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SMART GLOVE FOR BLIND USING TENSORFLOW

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ABSTRACT: In the world for visually challenged people finding the objects in an indoor environment becomes a challenging task in a daily routine. Where they should be assisted by one or the other for finding an object, in order to overcome this, we have come up with this paper. The aim of this paper is to design a glove using Tensorflow and object detecting algorithm for visually challenged people in an indoor environment. The glove will have a micro-vibrating motor to indicate the object found ,there will be a voice recognition module which is connected for raspberry pi for giving the input of object looking and in hand of the glove will have pi camera which will provide the real time video to raspberry pi for processing. The visually challenged person vocally commands to a system using micro phone which is inbuilt in the voice recognition module. And the object is found using the object detecting algorithm. And some other features are included.

Key Words: Object detection, Voice recognition, Micro Vibrating Motors, Ultrasonic sensors, Tensorflow

I. INTRODUCTION:

In the world there are around 285 million visually impaired people,39 million people are blind and 246 million with low vision. The eyes are window to the world, they are physical portal through which data from environment are collected, but due to myopia, glaucoma and by natural accidents many of them have lost their vision. For them getting a desired object that they are looking for in an indoor environment is difficult in a day to day life. There are many systems designed for assisting the vision less person in an outdoor using recent technological advancement. In outdoor there are electronic assisting devices for blind person to assist like a guide cane but in indoor environment assisting a visually impaired person is different. Detecting an object in an indoor environment is a different scenario. So, we have designed a glove for making their work easier. The designed system helps the vision less people to get the object that they are looking for. In past there are some system designed for collision avoidance [4], it just detects that there is an object, but it will not tell what is an object, example is a white cane which is used as a collision avoidance system. And there are many sensors like infrared sensor and [2] SONAR which are used for obstacle detection(collision avoidance).There is device by named [3] Eye vista which is used for obstacle detection in an outdoor for alethic person .Where white cane is also designed using control system for obstacle detection and the walking cane are also used for collision avoidance, the disadvantage of this systems is they cannot identify the object. Our system is implemented using [1] Tensorflow API and SSD Mobile Net for detecting the object that they are looking for. There are some object detecting system designed using Caffe frame work but Tensorflow is more efficient compared to other frame work for the following reasons:

1. The language used is python

2. It is more useful for GPU system models

3. Working with tensorflow is more ease

	Caffe frame	Tensorflow
Language	C++	Python
Pretrained	Yes	Yes
GPU	CUDA	CUDA
Good at RNN	NO	Yes

Table I

The SSD Mobile net is already a predefined module available in Tensorflow, this model helps for getting the accurate result and the COCO dataset contains the captioning dataset and image dataset for object detection. where the whole system works on user commanding vocally, previously we had speech to text converter and some pyttsx3 modules for converting the voice to text but there is a module by

named voice recognition module which is used for recognition of voice and comparing it with the database and also helps for sending the data of object that they are looking for to the system using microphone that is been attached to voice recognition module. And the micro-vibrating motors are used for guiding a person to navigate towards the object. The ultrasonic sensor is used for distance measuring in our system. So, to help the visually impaired people we have come up with this solution.

II. METHODOLOGY:

The smart glove is designed to assist the blind person for getting the desired object. It works as an independent system and comprises of raspberry pi, voice recognition module, object detecting, ultrasonic sensors and micro-vibrating motors as shown in the block diagram figure 3. where raspberry pi consists of pi camera (USB camera). The work flow starts with user vocally communicating to a microphone connected to voice recognition module which is interfaced with raspberry pi where as shown in the figure 1. Once the voice input from the user is received by the microphone, the voice is compared with the predefined voices of voice recognition module. if the voice approximately matches the predefined voice then the respective binary digit of the object in the database is display in the LED of voice recognition module, the keyword is extracted from voice by converting voice to text ,checks for the keyword in database if it is present then the keyword is passed to object detecting module of Tensorflow then pi camera that is connected to raspberry pi starts capturing the real time video and feeds to Tensorflow API that is running on raspberry pi and with the help of the COCO database the images are compared , once the object is detected the audio message is generated through the speakers, using ultrasonic sensors which is interfaced with raspberry pi as shown in the figure 2 for distance calculation between pi camera and the object.

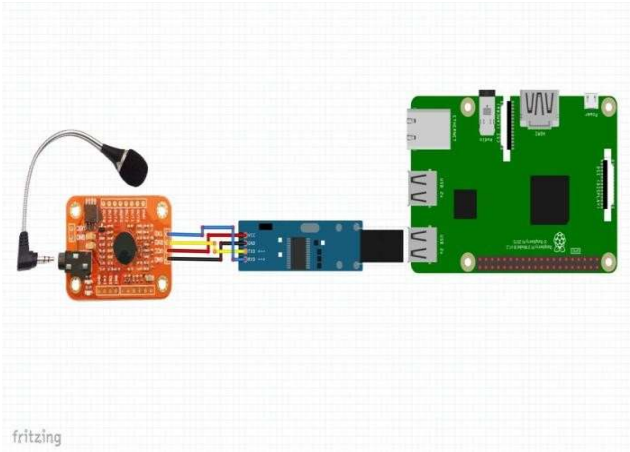

Fig 1: Interface of the raspberry pi with voice recognition module

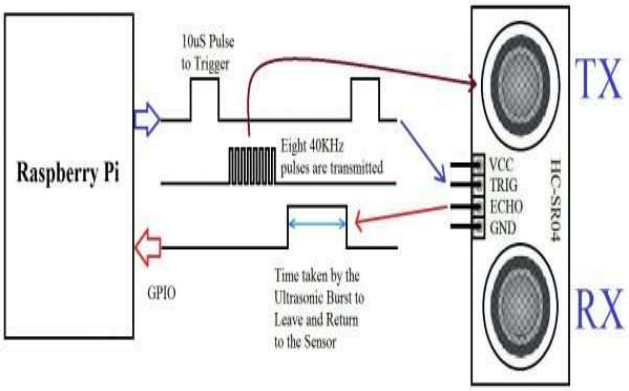

Fig 2: Interface of raspberry pi with Ultrasonic sensor

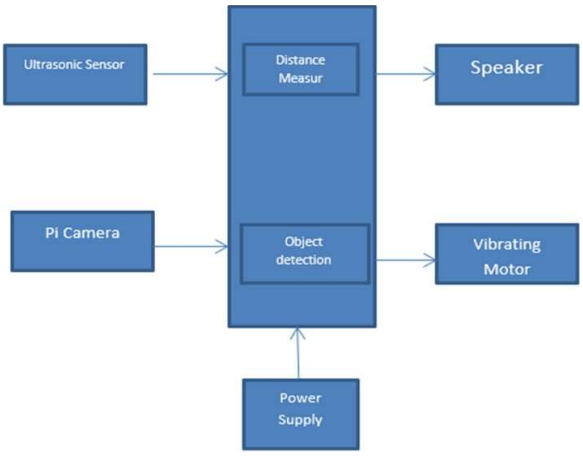

Fig 3: Block Diagram of the System

A. Raspberry pi 3B

The raspberry pi 3B is third generation raspberry pi with a Quad Core 1.2GHz Broadcom BCM 2837 64 bit and 1GB RAM, BCM43438 Wireless LAN and Bluetooth low energy on board ,100 base ethernet ,40 pin extended GPIO,4 USB 2 ports which is used for object detection using Tensorflow using this other components like micro vibrating motors, voice recognition module, ultrasonic sensor, object detecting module.

B. Voice recognition module

The voice recognition module is a compact easy-control speaking recognition board. It is a speaker dependent module and supports around 80 voice commands. Any sound can be trained as a command and 7 commands are effective at a time, the first user needs to train the model for recognizing the voice this board has 2 controlling ways: serial port(full function), General input pins (part of function) on the board generate several kinds of waves while corresponding command is recognized and also the voices can be predefined in the voice recognition module. With a voltage of 4.5- 5.5V, current of 40mA, digital interface :5V TTL level URAT interface, analog interface:3.5 mm mono-channel microphone connector with an easy control and connected to the GPIO 19 16 20 21 of Raspberry pi

C. Ultrasonic Sensor

The ultrasonic distance sensor is designed to measure the distance between the source and target using ultrasonic sensor waves, it consists of ultrasonic transmitter, receiver and control circuit, the transmitter transmits short bursts Which get reflected by target and are picked by the receiver. The time difference transmission and reception of ultrasonic signals calculated. Using the speed and “speed=distance/time” equation, the distance between the source and target can be calculated. The ultrasonic sensor module contains four pins as follows:

1. VCC-5V, input power
2. TRIG-Trigger input
3. ECHO-Echo Output
4. GND-Ground

Connect the ECHO and TRIG to the GPIO port of raspberry pi and connect VCC and GND to the same pin (2 and 6)

D. Micro-Vibrating motor

The micro-vibrating motors helps to keep the object within the frame and indicates the object detected, and connected to 9V battery once the object is detected the micro-vibrating motor turns off automatically.

E. Tensorflow object detection

The tensorflow runs on raspberry pi for detecting an object with the help of OPENCV the image is feed to Tensorflow API, using the COCO dataset of the tensorflow the object is detected and the Protobuf which implements Goggle protocol buffer data format for image reading which becomes easier.

The API is trained on the COCO dataset (common object in context) it is a dataset of 300k images of 90 commonly found objects with model by named ssd_mobilenet_v1_coco model which is a part of Tensorflow API.

F. Power supply

The system can be powered using any standard power bank battery which as a power rating that is sufficient for Raspberry pi.

III. PROCESS FLOW

The process flow of our system is as shown in the flowchart fig 4. The process when the user vocally communicates to system by telling the object that user is looking for. if the voice match the predefined voice then the keyword extracted is checked in the database is that word present or not if present the binary digit in the LED is displayed then keyword passed to the objection detection model once the object detected the distance between the object and the source is calculated using ultrasonic sensor, the user reaches the desired object.

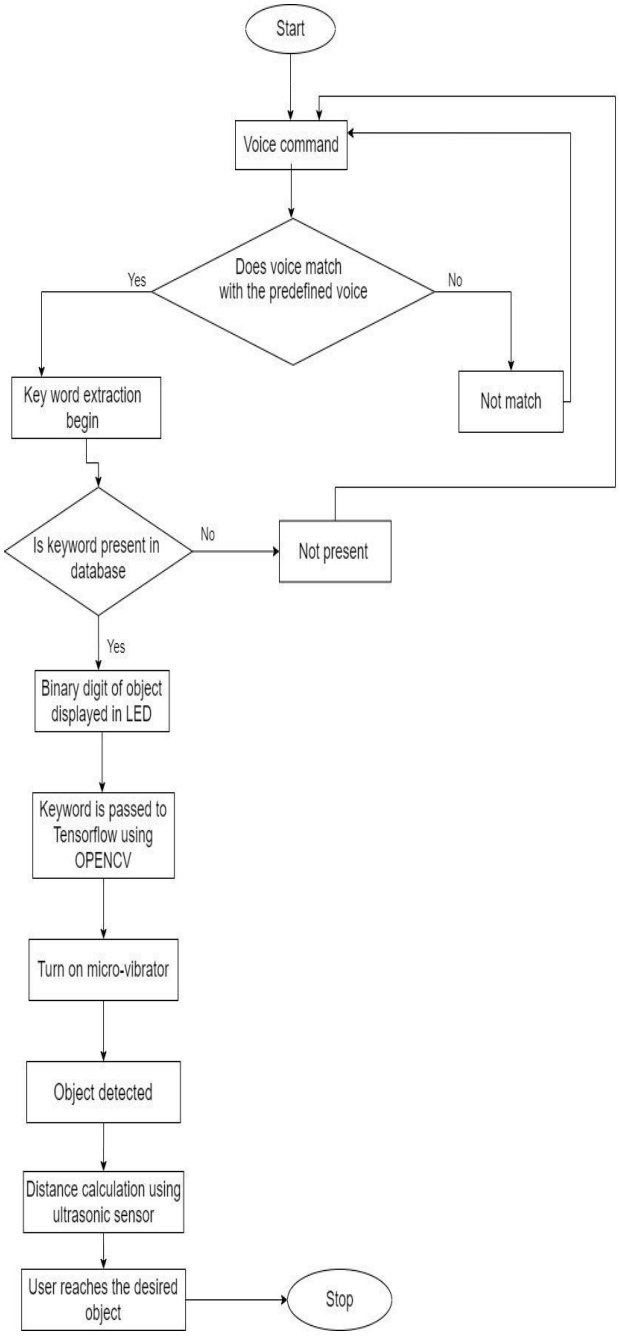

Fig 4: Flow Chart of the entire system

IV. RESULTS

After completing the experiment, the following results are obtained:

A. Voice Recognition Module

It checked for the voice, after the voice is matched with predefined voice and display the extracted keyword respective binary digit in the LED example that we gave the keyword as keyboard through the voice, it recognized the keyword as displayed the respective binary digit 0100 as shown in the below figure 5.

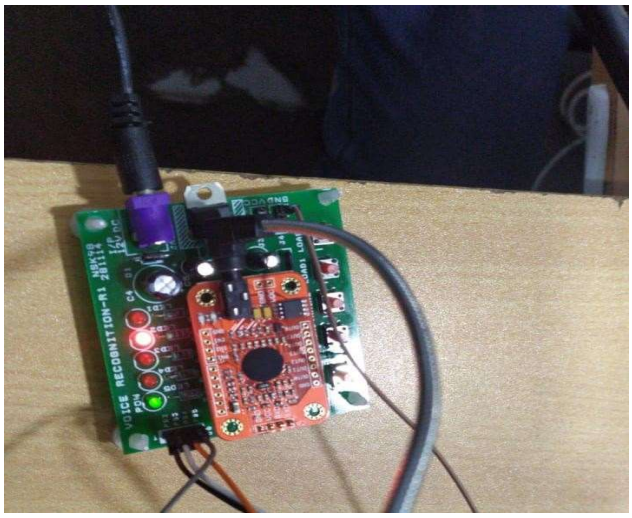

Fig 5 Displaying the respective binary digit Object detection using tensorflow

The object will be detected using the SSD MOBILE NET model, it detected the extracted keyword and found the object the example that we took is keyboard as shown in the fig 6 and it will voice output that KEYBOARD FOUND WAIT CALCULATING DISTANCE and this will also be displayed on the screen as shown in the fig 7.

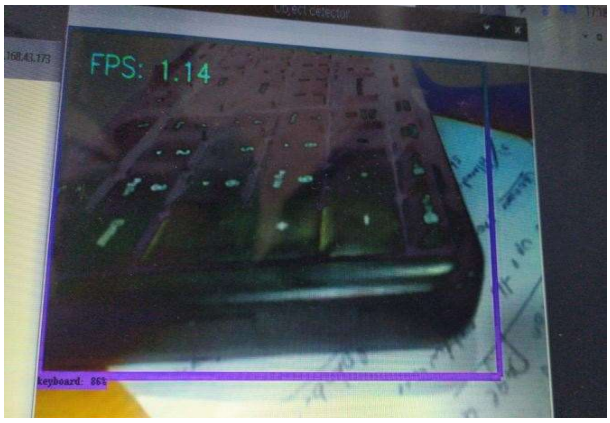

Fig 6: Object detected

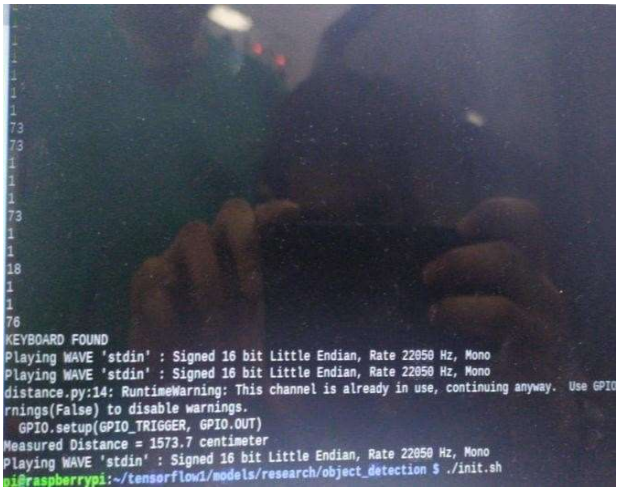

Fig 7 Displaying on screen that object is found

B. Ultrasonic sensor

They are used for measuring the distance, the distance between a source and keyboard was voice outputted for an example that we got was around 8 cm and it will automatically clear previously stored distance measured value so that it will not overlap with the next time when its measuring the distance.

C. Micro-Vibrating Motor

Once the detection starts the micro vibrator which is connected to 9V power supply start vibrating then once the object found the vibrator will automatically turn off as shown in the figure 8.

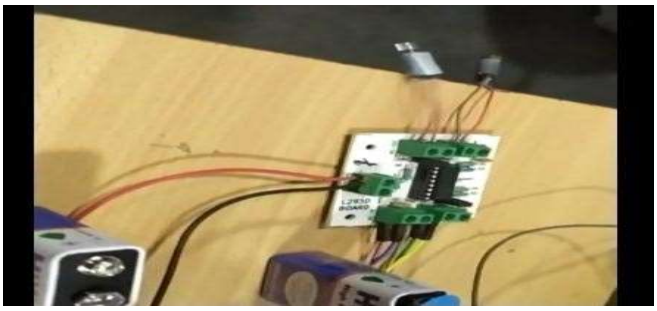

Fig 8 Micro Vibrating Motor Vibrating

D. Cost Estimation

The project that is been done is cost effective as shown in the Table II the cost may vary based on the component price in the current market

Sl.NO	Components	Cost	Quantity	Final Cost
1	Raspberry Pi 3B	2799	1	2799
2	Voice Recognition	2199	1	2199
3	Raspberry pi camera	499	1	499
4	Ultrasonic sensor	799	1	799
5	9V Battery	25	1	25
6	Power Bank	799	1	799
7	MicroVibrator	149	2	298
8	Glove	200	1	200
9	Miscellaneous	250	-	250
10	Speakers	500	1	500
Total Amount	Rs. 8368			

Table II

E. Final Prototype Look

The final prototype after attaching the components like ultrasonic sensor and raspberry pi and speakers it looks like as shown in the figure 9.

Fig 9 Final Look

V. CONCLUSION

The prototype that we have designed helps the blind person for getting the desired object using Tensorflow in the future we can use Pytorch instead of Tensorflow and combine finding the object and collision avoidance together and we can use for NCS for better framing and fast access in the future.

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