Visually Impaired System

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ABSTRACT
Blindness or say eye disability is the most worrying problem among the people. Visually disabled people find difficulties to travel or say navigate. The Visually Impaired System (VIS) supports this process by providing key facilities a short-range system for detecting obstacles, a short-range system for identifying obstacles, a signboard recognition system, and a shortest path guidance system for source to destination. Obstacle Detection, Distress Calling, Global Location Tracking, Voice Command Functionality & Shortest Route Guidance are all real-time features of this system. The aim is to build a program that will direct visually impaired people to reach the desired destination and help them understand the natural world around them. The blind or visually impaired mainly rely on their other senses such as sound, touch and smell to understand their environment. They find it pretty hard to go out alone, not to mention toilets, subway stations, restaurants etc. The visually impaired program aims at giving blind people great exposure to their environment.

Keywords:-*Visually impaired system, blindness, obstacle detection, obstacle recognition, global location tracking.*

INTRODUCTION

The visual disability is characterized as restricting the visual system's behaviour and functions. visual impairment can come in various categories such as a person has reduced his/her ability to see. This means a visually impaired person is not able to see clearly. Blindness word is used for people who have lost complete vision to see. Visually impaired people generally use glasses for seeing correctly, So some times the visual problem increases. Visual Disability or blindness makes the regular life of people difficult.

A System is a collection of objects that function together as parts of a process or a network of interconnections; a complex whole. Interconnection between the nodes or say system entity can be said as a network. Usually, the network is a cluster of interconnected devices. System or say any device which is connected to the network is surrounded and affected by its surrounded environment which is scripted by its architecture and its working. .The device is which processes correct input and generates suitable output.

When a System is created for the use of visually impaired people we can say it as a Visually Impaired System.

WHY VIS?

According to official World Health Organization (WHO) figures, there are around 940 million visually disabled people in the world up to 2015: around 39 million are fully blind and 246 million have limited sight .This number will rise slowly as the generation of baby boomers ages. Many individuals with visual impairments, particularly those new to them, have considerable difficulty in

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perceiving and communicating with the world. The VIS is about helping people with visually disabled disabilities. This project will help them with their day-to-day tasks and will make them almost feel like a regular person. Developing a program for people with visual impairments is not an issue that has arisen recently. But a still-creating field is creating a computer-aided program. Both of these programs aim to help the user navigate without a second person's help.

LITERATURE SURVEY

Existing Systems

In a fast-flouring world, countless attempts have been made for the welfare of our society's especially disabled people.

One such effort is the "Prakash Initiative," an empathetic effort to help the blind children acquire knowledge of a series of challenges around them through the use of their brains. By using a smart white cane where ultrasonic sensors are used, many have focused on how blind people can sense some sort of pits, potholes and other ups and downs. This software cannot use a multilingual audio feedback device, because it can only record for 680 seconds. There is an ultrasonic sensor, a water sensor and a pit sensor to the concept that can be used in. It also consists of a GPS but the user needs to send the present position here as the input itself. No mention of the method of doing so was made here. It can be observed that it consists of a video camera on the frame itself as well as a computer processing unit that is sensitive enough to fit into the pocket and software that provides images of objects similar to transparent displays on the eyepieces. The main drawback of this system is that it is absolutely inappropriate for the blind. Those with poor vision or night-blindness are not recommended.

H.A.L.O, or Hectic Assisted Obstacle Position, is a recent effort to assist the blind. It consists of rangefinders from output to mounted pulse vibration motors which would take input from ultrasonic sensors and feedback on the blind man's head. The force and frequency of the vibration increases as the individual approaches the target. A key drawback is the use of a vibration motor. The vibrations as output input are extremely annoying for any blind person. There have been many attempts done to implement Visual Impaired System.

There are mainly 3 ways we can create a system for visually impaired people as follows:

1. Web-based system
2. Mobile Application based system
3. Embedded System

We will see each of them in detail as follows:

Web-based System:-The content on web pages cannot be accessed by all web users. Users with sight disabilities navigate the web using voice reading software. Several programs have evolved such as using voice reading software to make the internet more available to visually impaired people. Speech reading software collects data from a given website and then the program informs the user voice data. On web pages not all web users are able to access the content. Users with blindness, use voice read tools to understand disabilities on the internet. Visual deficiency not only affects blind users, but even users with colour blindness, elderly users with impaired eyesight, users with chronic mouse pain problems or even users with ADHD or short-term memory loss. Some of those programs have been developed to support visually disabled people. So, e.g. Natural Reader is Software enabling voice interpretation.

Mobile Application Based System:-Smart phones have made life easier for many blind or visually disabled people. A

job that would have forced a non-sighted person to seek another's aid was being able to interpret items that are only in the visual text. Yet devices combined with technology's ever-growing growth give people new ways to read stuff and do whatever. We learn to read with our ears and to communicate using our voices. Voice-over apps on smart phones are a game changer. They give the same exposure to the digital world to the unseen users as any other. In effect, more people seem to know that blind people also care. Microsoft pushed for more open versions of Windows. Netflix has adopted the audio processing platform for its services. And everywhere we look, we redefine the concept of "look" People are people regardless of how they "speak," and apps help people to level their field of play and become more autonomous. We'll be concentrating on 5 blind mobile applications that have made a difference. So, e.g. such mobile device frameworks for the visually impaired are Money Identification Mobile App, Reader App, Navigation App, Identify Object Apps etc.

Embedded System:-An embedded system is a small machine with a particular purpose within a larger mechanical or electrical structure – a combination of a small processor, computer memory, and peripheral devices for input/output. Embedded system is a system like a computer itself but it is having its own limitations. The embedded system consists of different parts that make the system for a specific use. e.g. for the embedded system are as a microwave oven, washing machine, etc. They have built for specific intent. The Embedded system also consists of a processor or say computer which handles the process or operation of embedded things. These systems have their own limitations usage. Hundreds of devices commonly used today are powered by embedded systems. On embedded systems ninety-eight percent of all mounted microprocessors are used. Because the embedded system is dedicated to specific tasks, design engineers may design it to reduce device size and cost, and increase reliability and performance. The majority of embedded devices are mass-produced, taking advantage of economies of scale. Embedded solutions range from compact, visually impaired devices such as Smart goggles, Smart Press, etc.

MOTIVATION

Individuals with visual disability can face several difficulties and one of the main difficulties is when they engage in self-navigation in an area that is unfamiliar to them. To them, physical activity is one of the greatest obstacles. Besides that, when they are driving or walking in a crowded hallway, it can cause considerable difficulty and they often cannot identify objects around them. One of the current challenges for visually impaired people in moving in a corridor is that they cannot feel they need to turn left or turn right when they approach the end of the corridor using just the walking stick. As we know they will locate the sidewalk boundary in the street for people with visual impairment to walk in the street and then use their walking stick to identify their current position. The reason visually disabled people do so is that they can't foresee the obstacle that's far away from them and they can only use the walking stick to feel the world around. It discusses the reason why the software should work for the visually impaired.

SYSTEM OVERVIEW

The visually impaired program is going to support those with visually disabled disabilities. This program will assist them in their day-to-day tasks and will make them almost feel like a regular person. The system helps to warn about the objects that cross the user's path and also identify the specific object by using certain sensors

and camera respectively, it will contain the computer that has to be switched on to navigate via GPS and will provide feedback as an acoustic / audio response. It also has built-in modules, detecting public signs like Zebra Crossing, Toilet Signboard etc.
This system is integrated with five modules as described below,

- Ultrasonic Module
- Object Detection Module
- Navigation Module (GPS)
- Audio and Alert Module
- Sign Recognition Module

If sensor finds object in this protocol but distance is greater than 3 meters then it does not feel if distance is less than 300 cm then it detects and produces sound. Ultrasonic obstacle tracking used as a visual aid for the blind. By sensing obstacles and generating subsequent warning signals based on the distance from the obstacle, the blind people had a way to walk safely.

Object Detection requires processes such as image, video or webcam feed recognition of objects. Object recognition refers to a set of similar activities for automated photographic identification of objects.

No internet connection is mandatory to use GPS services. Global Positioning System (GPS) is available anywhere on Earth at no cost. That's why our system's GPS will function even if there is no internet connectivity to get current longitude and latitude position, but we need the internet for navigation. Guiding people with visual disability is referred to as Visually Impaired Navigation Assistance (NAVI) by using some sound technology that helps them find their way with the aid of some mobile devices People with vision loss typically use dogs or walking sticks to help them spot obstacles. The proposed device would consist of a Bluetooth-connected headset. When the receiver receives the data in the headset, they must use a speech recognizer to translate it into text. It is communicated to them via the Navigator voice recognition system. The navigator also recommends mode of transportation and tests the distance and time needed to reach its destination. People with visual impairments need to choose their mode of transportation based on those criteria.

The devices, being the input signals, are also combined with the messages of vibration, sound and voice to warn the obstacles to blinds before them. The object recognition and navigation system output / feedback is translated into voice and supplied to the headset. Using this knowledge the person will recognize the objects that traverse his/her path and reach his/her destination without any difficulty.

In the aspect of sign identification and recognition we note that usually the public signs are built with unnatural colour and form, making them visible and well defined. Colour and shape methods are the original and simplest methods for detecting sign heart, but these methods tend to be sensitive to the environment. As regards the identification and recognition of signs, we note that usually public signs are constructed with artificial colour and shape, making them visible and well defined. Colour-, shape- approaches are the initial and simplest approaches for identifying the source of signals, but they are usually environmentally sensitive. So, we're using a recognition algorithm based on abstraction and function description. Public sign recognition involves three main steps: the first is the identification of points of interest, the second is the extraction of the point value vector characteristic and the third function is the matching vector between the two images.

CHARACTERISTICS OF VISUALLY IMPAIRED SYSTEM

In this section, we are going to see the characteristics of Visually Impaired System as Follows:

1. Detects Obstacle and tell to the user about it via earphones/headphones.
2. Recognizes the object and tells the user about it via earphones/headphones.
3. GPS module helps define the user's current position and lets the user navigate via the Google Map API to their destination. The user's destination feedback is taken through microphones.
4. This system also recognizes the signboards and tells the user what signboard is indicating via earphones/headphones.

TECHNOLOGY USED FOR VIS

The technology used to develop the Visual impaired system by implementing hardware and software technologies as follows:

Hardware Technology

1. Raspberry Pi 3 Model B: The Raspberry Pi 3 Model B is a small unit, sized by credit cards. Only add a keyboard, mouse, monitor, power supply, Linux Distribution mounted micro SD card and you'll have a full-computer that can run applications from word processors to all kinds of applications.
2. Raspberry Pi Camera Module: You can use the camera module to take high-video and still photographs. We can see for specifications in the following https section:/www.raspberrypi.org/ documentation / hardware / camera/.
3. Ultrasonic Sensor: This is where the SONAR system used the idea of obstacle detection. As soon as the sensor senses the barrier, its distance is forwarded to the Raspberry pi.
4. Headphones with microphone: For getting voice messages & alerts and to give user input.
5. Jumper Wire: A jump wire (also known as a jumper wire or jumper) is an electrical wire, or group of it into a cable, with a connector or pin at each end (or sometimes without it-simply "tinned"), usually used for connecting breadboard or other prototype or test circuit parts, internally or with other equipment or parts, without soldering.

Software Technology

1. Google stuff for Android: Android Stuff is Google's embedded Android operating system interface, revealed at Google I / O 2015. It is intended to be used with low- and memory- Internet of Things (IoT) devices, typically designed from various MCU platforms. It is designed as an IoT OS to function as low as 32–64 MB of RAM. It supports Low Energy Bluetooth and Wi-Fi.
2. Raspbian OS: Raspbian is a computer operating system based on Debian based Raspberry Pi. There are other versions of Raspbian available including Raspbian Buster and Raspbian Extend. Since 2015, this is officially supported by the Raspberry Pi Foundation as the primary operating system for single-board computer family Raspberry Pi.
3. Tensor Flow: It is an open-source artificial intelligence library that builds models using data flow graphs. It is helping developers construct massive, multi-layered neural networks. Classification, perception, understanding, exploration, prediction, and development are the key uses of tensor flow.
4. Google maps or the Here API: This software can be used to use GPS. This offers satellite images, aerial photography, street maps, 360° Street View panoramic views, real-time

traffic conditions, and route planning for foot, car, bicycle and air (beta) or public transportation travel.

FUNCTIONS OF VSI

Function 1

Obstacle Detection

As shown in Figure 1, Ultrasonic sensors can be used for this purpose. This system lets blind people quickly feel the challenges they face, and can save them from accidents. Here the concept of the identification of obstacles by ultrasonic sensors was used. If the barrier is sensed by the sensor it transmits the distance to the Arduino. We convert the distance to centimetres from milliseconds and test if the distance to the obstacle is less than 3 m, if yes, then we send the output through a headphone. Ultrasonic sensors work by emitting sound waves at frequencies that are too loud for humans to detect. They then wait until the sound reflects, measuring the distance depending on the correct time.

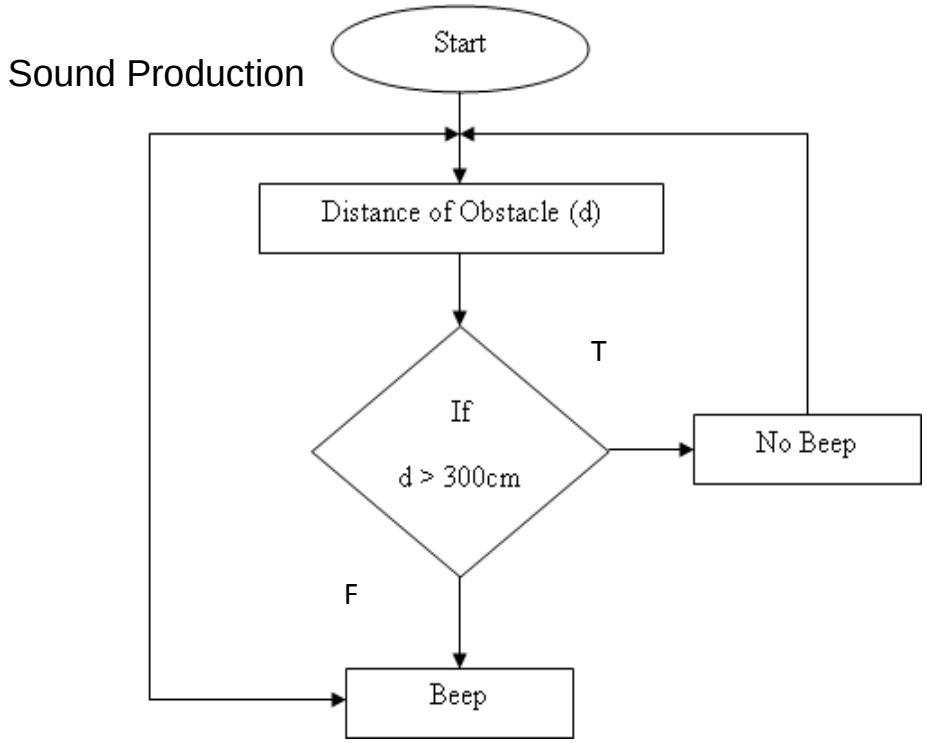

Fig.1:-*Object Detection Module Flowchart*

Function 2

Object and Face recognition through the Camera

As shown in Figure 2, an object recognization module tends to recognize the object or say surrounding environment entity and things. The camera captures the surrounding environment in the form of a video that is continuously capturing images. Artificial Intelligence is a technology that can be used to identify or recognize objects uniquely. The matching takes place between the captured image and images present in the database, by analyzing patterns of objects we can identify objects. This tensor flow technology is used here to help the blind recognise real-world human faces or object/face recognition device objects. The product of the identification is conveyed over headphones to the blind person via an audio voice. The camera is installed and attached to a multiprocessor, and is attached along with the headset to the computer (wired or wireless).

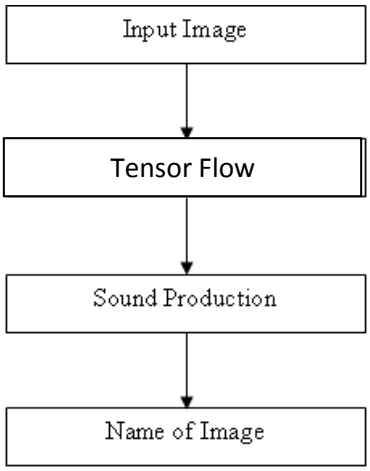

Fig.2:-*Object Recognition Module flowchart*

Function 3

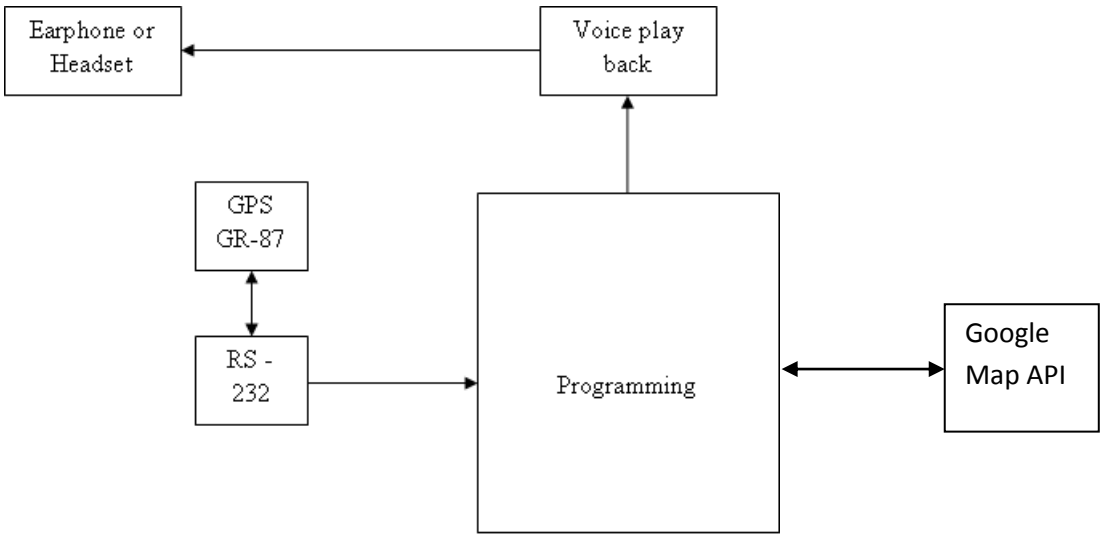

Fig.3:-*Navigation Module*

GPS Navigation

Their autonomous outdoor pedestrian mobility is among the most pressing obstacles that blind people face throughout their lives. As shown in Figure 3, the visually impaired people used the Global Navigation Positioning System (GPS); because their mobility and mobility depend entirely on information and local knowledge, the GPS-based systems help them locate the destination and gain precise information about a specific destination. For visually impaired people, a GPS- person guidance system needs to include simple textual instructions, such as "go simple three parts, turn left and proceed two blocks".

Function 4

Audio Voice Alert

As shown in Figure 4, our approach is inspired by audible replacement tools that encode a video camera's visual scenes and produce sounds as an auditory representation called a soundscape. Scanning the visual scene from left to right transforms the images into sound. Doing this kind of image-to-sound conversion makes it possible to find and recognise everyday artefacts, as well as the identification of signboards.

The module for the identification of

obstacles is an ultrasonic sensor, the processing unit is a control module and the output system is a microphone. The control unit controls the ultrasonic sensors and gets before the man the specifics of the obstacle and analyses the information and then sends the data through the buzzer. When we reach the target we will hear a voice saying an individual is before you. We get the sound out of the headphones.

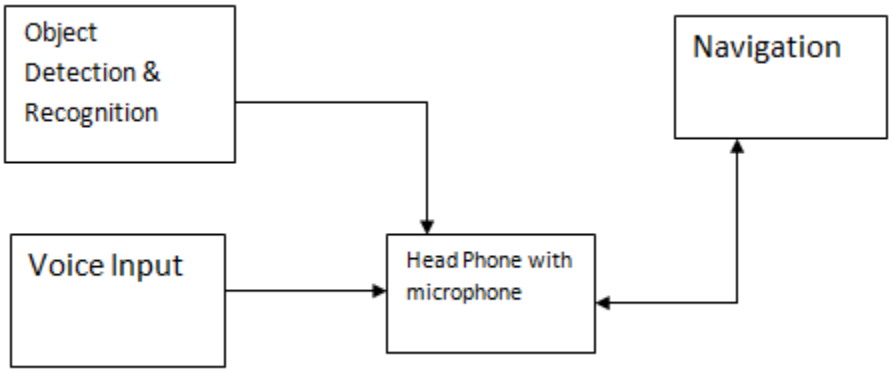

Fig.4:-*Audio Module*

Function 5

Sign Board Recognition

As shown in Figure 5, this program will identify and understand public signs in towns, and provide the blind person with corresponding voice hints. Via the headphones it gives speech indices. These voice hints are created using functionality (refer to Functions of VSI, Function 2).

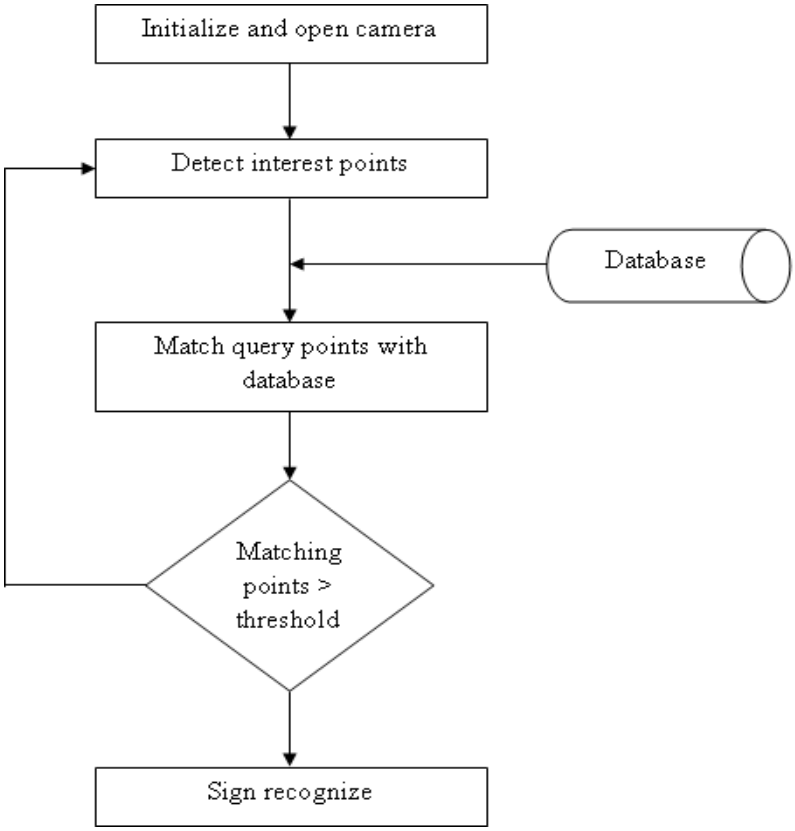

Fig.5:-*Sign Recognition Module using Tensor Flow Technology flowchart*

Architecture of VIS

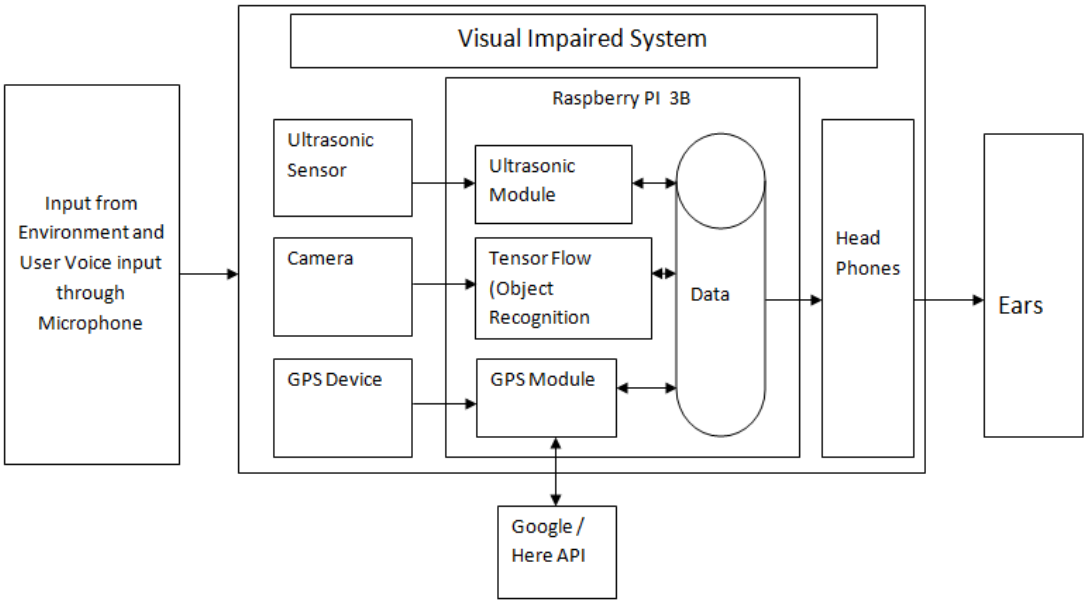

Fig.6:-*System Architecture*

Implementation of visually impaired program contains two components: hardware implementation and software design. And the unit block diagram is mentioned on Figure 6.The camera within the board records the video stream through the blind in the 'unit block diagram' and then transfers it to the Raspberry Pi. When the device matches the public signs, according to the respective signs the kernel will send the proper instructions. And the system can call both the Bluez module (if not wired) and the Audio module to forward voice instructions through headphones. Ultrasonic sensors will be the strongest instruments that can be used to detect objects because ultrasound is a strong point, with the absorption of slow wave energy propagating over a fairly distant medium distance. Therefore, it is also used to measure long distances. At around the same time, ultrasound has a certain adaptability in the dark, dust, smoke, electromagnetic interference, dangerous and other harsh environments for the system, with a wide range of applications.

ROLES OF MACHINE LEARNING AND IOT IN VIS

With the emergence of the Internet of Things (IoT), apps have become more intelligent and linked devices that have given rise to their use in all facets of modernity. As the amount of data collected increases, Machine Learning (ML) techniques are employed to further develop an application's awareness and capabilities. Machine learning (ML) is the computational study of algorithms and mathematical models employed by computer systems to perform a particular task without using explicit instructions, relying instead on patterns and inferences. It is a form of man-made intelligence. Machine learning algorithms create a mathematical model to make sample data-based predictions or decisions, known as "training data," without specific programming to perform the task. A number of researchers targeted the smart transport sector and were approached using both ML and IoT techniques. In terms of IoT-linked device is considered to be one thing. Items usually consist of

physical sensors, actuators, and a built-in microprocessor. Stuff needs to communicate with each other, creating the need for relations between machine and machine (M2 M). Wireless systems such as Fi, Bluetooth, ZigBee or WiMAX, LoRa, Sigfox, CAT M1, NB-IoT, GSM , GPRS, 3 G , 4 G, LTE, 5 G, etc. It is necessary to keep the cost of IoT devices low because of the wide usage of IoT devices in all types of daily-life applications. Also, IoT Applications are always able to handle the process as data collection, communication, and some application we can find the data processing.

Based on the software, IoT systems will also be able to perform basic tasks like data collection, M2 M communication and even some pre-processing of data. Therefore it is necessary to find a balance between costs, processing power and energy consumption when designing or selecting an IoT system. Machine learning is closely linked to computational statistics which focus on predictions based on computers. Study of mathematical optimisation includes methods, theory, and implementation domains for the field of machine learning.

ISSUES AND CHALLENGES IN VIS

Risks will always be present in every project because of the issues and difficulties that occur in the project process. This project often arises, without exception, some problems and challenges such as:

Code and Software Complexity

Complexity of programming is another big problem because of our limited knowledge of the Python language. Software that used to apply in this program is also a problem for us, because we have no knowledge of this area. In order to deal with this issue, we need to conduct research and study to increase my awareness in this programme. The problem we have faced is that we cannot let the laptop know which is the target, which the wall is, and which pixel we want to get to calculate the distance.

Some Issues and Challenges Faced in other existing Visually Impaired Devices:

1. The ultrasonic sensors are highly sensitive to temperature variations [1].
2. The ultrasonic sensors have more trouble reading smooth, bent, thin and small object reflections[1].
3. Only objects present at straight to the sensors will be identified [1].
4. Radiation can affect the brain (with respect to Sensor Position) [1] as this device has implemented as goggles.
5. 2 D navigation operation is more comprehensive than 3 D. Since 2 D Service Satellites are more than 3 D Satellites available [2].
6. Accuracy is facing a challenge again in rural areas [2].
7. Improving user trust in the GPS-based application has not been studied with regard to accuracy and perceiving environmental data [3].
8. The transparent object is not detectable by the use of depth sensors [4].
9. No object detection is executed here [5].
10. Not efficient Image Processing Algorithm used for Recognition object [5].
11. Less space for continuous power supply [6].
12. Hard to handle [6].
13. Quality Diminishes with Images complexity [7].
14. Edge Detection Technology Consumes more resources for processing [7].
15. A problem with that distance trust of labelling object is getting lower has been identified, so it is an area of development to solve on programming and hardware levels [11].
16. Only objects present at straight to the sensors will be identified [12].

CONCLUSION

Until the visually disabled people often did not believe in the technological aids that were on the market. We preferred the mobile aids to dogs and white canes. This is a smart guidance device for visually impaired users which can help them travel in a complicated indoor environment safely and efficiently. The computation is fast enough for obstacle detection and show. The sensors used in this system are simple and low-cost, allowing for widespread use on the consumer market. Many excellent image processing, object recognition algorithms, have been introduced on the new lightweight jacket framework. This machine can detect and recognize the target in real time. An individual who has a visual disability should not guess people. He may recognise these because their faces are captured by the camera. We will make the life of visually disabled people simple with these Visually Disabled System.

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