low cost audio based intelligent guidance system for visually impaired people

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Abstract - **In this paper we are proposing the IOT based intelligent guidance and navigation system for visually impaired person with low cost. As visually impaired person continuously requires assistant and monitoring of other people for their mobility, health and routine, due to this they are more dependent on other people. They can used only their senses such as by sound or by feel, touch and moreover, they use stick to navigate which is not much helpful. As they face issue in communicating easily with the surrounding. In order to solve the travelling issue we are presenting a light weight intelligent guiding system in the shape of pair of glasses which will provide guidance properly. As IOT has changed the whole industry, our proposed system for navigation system includes some sensors like ultrasonic distance sensor, GPS, camera which is being mounted on a Raspberry Pi board. This detects the obstacles in their path to navigate themselves on different location efficiently and safely. The information about the obstacle and the text which is present in front of the user is being informed to the visually impaired person through audio device which can be ear phones and if any issue arises regarding the audio which can be due to noisy environment the person is being informed through vibration. Camera module captures the object and informs the user what it is. This system continuously monitors in real time environment for avoiding the obstacles. Sensors plays the key role in the whole system to detect and guide the visually impaired person.**

Keywords - Smart glass, OCR (Optical Recognition System), ultrasonic sensor, ETA, camera

INTRODUCTION

According to the official measurement form the World Health Organization there are approximately 285 million around the world who are visually impaired and around 246 million people have feeble sight and 35 million are totally visually impaired [1]. This number will increment rapidly in the future [2]. Visually impaired people face huge difficulty in seeing and cooperating with the environment, particularly to those who are not familiar to this. Generally most of the people rely on stick for nearby route, as using the stick in front of them in order to discover the object and to protect themselves form that obstacle.

However they cannot satisfactorily see all the fundamental data for example volume or size of object or how far the object is, etc. [4]. Similarly, ETA(Electronic Travel Aid) can give more knowledge regarding the environment by coordinating various electronic sensors and have ended up being compelling on improving the visually impaired person lifestyle[4], and the gadget that is being presented in this work has a place with such classification.

It is hard for visually impaired person to go out alone and as there are not many available products that can assist them. However, Researchers have been going on for decades for developing an effective device for visually impaired people. Some device such as NavBelt [3], Guidecane [5] have been made.

In this paper we are presenting a unique design for the intelligent or smart glass that can help visually impaired or low sight people in multiple task keeping up at low structure cost. This device can accurately guide the person and provide legitimate guidance. The device will be mounted on the person face through the ultrasonic sensor the distances will be calculated and the camera will capture the picture of the environment which is being mounted on raspberry pi.This information is sent to the server in real time and is converted to audio through audio jack which is present on raspberry pi which is being provided to the person through ear phones.

LITERATURE SURVEY

Md. Razu Miah and Md. Sanwar Hussain et al proposed a system for visually impairment peoples in the form of smart glass. They used ultrasonic sensor and micro-controller to detect the object and help to guide them. They also include a GSM module for collecting the source of information with the help of internet. It sent messages to the guardian when the people feels in danger.This includes notification system when the person is in emergency situation which is sent to the respective person like guardian and alerts them.

Rohit Agarwal, Nikhil Ladha and Mohit Agarwal et al proposed a low cost ultrasonic smart glass for blind peoples or with the people which are having low vision. They included an object detection module and the one output device which is connected with the microcontroller. The device sending the output through the buzzer while it got the information about obstacles. This system is based on Intel Edison and the programming is done in C++.This glass easily provide guidance to the user.

Feng Lan, Guangtao Zhai and Wei Lin et al proposed a system for visually impaired peoples via light-weight smart glass. Blind peoples are not able to see or recognize the signs which are present public spots. They implemented an application to recognize the signs of public places to help blind people to navigate. They have done their implementation in c++ with using OpenCV.

Jinqiang Bai and Shiguo Lian et al proposed a smart guiding system especially for weak sighted peoples in the indoor environment. They presented a novel ETA – Electronics Travel Aids with sensor fusion. A guiding device which was in the shape of a pair of eye-glasses for guiding the peoples who were weak visions. They included augmented reality technique for processing the images and guiding people with audio to move here and there.

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Visually impaired people are more dependent on language which they understand for reading any kind of document and on the walking stick which they sway in front on them to get the idea about obstacle.In this system a camera is present on the nose which provide information about the object which comes in front of them and transfers to the system for processing and provides the output to that person. This whole system include camera, eye glass and the system database contain data about text and images.

PROROSED SYSTEM

Visually impaired as an exceptional gathering in the public eye, the requirements of society to give them more consideration, with the goal that they are better ready to live autonomously. However, how safe strolling blind life is the most serious issue. Conventional route gadget for the most part daze stick, dazzle by tapping the ground or strolling around the item to decide the bearing, the structure is straightforward, single capacity, simple to utilize, however the auxiliary impact isn't exceptionally self-evident, indeed, will experience numerous issues when utilizing the visually impaired, for example, poor street conditions, uneven, hanging before obstructions, normal stick cannot be demonstrated exact, such a genuine effect on the security of visually impaired explorers

Detecting obstacles and guiding through audio to the visually impaired person:

There exists an immense literature on detecting the obstacles and avoiding it. As per the sensor type, there are different approaches which can be used for avoiding the obstacle, so we are using ultrasonic sensor-based technique. Ultrasonic sensor-based technique can calculate the distance of obstacles and contrast it with some distance threshold for deciding whether to proceed or not.

In our project we are using three ultrasonic sensor which is being mounted on the glasses, left sided ultrasonic sensor is used for obtaining distance from left side, right sided ultrasonic sensor is used for calculating the obtaining the distance from the right side and the middle sensor is used for obtaining the distance for far away objects and it will work accordingly as per the coding done and send the yield through audio format to the user. Raspberry pi board is being used as it is of small size and as it contains audio jack so as to convert the input into audio format and provide it to the person is audio format. The sensor is mounted in the right, left and middle of the best bar and extension present in optical glasses as appeared in the figure. Every one of the segments are associated with the focal unit utilizing single strand copper wires and the power is given to the focal unit utilizing a USB link. The best sensors that can be utilized will be ultrasonic sensors since ultrasound is a solid point, the vitality utilization of moderate wave spreading in the medium generally far separation. In this way frequently it is utilized to quantify the separation over huge length. In the meantime, ultrasound for the item in obscurity, dust, smoke, electromagnetic impedance, dangerous and other cruel situations have a specific capacity to adjust, with a wide scope of utilizations.
As this approach cost low and works well with the real time application and is not complicated to calculate the distance of the obstacles which comes in front of the person.

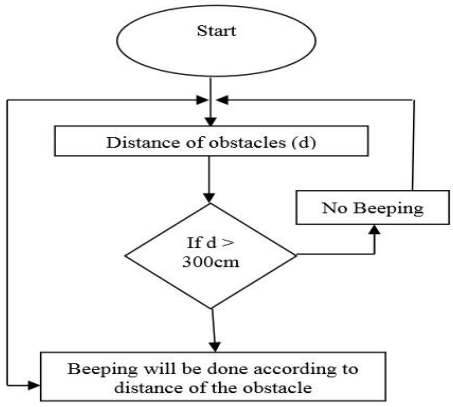

Fig 1: Flow chart for obstacle detection

In the above figure it shows that how the obstacle is detected and after detecting the obstacle the output is being sent to visually impaired person through audio format. The information is being sent to the person through head phones in order to take further steps in this manner guidance to the user is being provided easily and accurately

Converting text and signs to audio:

When visually impaired person come across any text then that text will get captured is converted to that person through an audio format using OCR with google cloud vision API. OCR is a strategy that changes advanced picture content into machine clear information. This Mobile Vision's text recognition API currently distinguishes text in different languages. The output of the text detection is based on segments. These segments can be block, lines, and words. And when the person come across any signs for example signs shown in fig. 2 that will also get detected and converted to audio format. In the part of sign detection identification and acknowledgement we see that open signs are normally planned with unnatural shading and shape, making the obvious and all around checked. Formed based and color-based techniques are easiest once to be used for sign root detection [6] [7], and yet this method are normally sensitive to the environment. So the feature is being extracted and transferred to the person through audio.

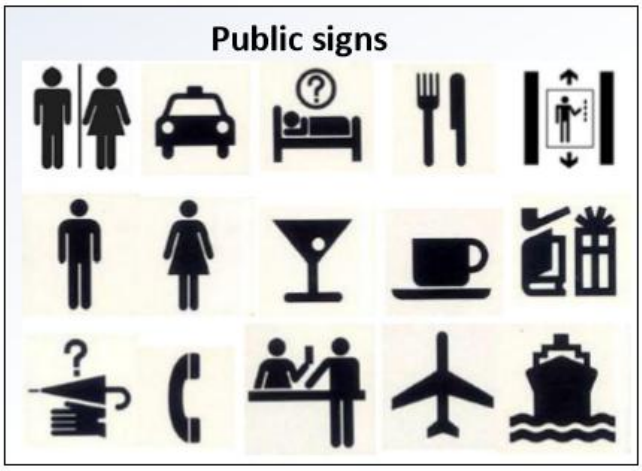

Fig 2: Different public signs

RESULT ANALYSIS

If a person come across an object which is far more away than the current location of object then that person will not be able to locate that object, this will work for only feasible distance object recognition.

Sensor implementation is being displayed in the following figure that is fig. 3. We have tested this implementation on text processing, it will give accurate output even low internet speed. It is recognized even hand written text and give accurate output in audio format.

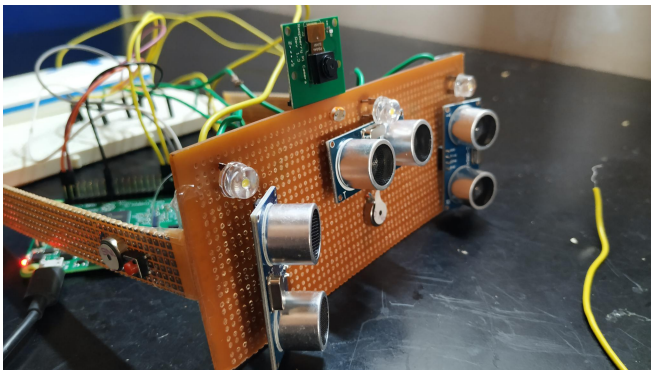

Fig 3 (a): Sensor Implementation

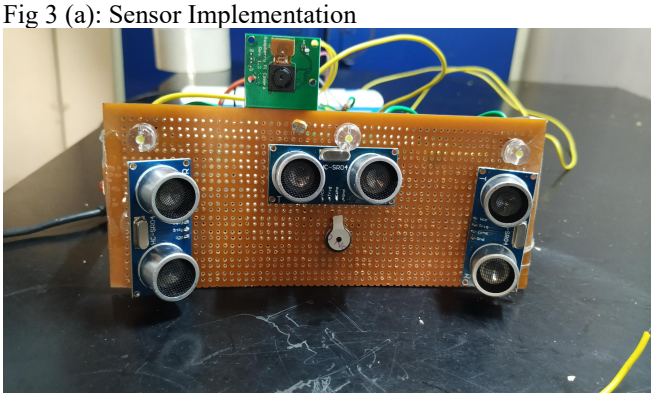

Fig 3 (b): Sensor Implementation

Name	Requests	Errors (%)	Latency, median (ms)	Latency, 95% (ms)
Cloud Vision API	32	0	524	7,130
Cloud Text-to-Speech API	13	0	237	1,415

Table 1: Cloud Request Accuracy

It is recognized the maximum request from the input and give the precise output. Table 1 shows the result from the cloud according to the requests. It is gives up to 100% correct output in text processing. The Smart glass also recognized the public signs and gives appropriately ouput.

CONCLUSION

In this paper we have proposed an intelligent and low cost guiding system for the visually impaired person, which can enable them to move securely and productively in the environment. This guiding system is more comfortable to the user as it provide output to the user through sound and the ultrasonic sensor which are used in device is light in weight and small and does not consumes more power so it is user friendly. It also provide quicker response to the user so that the person can take quicker action in order to move in right direction.

REFERENCES

[1] B. Söveny, G. Kovács and Z. T. Kardkovács, "Blind guide - A virtual eye for guiding indoor and outdoor movement," in *2014 5th IEEE Conf. Cognitive Infocommunications (CogInfoCom), Vietri sul Mare, 2014, pp. 343-347.*

[2] L. Tian, Y. Tian and C. Yi, "Detecting good quality frames in videos captured by a wearable camera for blind navigation," in *2013 IEEE Int. Conf. Bioinformatics and Biomedicine, Shanghai, 2013, pp. 334-337.*

[3] J. Brabyn, W. Gerrey, T. Fowle, A. Aiden and J. Williams. (1989). Some Practical Vocational Aids for the Blind. *Proc. of 11th Annual International Conference of IEEE Engineering in Medicine & Biology Society, pp. 1502-1503*

[4] D. Dakopoulos and N. G. Bourbakis, "Wearable obstacle avoidance electronic travel aids for blind: A survey," *IEEE Trans. Systems, Man, Cybern., vol. 40, no. 1, pp. 25-35, Jan. 2010*

[5] Raga Shoval, Iwan Ulrich2, Johann Borenstein ,NAVBELT AND GUIDECANE Robotics-Based Obstacle-Avoidance System for the Blind and Visually Impaired .Invited article for the *IEEE Robotics and Automation Magazine, Special Issue on Robotics in Bio-Engineering. Vol. 10, No 1, March 2003, pp. 9-20*

[6] Arturo De La Escalera, Luis E Moreno, Miguel Angel Salichs, and Jos´e Mar´ıa Armingol, "Road traffic sign detection and classification," Industrial Electronics, *IEEE Transactions on, vol. 44, no. 6, pp. 848– 859, 1997*

[7] Md. Razu Miah, Md. Sanwar Hussain, "A Unique Smart Eye Glass for Visually Impaired People", *International Conference on Advancement in Electrical and Electronic Engineering 22-24 November, 2018*

[8] Rohit Agarwal, Nikhil Ladha, Mohit Agarwal, Kuntal Kr. Majee, Abhijit Das, Subham Kumar, Subham Kr. Rai, Anand Kr. Singh, Somen Nayak, Shopan Dey, Ratul Dey, Himadri Nath Saha, "Low Cost Ultrasonic Smart Glasses for Blind", *IEEE, 2017*

[9] Feng Lan, Guangtao Zhai, Wei Lin, "Lightweight Smart Glass System with Audio Aid for Visually Impaired People", *TENCON 2015 – 2015 IEEE Region 10 Conference*

[10] Jinqiang Bai, Shiguo Lian, "Smart Guiding Glasses for Visually Impaired People in Indoor Environment", *IEEE Transactions on Consumer Electronics, Vol. 63, No. 3, August 2017*

[11] Constantino Alvarez Casado, Miguel Bordallo L'opez, Jukka Holappa and Matti Pietikainen, "Face Detection and Recognition for Smart Glasses" *In 5th Asia-Pacific Workshop on System, page 10. ACM, 2014*

[12] DiwakaSrinath A1, Praveen Ram A.R2, Siva R3, Kalaiselvi V.K.G4, Ajitha G5, "HOT GLASS-Human Face, Object recognition for visually impaired people", *978-1-5090-6221-8/17/$31.00 c@2017 IEEE*