RASPBERRY PI BASED ACCESSORY FOR BLIND PEOPLE

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ABSTRACT

Self-determination is the building methodology in achieving thoughts, intentions in life. Unsighted persons find themselves vindicate to go out individually. There are millions of blind people in this world who are always in need of helping hands. But coming to the point of Blind people, no matter what advanced technology you give them, they may not operate because they don't have the ability to see and use the devices. Not only devices, they need to depend on others completely for every small task. In order to fulfill the above missing parts of the blind people, we proposed a device embedded with advanced technology which will make the person to do their own work rather than being dependent on others. In this project we will be using Raspberry pi to which will make smart stick for blind people, which is embedded with pi camera module, ultrasonic sensor, moisture sensor. Pi Camera detects and find the type of object with the help of deep learning and it's representative tools, Ultrasonic sensor and moisture sensor to detect the real time hurdles while walking on the roads. The proposed system can provide more abundant surrounding information with the help of this stick.

Index terms - Raspberry Pi, Pi camera module, Deep Learning, Ultrasonic sensor, Moisture sensor.

I.INDRODUCTION

Blindness or visual impairment is a condition that affects many people around the world. This case leads to the loss of the valuable sensitivity of perception. Visually impaired people suffer inconveniences in their daily and social life. Eyesight plays a major role in collecting most of the information from the real world and that information will be processed by the brain. Across the world, there are millions of people who are visually impaired, out of which many are blind. The compulsion for beneficial devices was and will be interminable. There is a immense range of navigation systems and device existing for visually impaired individuals. India's population is currently at a whopping 133 crores, out of which, about 1.5 crore people are visually impaired, and 2.7 crore people are physically disabled.

The ingenious device for blinds is an contraption which helps the blinds people to navigate with speed and confidence by detecting the nearby objects and obstacles using the help of pi camera, ultrasonic waves and notify them with buzzer sound along with voice alert. The current technical knowledge is improving daily in different aspects in order to provide flexible and safe movement for the people. Currently the most widespread and used mean by the visually impaired people are the white stick, however it has limitations. With the latest technology, it is possible to extend the support give to people with visual impairment during their mobility, this project proposes an economical object detection based third eye for visually challenged people, so as to gain a personal independence and free from the external help. A portative user friendly device is flourished that can identify the obstacles in the path using ultrasonic sensors. If the obstacle is close then raspberry pi sends a signal to sound a buzzer and also sends the voice command through the earphones.

II.OBJECTIVE

The main objective is that, our proposed device with advanced embedded technology which will give the blind person an imaginary vision rather than being dependent on others. This project is designed keeping the view of visually impaired people, with this tool they can travel to their destination without the need of others.

Now days, there are several people in the world who are deprived of vision. There are a number of severe disabilities, of which blindness is one of them, in which a person needs to face many problems despite a number technological advancement. Astigmatism is a state of condition where the individual is unable to see and has no light perception. The astigmatism also refers to those who have so little vision that they use other senses as vision substitution skills. Thus, the astigmatism considers the person who has total vision loss or partial vision loss. The device will help them to go out independently.

III.LITERATURE SURVEY

Ayat A. Nada [1], was proposed, Stick solution use different technologies like infrared, ultrasonic sensor and laser but they still have drawbacks. In the present study we introduce, light pressure, low-cost, adaptable, fast response and low power utilization. Smart stick based infrared technology. A combination of infrared sensors can reveal stair-cases and other obstacle presence in the user path, within a range of two meters. The tentative results carry out good accuracy and the stick is able to identify all of disincentives.

S. Innet, N.Ritnoom [2] was proposed that blind people use a white stick as a tool for directing them when they move or walk. In spite of, the white stick is helpful, it cannot give a high assurance that it can assure blind people away from all level of hurdles. Several researchers have been obessed in establishing electronic devices to protect blind people away from obstacles with a higher guarantee. This study introduces an hurdles restraint alternative by using an electronic stick that serves as a tool for blind people in walking. It exploits an infrared sensor for detecting hurdles along the roadway. With all level of hurdles, the infrared stick facilitates to identify all type of earthly available in the course such as concrete, wood, metal, glass, and human being. The outcome also shows that the stick detects obstacles in range of 80 cm which is the same as the length of white stick. The twig is designed to be small and light, so that blind people can carry it comfortably.

Ross Girshick [3], we propose a Fast Region-based Convolutional Network method (Fast R-CNN) for object detection. Fast R-CNN frames on previous work to accurately distribute object proposals using deep convolutional networks. Correlated to previous work, Fast R-CNN uses several innovations to improve training and testing speed while also increasing detection accuracy. Fast R-CNN tracks the very deep VGG16 network 9x faster than R-CNN, is 213x faster at test-time, and achieves a higher mAP on PASCAL VOC 2012. Compared to SPP net, Fast R-CNN trains VGG16 3x faster, tests 10x faster, and is more accurate. Fast R-CNN is implemented in Python and C++.

IV.PROPOSED METHOD

The proposing system uses Raspberry pi, it is a small processing device which works as computer at relatively low cost. Blind and visually impaired people find difficulties in detecting obstacles during walking in the street. The system is intended to provide artificial vision and object detection, real time assistance via making use of Raspberry Pi. The system consists of pi camera module, ultrasonic sensors, moisture sensor, and headsets to receive the instruction through audio, Voice output works through TTS (text to speech).

The proposed system is equipped with pi camera module, two ultrasonic sensors and moisture sensor. This system detects an object around them and finds the type of the object sends feedback in the form of speech that is warning messages via earphone. The aim of the overall system is to provide a low cost, efficient navigation and obstacle detection aid for blind which gives a sense of artificial vision by providing information about the natural scenario of static and dynamic object around them, so that they can walk independently.

The functionalities of stick for blind people increases as compared to existing system as it has added opportunities that will help blind for free. Our added proposal system will help blind people in various domains and it becomes a multi-dimensional device which will yield better factor and increases the performance of the stick for the blind people.

V.BLOCK DIAGRAM

The block diagram of the Accessory tool for blind people represents the components that are used and the connections which are made accordingly. The block diagram is depicted in the figure below. The below block diagram consists of the components like Pi Camera module, ultrasonic sensor, moisture sensor, buzzer. The power supply is used to supply the necessary power to make the board function.
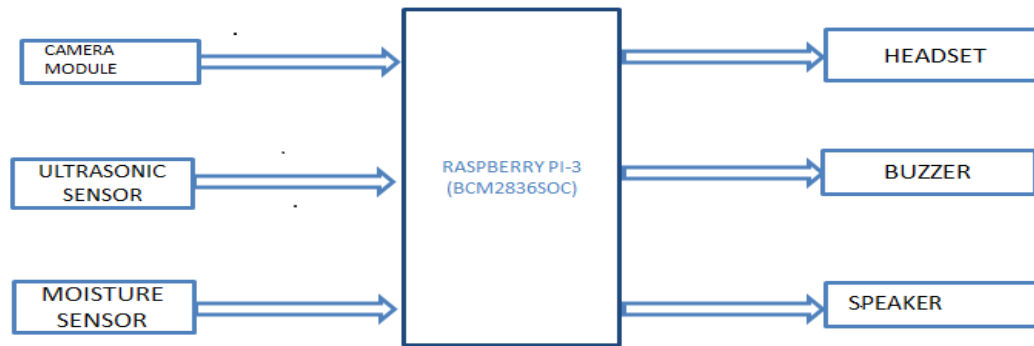
Fig. 1. Block diagram

5.1 Pi Camera Module

   Pi Camera component is a camera which could be used to take pictures and high definition video. Raspberry Pi Board has CSI (Camera Serial Interface) interface to which we can attach Pi Camera module directly. This Pi Camera component can unite to the Raspberry Pi's CSI port using 15-pin ribbon cable. The Raspberry Pi camera component could be used to take high-definition video, as well as stills photographs. The module has a five Mega pixel fixed-focus camera that supports 1080p30, 720p60 and VGA90 video modes, along with stills capture. The Pi Camera Module Interface with Raspberry Pi using Python. It captures the real time images through a tiny grid of light-detectors, known as charge-coupled device (CCD) from the location where it is place. The CCD novices the image into digital format so that computer can path this data. Pi cams do not have the internal memory to store the images so it transmits the data immediately to the host device through the USB or other analog cable.

5.2 Ultrasonic Sensor

Ultrasonic sensors expend short, high-frequency sound pulses at proper intervals. These propagate in the air at the velocity of sound. If they force an object, then they are catched back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo. Just as the distance to an object is obstinate by measuring the time of flight and not by the intensity of the sound, ultrasonic sensors are excellent at suppressing background interference. Essentially all materials which emulate sound can be noticed, regardless of their colour. Plane translucent components or thin foils represent no problem for an ultrasonic sensor.

5.3 Moisture Sensor

 The Moisture sensor is known to measure the water content (moisture) of soil. Although the soil is having water shortage, the module output is at high level, else the output is at low level. The present sensor reminds the user to water their plants and also monitors the moisture content of soil. The Moisture Sensor needs capacitance to measure dielectric permittivity of the enclosing medium. The sensor generates a voltage proportional to the dielectric permittivity, and therefore the water content of the soil. The sensor tolerable the water content over the entire length of the sensor.

5.4 Buzzer

 A buzzer or beeper is audio signal device, which may be mechanical, electromechanical or piezoelectric (piezo for short). Natural uses of buzzers and beepers comprise alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

5.5 Raspberry Pi

The Raspberry pi is a low priced credit –card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a skillful little device that facilitates people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It is adapted of doing everything you had expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spread-sheets, word-processing and playing games.

The Raspberry Pi obtain a Broadcom BCM2836 system on a chip (SOC), which encompasses an ARM1176JZF-S 700 MHz processor (The firmware includes a number of "Turbo" modes so that the user can attempt overclocking, up to 1 GHz, without affecting the warranty), Video Core IV GPU and it originally shipped with 256 megabytes of RAM, later upgraded to 512 MB. It accomplish not append a built-in hard disk or solid-state drive, but uses an SD card for booting and long-term storage. The Raspberry Pi Foundation prepares Debian and Arch Linux ARM distributions for download. Python as the essential programming language with support for C and Perl. In view of this project Raspberry Pi Model B is used and all codes will be written in C/Python. There are currently four Raspberry pi models. They are the Model A, the Model B, the Compute module. All models use the same CPU, the BCM2836, but other hardware features differ. The Model B+ released in 2014, the Model B+ is a revision of the Model B. It increases the number of USB ports to 4 and number of pins on the GPIO header to 40. In addition, it has improved power circuit, which allows high power USB devices to be attached and now hot plugged. The full sized composite video connector has been removed and the functionality moved to the 3.5mm audio/video jack. The full size SD card slot has also been replaced with a much more robust micro SD slot.

General-purpose input/output (GPIO) is a universal pin on an integrated circuit or computer board whose role- along with, even if it is an input or output pin-is tractable by the user at run time. A authoritative feature of the Raspberry Pi is the row of GPIO (general-purpose input/output) pins along the top side of the board. A 40-pin GPIO header is finding on all current Raspberry Pi boards (unpopulated on Pi Zero and Pi Zero W). Above mentioned to the Pi 1 Model B+ (2014), boards comprised a shorter 26-pin header.
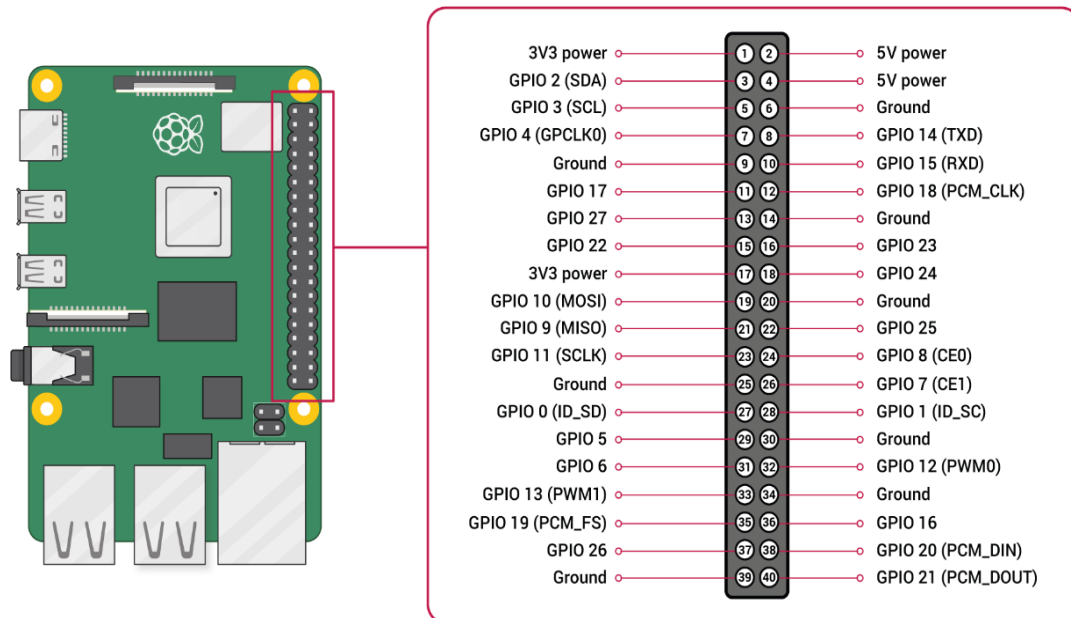

Fig. 2. Raspberry Pi GPIO pins

SPECIFICATIONS

- Chip Broadcom   : BCM2836 SOC
- Core architecture   : ARM11
- CPU   : 700 MHz Low Power ARM1176JZFS Applications Processor
- GPU   : Dual Core Video Core IV Multimedia Co-Processor provides
  Open GL ES 2.0, hardware-accelerated Open VG, and 1080p30
  H.264 high-profile decode Capable of 1Gpixel/s, 1.5Gtexel/s or
  24GFLOPs with texture   filtering and DMA infrastructure
- Memory   : 512MB SDRA
- Operating System   : Boots from Micro SD card, running a version of the Linux Operating system
- Dimensions   : 85 x 56 x 17mm
- Power   : Micro USB socket 5V, 2A

VI. DEEP LEARNING

Object detection is a computer-aided learning correlated to computer vision and image processing that grapple with espying instances of semantic objects of a certain class (such as humans, buildings, or cars) in digital images and videos. The method used for object detection is deep learning.

The word "deep" in "deep learning" indicates to the number of layers concluded which the data is transfigured. More literally, deep learning entity have a considerable credit assignment path (CAP) depth. The CAP is the group of conversions from input to output. CAPs depict probably causal connections among input and output. Deep learning methods can be applied to unsupervised learning tasks. This is an important benefit because unlabelled data are more abundant than the labelled data. Exemplifications of deep structures that can be trained in an unaided manner are neural history compressors and deep belief networks.

There are different approaches in deep learning, in which we used CNN algorithm in the project. A convolutional neural network consists of several different layers such as the **i**npu**t** layer, at least one hidden layer, and an output layer. They are best used in object detection for recognizing patterns such as edges (vertical/horizontal), shapes, colours, and textures. The hidden layers are convolutional layers in this type of neural network which acts like a filter that first receives **i**nput, transforms it using a specific pattern/feature, and sends it to the next layer. With more convolutional layers, each time a new input is sent to the next convolutional layer, they are

changed in different ways. For example, in the first convolutional layer, the filter may identify shape/colour in a region (i.e. brown), and the next one may be able to conclude the object it really is (i.e. an ear or paw), and the last convolutional layer may classify the object as a dog. Basically, as more and more layers the input goes through, the more sophisticated patterns the future ones can detect.
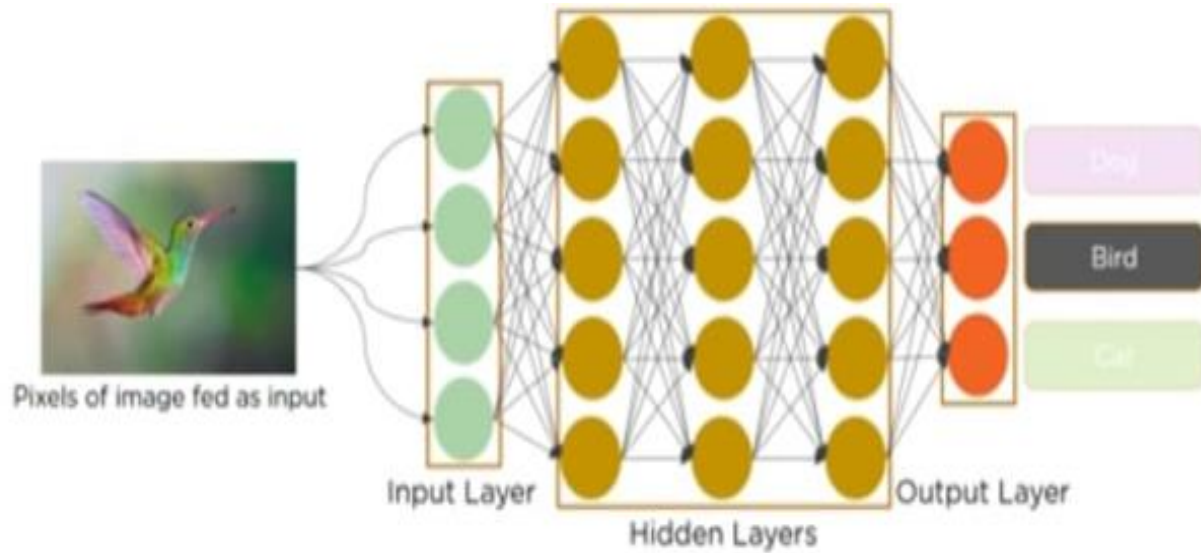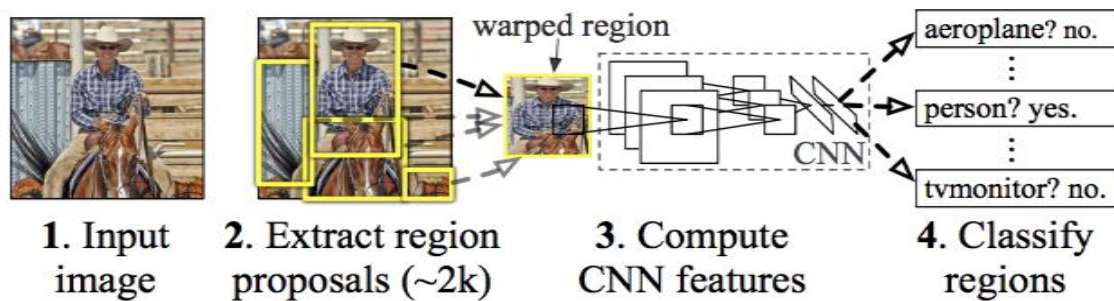

Fig. 3. Image Recognition

Fig. 4. CNN Algorithm

VII. METHODOLOGY

The methodology which we have used in our project is deep learning algorithm which is considered as the best one in order to predict the outcome of object detection.
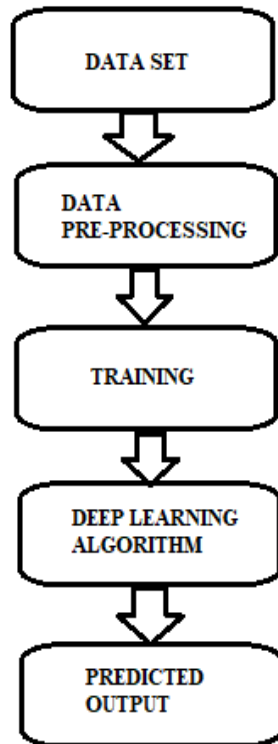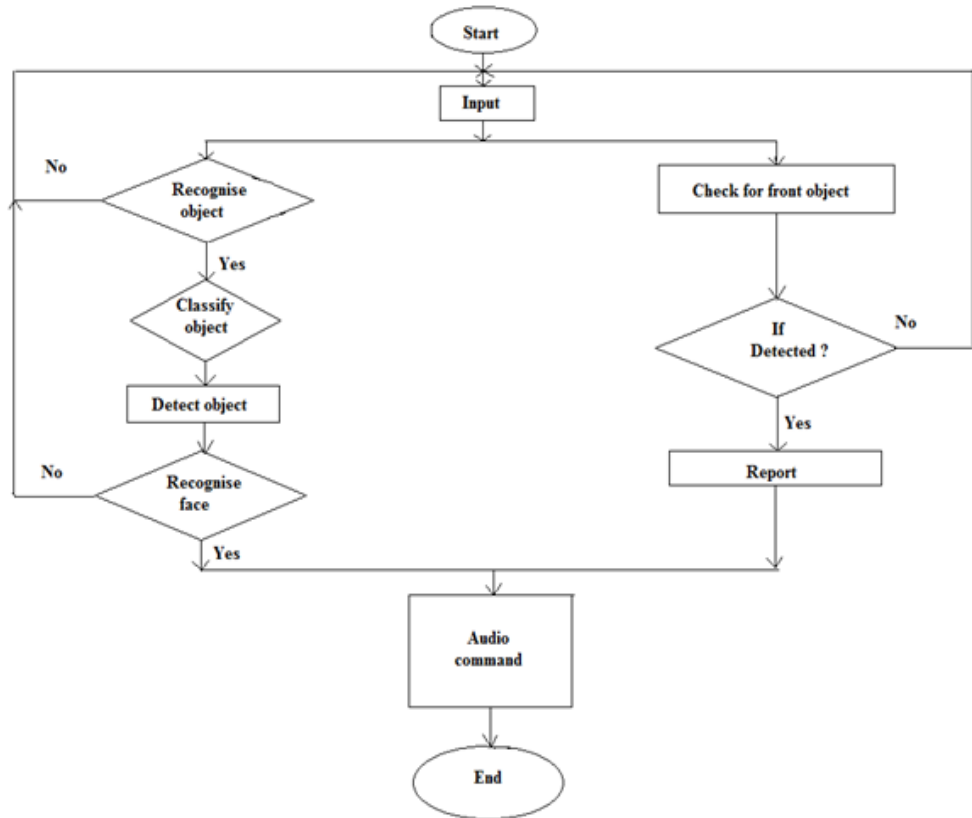
Fig. 5. Object Detection
      Process

Fig. 6. Flow chart

In Object detection process, we follow the tensor flow architecture, first pre-processing the data, building the model, train and estimate the model. It is termed tensor flow by reason of it will take input as multi-dimensional array, also called as tensors. You can fabricate a sort of flowchart of operations (called a Graph) that you want to enforce on that input. The input starch in at one extent, and then it dribbles through this system of multiple operations and comes out the other end as output.

After the training process, whenever the object comes near to the camera it captures the image and then verifies the image in the data set, then it alerts the user about the obstacle. It is a user friendly device which helps the user in all aspects.

Coming to the sensors, we used two ultrasonic sensors. One for far obstacle identification and the other for near obstacle identification. The accessory device can be used in two modes, 1st mode for object detection and 2nd mode for object distance measurement. Moisture sensor is used to identify any water content material is in front of him and warns him with a voice message.

VIII.SOFTWARE

 Python is a high-level, interpreted, collective and object-oriented scripting language. Python is accomplished to be highly decipherable. It uses English keywords intermittently where as other languages use punctuation, and it has trifling syntactical constructions than other languages.

- **Python is Interpreted** − Python is refined at runtime by the interpreter. You do not essential to compile your program before executing it. This is similar to PERL and PHP.

- **Python is Interactive** − you can literally sit at a Python prompt and collaborate with the interpreter directly to write your programs.

- **Python is Object-Oriented** − Python staves Object-Oriented style or technique of programming that encapsulates code within objects.

- **Python is a Beginner's Language** − Python is a tremendous language for the apprentice-level programmers and staves the enlargement of a wide range of relevance from simple text processing to WWW browsers to games.

IX.RESULT

The device works efficiently and fulfils the objective of helping blind people to go out independently. The prototype of our project is shown below.

Fig. 7. Prototype

In prototype, all the above mentioned components are embedded together as shown in the above figure. Our added proposal system will help blind people in various domains and it becomes a multi-dimensional device which will yield better factors and increases the performance of the stick for the blind people.
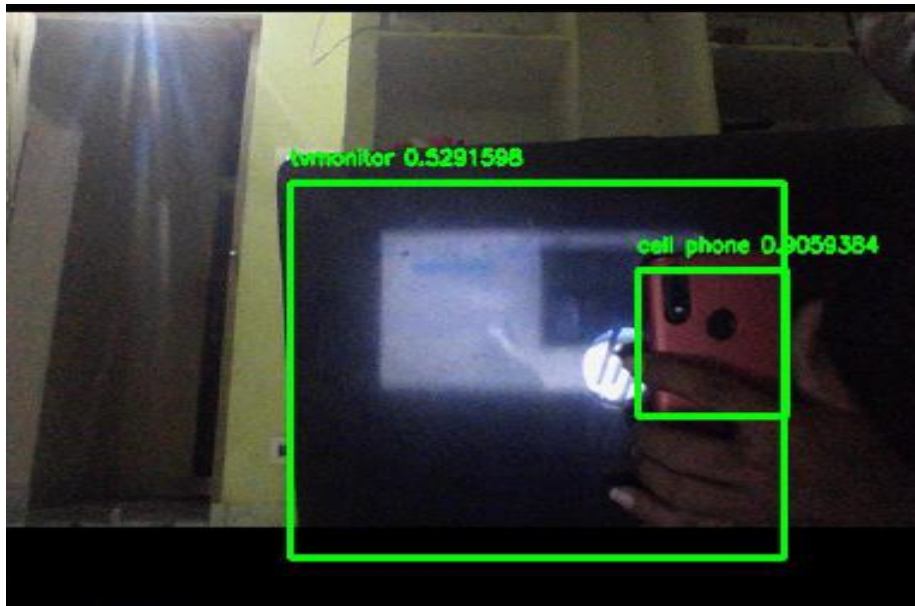
Fig. 8. Object identification output

- The above image it is shown that the detected objects are monitor and mobile phone with some accurate value.

- Whenever a object near to the device it activates and alerts the user with voice message by saying the object name and object is near or far to him. If the object is near it also alerts the user with buzzer sound.

- The visual footage is shown in the laptop with the help of camera which is fitted in the device.

X.CONCLUSION

The main purpose of this study is to produce a prototype that can identify type of object and that can detect obstacles in front of users and feeds warn back, in the form of voice messages and buzzer, to the user. Due to its powerful learning ability and advantages in dealing with occlusion, scale transformation and background switches, deep learning based object detection has been a research hotspot in recent years. This provides a detailed review on deep learning based object detection frameworks which handle different sub-problems, such as occlusion, clutter and low resolution, with different degrees of modifications on R-CNN. The analysis starts on inclusive object detection pipelines which provide base architectures for other related tasks. Finally, we move for several promising future regulations to gain a thorough understanding of the object detection landscape. It aims to solve the problems faced by the blind people in their daily life. The system also takes measures to ensure their safety.

XI.FUTURE SCOPE

The global position of the user is obtained using the "Global Positioning System" (GPS), and their current position and guidance their destination will be given to the user by voice. This not only helps the user but also gives the information about the current status of the user to their family members. Now Google is creating AI-powered glasses that can help the blind and visually-impaired people. The glasses, developed by Envision, can get visual details from images of the people and public transport, among other things and speak to the user. It can also read texts from books, identify friends and describe surrounding's to the person.

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