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COMBINING AR AND IOT TO HELP BLIND PEOPLE FEEL THEIR SURROUNDING. "A MATCH MADE TO FEEL THE PARADISE"

Dr. S Usha[*1]**, Aman Ulla**[2] **& Arpit Singh**[3]

[*1,2&3]Dept. of Computer Science and Engineering, Rajarajeswari college of Engineering, Bangalore, India

ABSTRACT

Having seen this Wonderful creation of god, it amazes everyone for the beauty around us is mesmerizing, the nature and the habitats on this planet. Every day we happen to encounter beautiful sunrise and starting the day with full potential and ending day peacefully and calmness like a sunset at evening. But What about those people who aren't blessed sight, wonder how they spend their entire life with only one color and no sight. So, the aim is to help the blind people sense the surrounding so that they can at least feel their surroundings and don't miss the God's creation. We for the first time combining Internet of Things (IoT) and augmented reality (AR) together and creating a real-time product which can help the blind to hear and know things in their surroundings. We are using a Raspberry Pi 3 microcontroller and a Raspberry pi cam to feed the video recording and then apply the Augmented Reality to the video and detects objects for real. C# language will be used to implement AR on the live video.

Keywords: - Community habitats, augmented reality, raspberry pi, c#.

I. INTRODUCTION

Currently the estimated number of people visually impaired in the world is 285 million [1]. This is a very large number to believe, and the steps adopted to help these visually impaired people is replacement of eye and there are very few people who donates their eye. So, when we consider the ratio of visually impaired people with the number of people giving eye donation it turns out to be 1:10696 and this not helping every impaired people. So, this Project aims to build a device which can help the blind people feel their surrounding and give them the taste of this beautiful nature. This product is made by combining IOT and AR (Augmented Reality) and the microcontroller used for this is raspberry pi and pi cam. Pi cam will capture the live scenario and feed it to the microcontroller and then the backend process where this video captured will be analyzed and process and give out the shapes of objects around them.
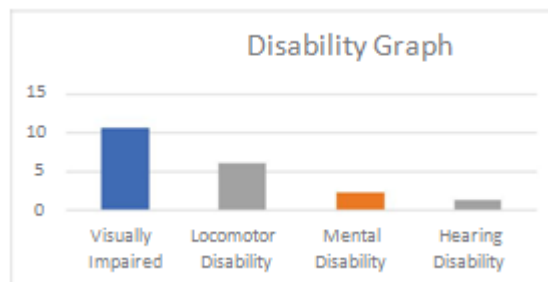
II. CASE STUDY

Fig 1. Graph comparing the disabilities [2]

There are many disabilities present but when we have a closer look we notice that the highest disability is Visually Impaired and that measures adopted to help them is very minimal. when we consider the ratio of visually impaired people with the number of people giving eye donation it turns out to be 1:10696 and this not helping every impaired people. This means not every visually impaired will get an eye transplant.
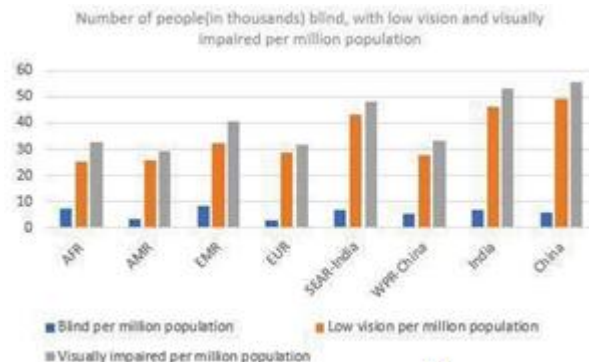
Fig 2. Number of people (in thousands) blind. [2]

WHO Region	Total Population (Millions)	Blindness No. in Millions (percentage)	Low Vision No. in Millions (percentage)	Visual Impairment No. in Millions (percentage)
AFR	804.9 (11.9)	5.888 (15)	20.407 (8.3)	26.295 (9.2)
AMR	915.4 (13.6)	3.211 (8)	23.401 (9.5)	26.612 (9.3)
EMR	580.2 (8.6)	4.918 (12.5)	18.581 (7.6)	23.499 (8.2)
EUR	889.2 (13.2)	2.713 1 (7)	25.502 (10.4)	28.215 (9.9)
SEAR (excluding INDIA)	579.1 (8.6)	3.974 (10.1)	23.938 (9.7)	27.913 (9.8)
WPR (excluding CHINA)	442.3 (6.6)	2.388 (6)	12.386 (5)	14.724 (5.2)
INDIA	1181.4 (17.5)	8.075 (20.5)	54.544 (22.2)	62.619 (21.9)
CHINA	1344.9 (20)	8.248 (20.9)	67.264 27.3	75.512 (26.5)
WORLD	6737.5 (100)	39.365 (100)	246.024 (100)	285.389 (100)

Fig 3. Number of visually impaired in world

Fig 2 and Fig 3, basically shows the graph and table on the number of visually impaired and types line low vision, complete blind. When we consider these values, it is not a small issue but a bigger one on how to decrease this on global scale. India along with 7.8 million blind people and while 45 million are visually challenged [3] , this numbers show that 20 percent of the visually impaired is in India.

III.   RELATED WORK

There are many invention and ideas utilized in order to help visually impaired. Many inventions include making a smart stick which buzzes when there is any kind of obstacle present in front. Making some upgradation to these products, like including GPD in the stick and camera to find out the obstacle. Another paper includes making of Shoe consisting of camera and ultrasonic sensors onto the shoe and identifies the obstacle and identifies human and is fitted with GPS so that anyone can track and know where the person is currently. Another paper revels that their goggle works on the similar principal that of used in parking in cars.

All the papers present finds solution only on avoiding visually impaired from getting hit by some obstacle but none of the paper tries to solve the problem to visually impaired knowing their surroundings, having a mutual friend present 24/7.

IV.   AUGMENTED REALITY

Since the beginning of silicon era we have seen a lot of evolution of computers. But also, we haven't seen any development in computers. The meaning here is all the development has been very basic and comparing the old tech with new computers we can see that not much has changed. We still are dependent on a square screen to do all the computing. But using augmented reality we can remove the screen from picture and use our surroundings as a screen.

V. ROLE OF AUGMENTED REALITY

Augmented reality is not a new technology and has been in since long but the computing power required to process the huge amount of input data has been achieved in recent times. Goal of this project is to combine AR with pi camera and use the live feed to do real time image and video processing to produce a holographic image of the object in focus of video. Augmented reality can be applied in many ways, e.g. through a normal computer screen for 2d application or by using a dedicated headset for real 3d implementation. Video processing is done using unity development software and the coding for certain aspects of video processing is done using Microsoft visual studio supporting both C# and unity development. All of the video processing and holographic projection is resource friendly as none of this is actually stored in the user's device instead it is a cloud base application and all the image processing is done by using cloud services by Microsoft and Google analytics by efficiently using their image recognition algorithms.

VI. SYSTEM MODEL

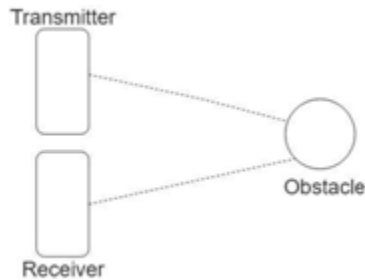*A. Working of Ultrasonic Sensor (Sonar)*

Fig. 4. Working of Sonar

The Sonar consists of two core parts, the transmitter and the receiver. The transmitter in the Sonar sends out a high-frequency waves and the receiver at the other end receives this high-frequency waves. Now the distance of the object is calculated based on the time taken by the wave to reach the receiver.

This can be given as,

Distance = (T/2) * S

Where, T- denotes the times taken by the wave to reach the receiver.

S- denotes the speed of light
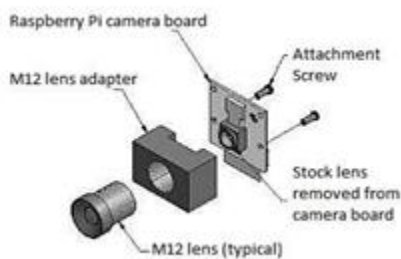
B.   Working of Camera Module

Fig 5. Inside a Pi camera

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The pi camera module is a mobile camera module, it is used for capturing images and videos. When ever the camera needs to capture image, it reads out the pixel from the sensor at time rather than capturing all the pixel value at once.

The maximum horizontal resolution we can get is 1920 and it captures by default in H264 config, the maximum framerate of the camera with overclocking is 120fps and the maximum time exposure is 10 seconds.

The pi camera module uses MMAL components together to pass the image data around by encoding, the MMAL object layer introduced in pi camera is aware of these encoding between components and performs more efficient.
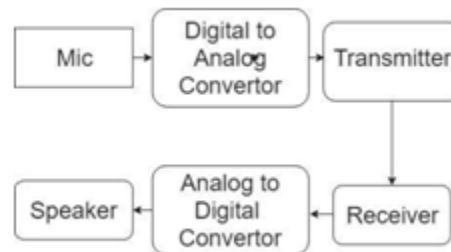
C.   Working of Wireless mic

diagram shows the working of a wireless mic module, at first when the mic receivers any kind of sound waves it captures and sends it to the convertor, from there it is converted into analog signal and then sent to the transmitter, the transmitter then sends the signals wireless and the receiver at the other end receives the signal and then sends it to the convertor and the digital signals are sent to speaker as output.
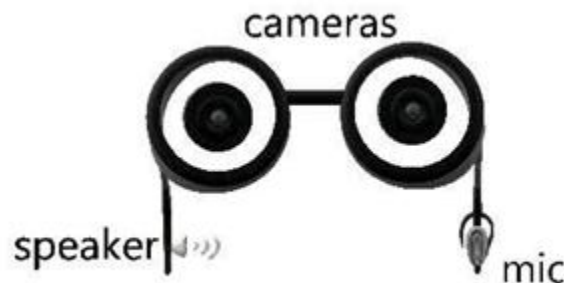
VII.   PROPOSED SYSTEM

Fig 7. The prototype model of the product

The product will be made in texture of a goggles. Which will include a camera and a dc battery for power supply. The product will have some dedicated speakers for audio and a dedicated mic for recording human command. Their will be a small offline AI setup so that the visually impaired people can communicate with AI as a mutual friend

The camera used for making the prototype model is a pi cam and all the video recording and other entities will be sent to raspberry microcontroller. Another microcontroller called Arduino will be used to store offline text and speech recognition and connected to the dedicated speakers.

The later versions of this product can be upgraded by including many sensors such as temperature sensor and pulse sensor to determine the pulse rate of the person. And more of a fit bit.

The product aims to help the visually imparted people to feel and enjoy the nature. It shocks everyone how the visually impaired people spends their entire life with no color and no sight. A normal person gets bored of seeing this nature and disrespect the surrounding but there are few who aren't blessed to see God's creation.

A. *Advantages of combining AR and IOT to build a product*

In this era with AI and many advance technologies increasing day by day. Every now and then something new is being invented by combining all the technologies and features. Similarly, a new technology is invented by combining IOT and AR. Now a day this feature is widely used in medical field and in many other domains like building stimulators. These stimulators are used in medical for practicing surgeries.

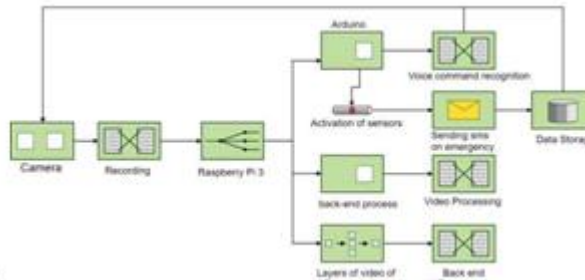## VIII.   ARCHITECTURE OF PROTOTYPE

Fig 8. Architecture of the Prototype

The architecture shows the different layers involved in the process. At first the camera record or send the live video to the microcontroller then from the microcontroller it is sent to two different layers simultaneously. In the above layer all the essentials details are acquired and from there the sensors are activated like speakers, temperature. Another layer processes the video further for adding augmented reality. All this backend process is carried out very fast and then result is been sent to the microcontroller which then sorts and search the best reply to be passed on. The prototype will also include offline text and speech replies which will be controlled by the Microcontroller.
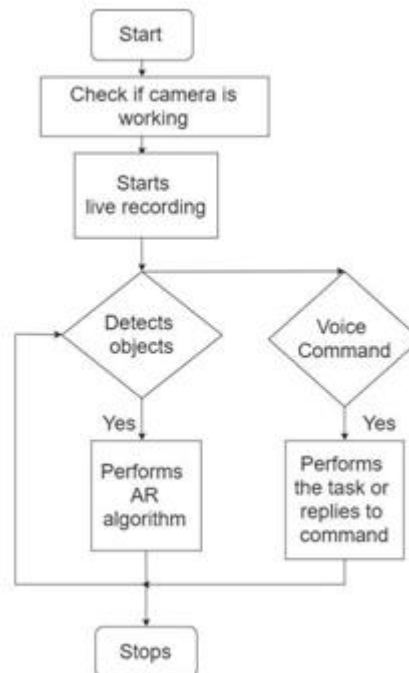
IX.   FLOWCHART

Fig 9. Flowchart of flow of process

The flowchart shows the graphical way for the flow of process and the placement of each system models at first the raspberry pi checks If the camera is working and Arduino microcontroller checks if the other sensor and module is working. Once the validation is done the camera starts the live video recording and sends the data to the raspberry for further video processing.

When ever there is an voice command the Microcontroller records it and then sends it for speech recognition and based on AI the output is given.

X.   CONCLUSION

This product can help many visually impaired to experience their surrounding and also have a taste of this nature. This being the Initial version and a testing prototype, the final version will be fully functional and can be distributed to the visually impaired.

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