ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)

Vol 8, Issue 9, September 2021

Smart Glasses for Visually Impaired Person

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***Abstract*--- This paper represents a new prototype of a smart eye glasses that can help a visually challenged person to recognize the person in front of him and learn about obstacles ahead.This will be enabled by face recognition and distance detection features.This prototype consist of Raspberry pi2 as the heart of processing, raspberry pi 2 camera, ultrasonic sensor, 5V power supply and a pair of glasses. Experiment results demonstrate that the prototype is working as intended.**

***Index Terms*— Internet of things (IOT), smart devices, smart healthcare, visually impaired, Text recognition, Raspberry pi**

I. INTRODUCTION

Fig. 1

In this paper, we develop a smart eye glasses whose working model is shown in fig.1. It can help a visually challenged person to recognize the person in front of him and learn about obstacles ahead. This will be enabled by face recognition and distance detection features. [1]

According to the official data from World Health Organization (WHO), The number of visually impaired people of all ages is estimated to be 285 million globally, of them 39 million are blind. People 50 years and older are 82% of all blind.

These visually challenged people have great difficulty in interacting with their surroundings, especially those people who are unfamiliar to the surrounding[2].

To overcome this dilemma for the visually challenged community , researchers came forward with an idea known as smart glasses for visually impaired person for giving these people guidance efficiently and safety.

In this prototype Raspberry pi and Pi camera for facial recognition process are used. And also used an Ultrasonic sensor for obstacle detection and avoidance and a 5V power supply to run the Raspberry pi.

II. LITERATURE REVIEW

The IOT is a theory which reflects a connection of any person, anything, anytime, anywhere, any service and any network[5]. IOT is an upcoming trend in next-generation technologies which will affect the whole scope of the heart and can be considered as the interconnection of intelligent objects and devices. The general benefits include the advanced connectivity of these devices, systems and services that goes beyond machine-to-machine (M2M) scenarios. So the introduction of automation is possible in almost all fields. The IOT compromises suitable solution for a wide range of applications, such as smart cities, traffic congestion, waste management, structural health, security, emergency services, logistics, retail sales, industrial control and medical attention[6].

The proposal of this smart glass mainly depends on the processing unit, i.e. raspberry pi 2. The main hardware of this design is a Linux based ARM processor which support a micro SD card and further we can increase the task functions number according to our choice. For image processing a raspberry pi camera is used which is connected to the raspberry pi through a flex cable, and was fixed on the top center of the glasses for optimal image capturing. The raspberry pi comes with an audio port

ISSN (Online) 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)

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which connects to earpiece. The raspberry pi GPIO port was configured to receive input from push button switches.

III. COMPONENTS USED

Here is the list of components shown in fig. 2, which have used to complete this proposed prototype and can also find the associated image of those components in fig.3.

Component Name	Quantity	Description
Raspberry PI 4	1	Main Board
Camera	1	For Face Recog
Ultrasonic Sensor	1	For distance
USB Cable	1	Optional for conn.
Wires	20cm	For Connection
Glass	1	1
Battery 5V/Powerbank 5V	1	To power Pi

Fig. 2

Fig. 3

IV. METHODOLOGY

Fig. 4

For the proposed model, developed two different codes in Python3, one to tell the distance of obstacles ahead and other for face recognition. The first code measures the distance of obstacles and alert the user using voice output. Also added a vibration motor for haptic feedback.

For Obstacle detection and avoidance-

Open the Python3 IDE to start coding. Here we need two modules – time and espeak. Furthur imported both the modules in code. After that create a distance function where import the GPIO and set the pins for distance sensor. Next using while loop that continuously checks the distance. In this while loop ,also added an if condition to check the distance between the user and the obstacle. If it detects an object close to the user, it will automatically inform the person by giving audio and haptic feedback.

For Facial Recognition-

To recognize the person in front of the user (known or unknown) then imported 3 modules: face recognition, cv2 and numpy. In module, created different arrays for known faces and their names. Further named the image file for the face recognition of that member.

V. RESULT

A. Result Output of the facial recognition for the known person as shown in fig.5.

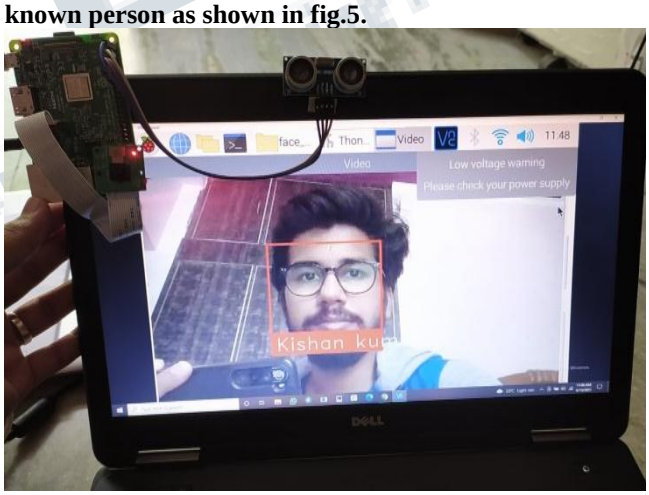

Fig. 5

In the fig 5, it is observed that when we interface our raspberry pi and camera with a laptop and when we run the program in the interface we will get an output. If the person's facial data is already stored in the memory then it will recognize the person and will show the person's name as the output.

This output will also be in the form of audio through the earphone jack.

ISSN (Online) 2394-6849

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Vol 8, Issue 9, September 2021

B. Facial recognition Output for the unknown person as shown in fig. 6.

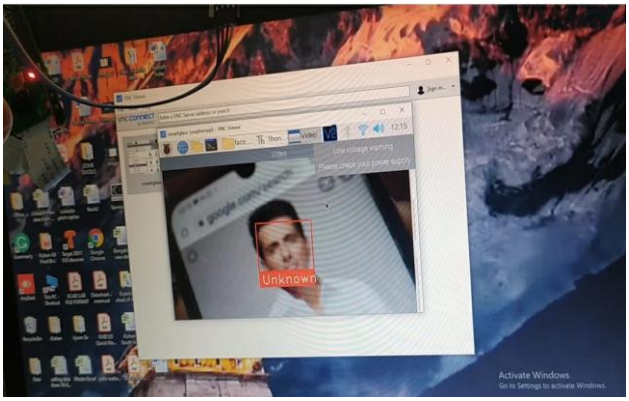

Fig. 6

Similarly, if an unknown person whose facial data is not stored in the memory then it will show unknown as the output. This output will also be in the form of audio when connected through earphone jack.

C. Obstacle Detection

Interfacing the program with infrasonic sensors, whenever the person wearing the smart glasses will encounter an obstacle within a specified range then the infrasonic sensor will immediately inform the person about the obstacle and the distance between the person and the obstacle to avoid collision.

The information will be given through an audio output and for this an earphone jack is also provided to connect to the audio.

D. Text to speech output

As discussed earlier about the facial recognition of known or known person infront of the camera. The output of the facial recognition will be a text to speech output i.e., when a known person is detected by the camera then the name of the known person which is in text format will be converted into speech and the output will be heard in audio format through the earphone jack available. Similarly, for an unknown person the text will be converted into speech and an audio of known person will be heard through the earphone jack.

VI. DISCUSSION

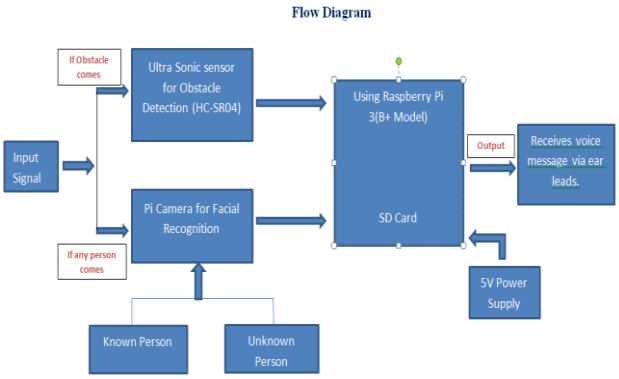

Fig. 7

In the above fig.7, it shows a flow diagram having a Input signal through which two cases arises which are mentioned below:

Case 1- Obstacle detection

If obstacle comes in front of smart glass wearer, then the device sends the voice message to the wearer that obstacle detected at certain distance.

Case2- Facial Recognition

If any known person comes in front of the Pi camera whose image is already in our database then the device sends the information to the Raspberry Pi that 'known person is detected along with its name' which we have stored in our database.

And if any unknown person comes in front of the Pi camera whose image is not stored in our database then an alert voice message goes to the Pi and wearer hear a voice message i.e. 'unknown person detected'.

The Output of both the cases goes to Raspberry Pi 3 and as per the coding certain decision will be taken and that output comes in terms of voice message.

VII. CONCLUSION

This paper presents a proposed idea of smart guiding device for visually impaired users, which help them move safely and efficiently in complicated indoor and outdoor environment. The depth image and the multi-sensor fusion based algorithms solve the problems of small and transparent obstacle avoiding. Three main auditory cues for the totally blind users were developed and tested in different scenarios, and results show that the beep sound based guiding instructions are the most efficient and well-adapted. For weak sighted users, visual enhancement based on AR technique was adopted to integrate the traversable direction into the binocular images and it helps

the users to walk more quickly and safely. The computation is fast enough for the detection and display of obstacles. Experimental results of proposed prototype shows that the proposed smart guiding glasses can enhance the travelling experience of the visually impaired people. The use of simple and low cost sensors, make it widely usable in consumer market.

ACKNOWLEDGMENT

This paper and the research behind it would not have been possible without the exceptional support of our mentor 'Dr. Seema Nayak' HOD of Electronics and Communication Department. Her enthusiasm, knowledge and exacting attention have been an inspiration to us.
We would also like to express our deep gratitude to our parents, all well-wishers whose enormous help assist us to complete this project.

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