MAT JOURNALS

Journal of Embedded Systems and Processing
Volume 4 Issue 1

Object Recognition Using Perspective Glass For Blind/Visually Impaired

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DOI: http://doi.org/ 10.5281/zenodo.2624630

Abstract

Perspective glass is wearable pair of glass which is designed for blind people which helps them in resolving a major difficulty they face such as identifying the objects or obstacles present before them during walking. The Perspective glass consists of a raspberry pi board, 5mpcamera, ultrasonic sensors, buzzer, headphone, power source. This glass is controlled by a Power button which when pushed ON, will take pictures of the surroundings with respect to the position of the person wearing it. The clarity and the resolution of the picture purely reside on the camera used. The captured information is transferred to the application software which is manually built with the help of Fire Base application. The transferred data is then analyzed with the help of library files that are interfaced to the application via Neural Network "Tensor Flow". Finally the captured image is recognized with the help of Tensor Flow, and the information regarding the object is given out as a voice output to the person via speaker/headphones. All the components are interfaced to the Raspberry pi board which act as the central processing unit. It has the overall control on this setup. In addition to that an Ultrasonic Sensor is connected to the setup which when sensing an obstacle within a particular distancze of 3 meter, will produce a buzzer sound instantly giving a caution alert to the blind person. The overall setup is powered through an external power source (power bank). These Smart Glasses for Blind people is a portable device, easy to use, light weight, and user friendly. These glasses could easily guide the blind people and help them in better handling of obstacles.

Keywords- *Raspberry pi, android things, Tensor Flow, Ultrasonic Sensor.*

INTRODUCTION

It is estimated that visually impaired people counts around 1.3 billion approximately globally. 188.5 million people have mild vision impairment regarding to distance vision, and 36 million people are completely blind [1].Have you imagined about the life of a blind person. Their life is totally full of risk. They will need any kind of assistance from others every time when they step out of the gate. People who are completely blind have a very difficult time navigating about the outside world. There is a solution for the blind people to walk safely by detecting obstacle and generating corresponding alert signal according to the distance of the obstacle [2].

Traveling or merely walking down a crowded street can be even more challenging. Infact, people with low vision will prefer to travel with a sighted friend when going to unknown places. In this protocol when an obstacle is found within a distance of 1.2 meter then buzzer produces sound. The same approach is also used in many applications. This gives blind people the great accessibility to their environment through the smart system [3]. They are also curious about the beauty of the world; they will be having the

excitement to explore the world, and to be aware of what is happening in front of them, even though they can't find their own things without anyone's assistance. It is could be overcome by using an indoor navigation wearable system together with an audio assistance for blind people [4].

An intelligent assist blind glass system, comprising a wireless transmission module, a high-definition camera, an infrared sensor, an eyeglass frame, mounting the cartridge refers with the image recognition and transferring [5].

EXISTING MODEL

Blind as a special group in society, the needs of society to give them more care and attention, so that they are better able to live independently. However, how safe walking the blind life is the biggest problem. Traditional navigation device were mostly blind cane, blind by tapping the ground or walking around the object to determine the direction, the structure is simple, single function, easy to use, but the secondary effect is not very obvious, in fact, it will encounter many problems when used by the blind such as poor road conditions, uneven, hanging in front of obstacles, ordinary cane cannot be proven accurate, hence impose such a serious threats on the safety of blind travelers. The Existing models include production of buzzer sound using the sensing ability of the Ultrasonic Sensors. Whereas, Perspective Glass takes a major leap by helping differently abled in naming and identifying the obstacles or objects present before them.

PROPOSED MODEL

The Perspective glass comprises of a pair of wearable glasses for blind people which also contains 5 MP pi camera for image capturing, ultrasonic sensors for detection of obstacles in the path of blind person, a buzzer to produce sound based on the distance of the obstacle from the person, a central processing unit comprising of raspberry pi board which takes the overall control on the setup.

The Raspberry Pi is a series of small single-board computers whose Processor speed ranges from 700 MHz to 1.4 GHz; on-board memory ranges from 256 MB to 1 GB RAM. Secure Digital (SD) cards in MicroSDHC form. The boards have one to four USB ports. For video output, HDMI and composite video are supported, with a standard 3.5 mm sleeve jack for audio output. Power supply is given to the central unit through an external power source which then distributes the power to different components.

The Raspberry pi Camera is mounted in between the top bar and bridge present in optical glasses. The 5MP Pi Camera is connected to the central unit through a flex cable (100mm).The Raspberry Pi board is fed with application software which is manually built with the help of Fire Base application builder. The App is said to access the library files which are linked to a Neural Network called Tensor Flow.

The Tensor Flow is an open source machine learning framework designed for everyone. It comes with strong support for deep learning and machine learning. Thus after analyzing, identifying and recognizing the captured image the result is carried out forward. The obtained result is a voice output which could be heard through establishing a connection between Raspberry pi board and a Headphone. The Raspberry Pi has two audio output modes.

For the blind, the information from the sensor about the obstacle present in front of them is thus provided. In addition, for safety purposes an Buzzer activated with the help of signals obtained from the Ultrasonic Sensors are also equipped.

It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 80cm to 120 cm. At the same time, ultrasonic waves detects the object in the dark, dust, smoke, electromagnetic interference, toxic and other harsh environments. It does have a certain ability to adapt, with a wide range of applications.

The sensor is placed over or nearer to the pair of glasses. The Ultrasonic sensor and the pi module are interfaced together as shown in figure1. Thus the Buzzer starts producing caution alert if the particular range mentioned above has some obstacles. Finally, the overall information is processed according to the coding done and the resultant output is therefore attained.

Components Used

Android Studio: It is the integrated development environment developed for Google's Android operating system. Both Windows, and Linux based operating systems users can download it for their development and usage.

Android Things: It lets you experiment with building smart, connected device applications. It is also used to develop apps for your devices with existing Android development tools, apps, and resources.

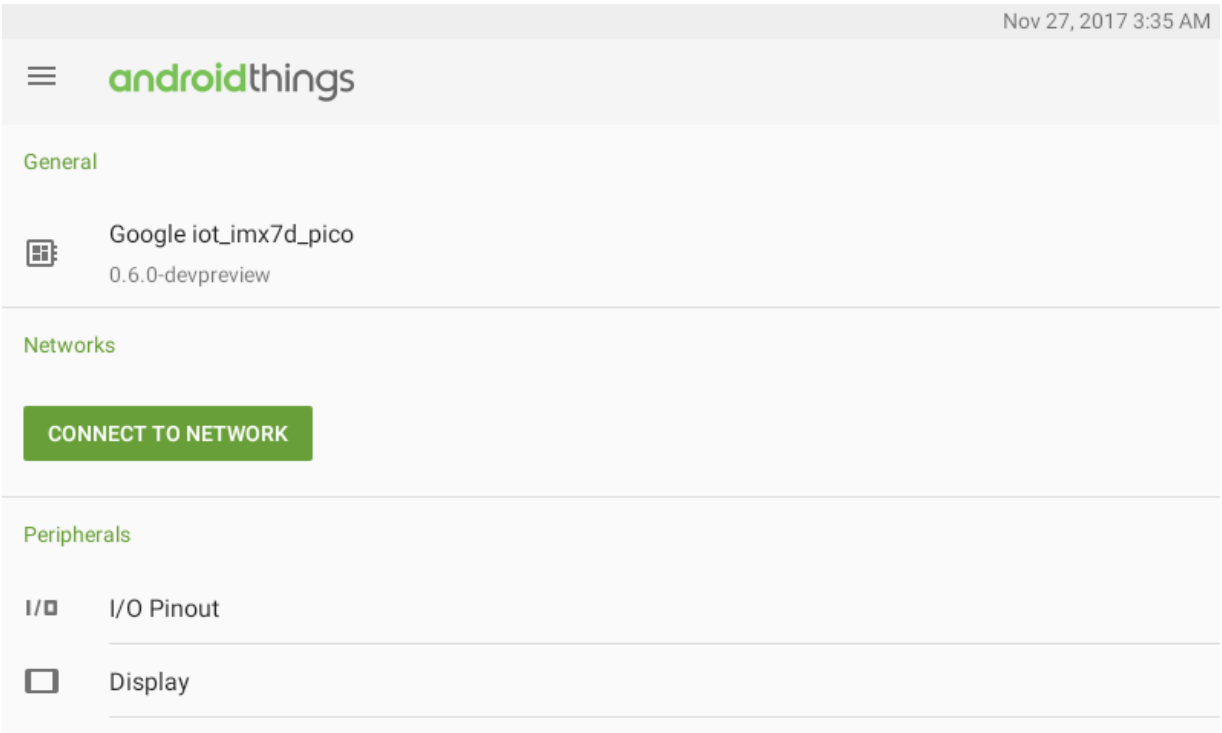

Figure 1: *Interfacing OS in Raspberrypi*

Tensor flow: It is an open-source software library for dataflow and differentiable programming across a range of tasks. It is also used for machine learning applications such as neural networks through the help of a guided symbolic math library. Now the model selection is important as you need to make an important tradeoff between Speed and Accuracy. The correct model could be selected based upon the requirement and the system memory used.

The Raspberry Pi: It is a series of small single-board computers. It was released in February 2016 with a 1.2 GHz

64-bit quad core processor, on-board wifi, Bluetooth and USB boot capabilities. The boards have one to four USB ports. For video output, HDMI and composite video are supported, with a standard 3.5 mm sleeve jack for audio output. Power supply is given to the central unit through an external power source which then distributes the power to different components.

Android Studio: It is the integrated development environment developed for Google's Android operating system. Both Windows, and Linux based operating systems users can download it for their development and usage.

Firebase: It is a mobile and web application development platform. Firebase's first product was the Firebase Real-time Database, an API that synchronizes application data across I os, Android, and Web devices, and stores it on Firebase's cloud. It could help in assisting software developers in building real time, collaborative applications. Firebase Storage is backed by Google Cloud Storage.

The Raspberry Pi Camera: It could be directly plugged into the CSI connector on the Raspberry Pi board controller. It could able to provide a 1080p HD video recording at 30fps or a clear 5MP resolution image.

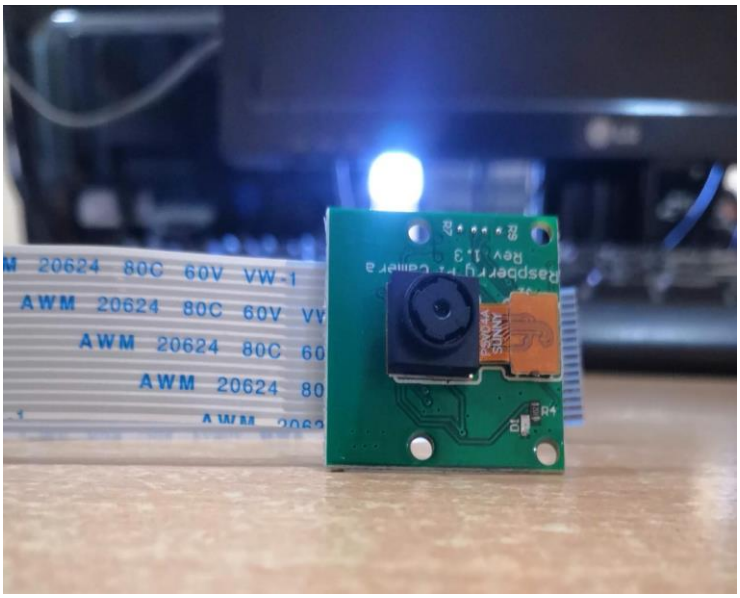

Figure 2: *Raspberrypi camera*

Ultrasonic Sensor: It the Ultrasound are used for measuring speed or direction. The device use multiple detectors respect to particulates in the air or water and calculates the speed from the relative distances in. They can easily detect approaching objects and also track their positions. This method can be very precise in terms of temporal and spatial resolution because the time-of-flight measurement can be derived from tracking the same incident (received) waveform either by reference level or zero crossing. This enables the measurement resolution to far exceed the wavelength of the sound frequency generated by the sensors. An ultrasonic wave detects the object in the dark, dust, smoke, electromagnetic interference, toxic and other harsh environments. It does have a certain ability to adapt, with a wide range of applications.

Buzzer: It is an audio signalling device which is connected to digital outputs, where it will emit a tone at

audible range only when the output is HIGH. Thus the Buzzer starts producing caution alert if the particular range mentioned above has some obstacles.

Figure 3: *Final Setup of the Model*

Architecture

Proposed Protocol

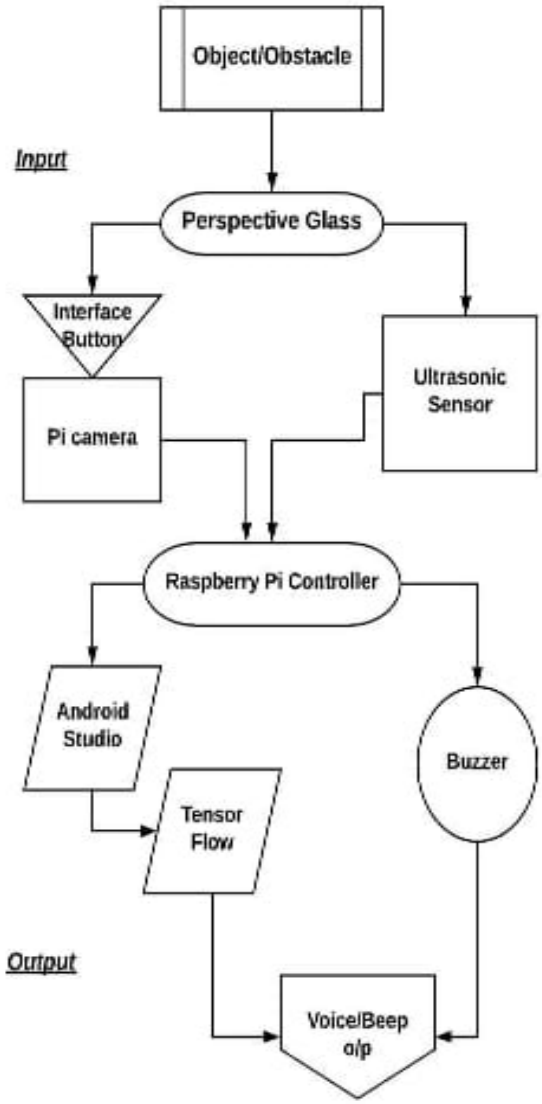

Figure 4: *General Architecture*

Description of the protocol

The Obstacle/object detection setup along with the output device is connected to the central processing unit. An external power source is used for supplying power to the central processing unit. The obstacle detection module basically consists of a pi camera, along with ultrasonic sensor as the processing unit and control module and the output unit consists of a buzzer and a headphones.

The control unit of the camera captures the image, processes it and gives the information or details through headphones and similarly, the control unit also controls the ultrasonic sensors and gets the information of the obstacle present in front of the man and processes the information and sends the output through the buzzer accordingly.

CONCLUSION

This smarter glass is implemented for the blind person who is unable to visualize any object present before them. This helps them keep aware of the particulars of the object or obstacle that may impose serious threats and even accidents if left unnoticed.

In future it can be further implemented into facial image recognition system where the user could differentiate and even recognize the minute expression like happy, sad, angry, etc that the human present before them could give.This might be very important for the people who are blind by birth. It is because they would have not experienced any kind of facial expression ever before. Thus this may make the more interactive, attentive and attached to their surrounding environment.

FUTURE ENHANCEMENT

A normal Glass is not comfortable much when it comes with the weight of the hardware. So we are rapidly designing and researching most comfortable glass for Sight.

This model is a wearable device. So we are concern about the battery backup of this model. We are going to develop an optimized power distribution board.

A headphone is not comfortable to wear all time. So, we are researching on a better and minimalist solution. We finally concluded on Bone conductive speakers. Bone conductive speakers will also help those who can't hear.

The camera that we used in this model is not suitable for manufacturing a product. It has some limitations like we can't use them in nights or in dark places. So we are upgrading them into IR camera comes with a better resolution.

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Cite This Article as:
S. Naveen Kumar, K. Varun, & J Mohamed Rahman. (2019). Object Recognition Using Perspective Glass For Blind/Visually Impaired. Journal of Embedded Systems and Processing, 4(1), 31–37. http://doi.org/10.5281/zenodo.2624630