A SMART STICK FOR VISUALLY IMPARED PEOPLE USING RASPBERRY PI

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***Abstract*— This project investigates methods and procedures to construct an efficient system to assist blinds in their everyday life. In particular, various technologies that can be utilized to build a wearable system are examined. The system imaginative and prescient and the conversation aspect of the blind navigation and steerage is designed now no longer handiest to map the environment surroundings however additionally to decide a secure direction to a favored destination. This function highlights the significance and additionally affords the commands to blinds for effective navigation and secure Information with the aid of using incorporating object/pedestrian in real-time.**

One of the major problems faced by Blind people is detecting and recognizing an obstacle in their path. The projects approach lies in developing a system based on Raspberry Pi 3 , which is capable of labeling objects with the help of OpenCV and TensorFlow libraries and converting the labeled text to speech and producing output in the form of audio signals to make the blind person aware of the object in front of him. The scope also includes measurement of the distance of the object from the person and reporting the same. Most of the Object Detection algorithm has been tested on GPU with high computation abilities and are less likely to achieve same speed and accuracy with less powerful devices with microprocessor only, which are in high demand in current scenario. We choose Raspberry Pi 3 as our platform because it is a standard representative of embedded device and is widely being used for devising low cost-system. We would like to have a prototype that can successfully perform real-time detection in about 5-10 fps onPi, with decent accuracy.

I. INTRODUCTION

Nowadays the demand of low cost well-trained embedded devices that can be applied in real world is increasing.Our efforts in this project are determined to achieve a system which can render one among such application to profit the blind people. In this project video detection and recognition is presented supported one board computer represented by Raspberry PI as an embedded solution. The aim is to form a sensible system which detects the item for the blind user, measures its distance , and report the output within the type of audio signals to alert the blind user of the obstacle ahead. This entire work is done on raspberry pi with operating system ported on it.

In this project, the Pre-trained model is employed, Its accuracy is over ninetieth. It also can be custom-built to acknowledge different objects exploitation Transfer learning. The MobileNet is depth wise severable convolution, reduces the quantity of parameters. it's additional appropriate for vision-based applications wherever there's less performance power of the system.MobileNets area unit the newest providing from Google. they're appropriate for embedded and mobile devices as a result of they need a tiny low size, low latency and want low power. they will be used on platforms with resource constraints for varied use cases. they will be used like some widespread, however giant scale, models like beginning web for the tasks of classification, detection and segmentation.

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II. STATE OF THE ART

Literature Survey

In this [1] object detection and recognition algorithms are applied.With these algorithms the required objects are grasped by the gripper of the robotic arm platform.In this project native feature-based algorithms like SURF,SIFT,FAST and ORB are used. A camera is employed to capture the photographs of the thing and acknowledge it . These algorithms are enforced in an exceedingly computer code for object detection. C++ is that the artificial language utilized in this project exploitation OpenCV and therefore the computer code runs on Raspberry Pi in UNIX system Platform. [2] This paper presents AN obstacle rejection system for blind individuals exploitation Kinect depth camera. This helpful technology acknowledges the medium before of the user exploitation Kinect depth camera. The model receives the depth pictures from the Kinect camera and then it processes its windowing-based mean or average technique to provide obstacles within the scanned area. once the system acknowledges obstacle, it sends a voice feedback to the user through earphones. [3] a unique wearable navigation device is given during this paper. The locating, way-finding, route following, and obstacle avoiding modules ar the essential elements during a navigation system, whereas it remains a difficult task to contemplate obstacle avoiding throughout route following, because the indoor setting is advanced, changeable, and presumably with dynamic objects. to handle this issue, we have a tendency to propose a unique theme that utilizes a dynamic subgoal choosing strategy to guide the users to the destination and facilitate them bypass obstacles at identical time. [4] several exceptional algorithms are developed for object detection and chase,

together with color segmentation, edge chase and lots of additional. However, of these algorithms long-faced the restricted success within their implementation in the globe and were additionally finite by the constraints like white/plain background. This paper is that the result of our analysis wherever our analysis team developed and enforced object detection and chase system operational in an unknown background, exploitation period of time video process and one camera. [5] This paper aims at the event of a answer which will be adopted by the visually impaired for distinctive and locating menage objects in their way of life. the answer includes a wearable device that listens for the user's voice, understands the user's command and locates the thing within the encompassing setting. Once the target object is found, it offers user the data concerning the thing and also the most potential distance of the thing from the user. [6] This paper addresses the matter of distinctive the matter of period of time visual perception of dental instruments by utilizing deep learning techniques. For this reason, the one Shot MultiBox Detector (SSD) network was thought-about because the meta structure and joined with the bottom Convolution Neural Network (CNN) MobileNet to form SSD-MobileNet. This methodology will acknowledge instruments additional exactly and quickly as distinction with alternative light-weight system ways and traditional machine learning techniques. we've got achieved the exactitude and accuracy of 87.3% and 98.8% severally

III. PROPOSED WORK

Description:

From the various literature surveys, we could draw an inference that there is no current system that uses MobileNet to develop object detection and recognition using raspberry pi.In this project we are using deep learning along with convolutional neural networks is used with a pre-trained model. The whole idea behind the project is to help blind people through creating a smart stick that can easily detect and recognize objects around it and help in understanding them what the object is. The project will identify any target present in the database by using two important algorithm in object detection and recognition, namely, MobileNet algorithm, and Single Shot MultiBox Detector(SSD) algorithm to train the machine on how to detect a object, how to recognize a object, and what output to give when the object is either recognized or not.A ultrasonic sensor is used to calculate the distance between the person and the object. The project is further implemented on a stick that is used by the blind people so that the objects in front of them can be detected and recognized all the components are embedded into a stick and whenever it detects an object it provides the output as audio service

Benefits:

1) Recognition is real time.

2)Convolutional Neural Network is very advanced deep learning algorithm

3) Number of data set is high hence accuracy is also high

4) Uses simple USB camera for video capture

5) No 3D camera is used .

Trade-off:

The trade-off between the Proposed system and the Existing system is that,

1) the Existing system has a low accuracy of recognition as it only uses one algorithm whereas our Proposed system uses more algorithms to detect and recognize the same object for a greater yield of accuracy.

2) Unless we are using the algorithms simultaneously the time consumed in our Proposed system will be relatively higher than that of the Existing system.

3) In order to reduce time we can use more memory in order to run all the algorithms simultaneously. The trade-off is that the Existing system uses less memory as it usually only runs one algorithm.

Algorithms :

The algorithms implemented in our project are as follows:

Deep Learning Algorithm: Deep learning may be a category of machine learning algorithms that uses multiple layers to increasingly extract higher-level options from the raw input. for instance, in image process, lower layers might establish edges, whereas higher layers might establish the ideas relevant to a personality's like digits or letters or faces. In deep learning, every level learns to remodel its input file into a additional abstract and composite illustration. In a picture recognition application, the raw input is also a matrix of pixels.

MobileNet Algorithm:MobileNet may be a design model for Image Classification.MobileNet desires terribly less computation power to run or apply transfer learning to.This makes it an ideal suited embedded systems and computers while not GPU or low machine potency with compromising considerably with the accuracy of the results. The core layer of MobileNet is depthwise divisible filters, named as Depthwise divisible Convolution. The network structure is another issue to spice up the performance. Finally, the dimension and determination are often tuned to trade off between latency and accuracy.

SSD Algorithm: SSD is intended for object detection in period. quicker R-CNN uses a district proposal network to form boundary boxes and utilizes those boxes to classify objects. whereas it's thought of the start-of-the-art in accuracy, the full method runs at seven frames per second. way below what data processing wants. SSD quickens the method by eliminating the requirement for the region proposal network. To recover the come by accuracy, SSD applies many enhancements together with multi-scale options and default boxes. These enhancements permit SSD to match the quicker R-CNN's accuracy mistreatment lower resolution pictures, that any pushes the speed higher.

IV. IMPLEMENTATION

The implementation is being done and tested using Python and OpenCV surroundings where we tend to use a pre-trained model. the info was kept domestically within the SD card. The trained dataset was then utilized in detection and recognizing the objects in an exceedingly dynamic (or moving) situation or in an exceedingly static situation. the space between the item and also the person will be found through the ultrasonic device. It measures the space between them and offers the output as audio signal. Raspberry Pi is shoed with the SDCard, with libraries put in like Keras, Tensorflow backend, numpy, etc. USB camera is interfaced with the Raspberry pi to create it because the real-time object recognition application. A python script is formed to capture the pictures. All the photographs that are taken by the Python script are saved to the own folder with current timestamp computer filename. The folder is found at /var/www/camera/.

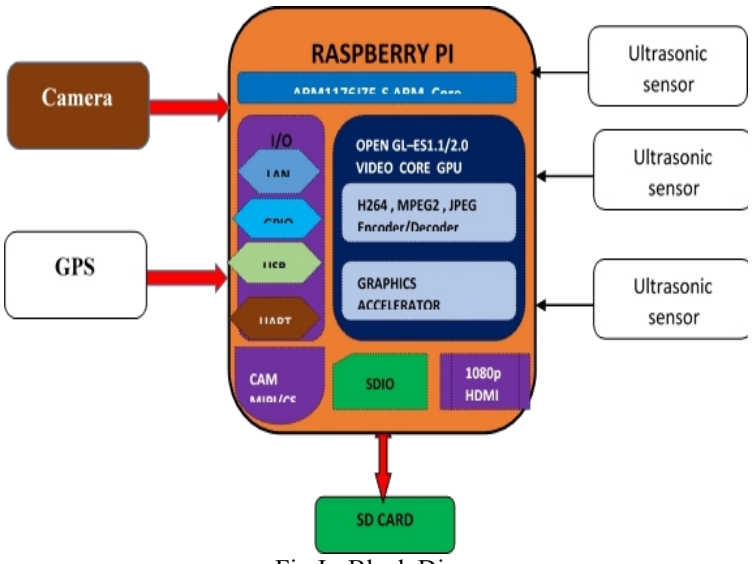

Fig:I - Block Diagram

Although the training and recognition takes time, it is due to the fact that the dataset was dynamic and not just a static picture of the object. For static data the recognition speed and efficiency increases dramatically.

The implied method of using multiple recognition algorithms gives an increased efficiency of up to 35-40% depending on the source of tthe picture which is more than the traditional Object Detection algorithm alone.

As for the unknown (or untrained) Objects, the system shows the user that the object is “Unknown”, i.e., the object does not exist in the training database.

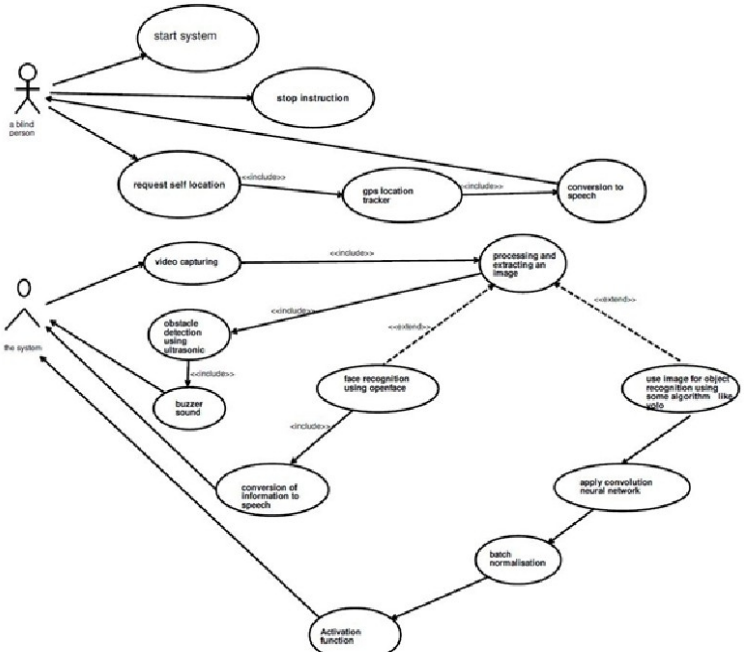

Fig:II - UML Diagram

V. RESULTS DISCUSSION

The result obtained was extremely satisfying given the condition that the recognition of the target objects were done in a dynamic environment.

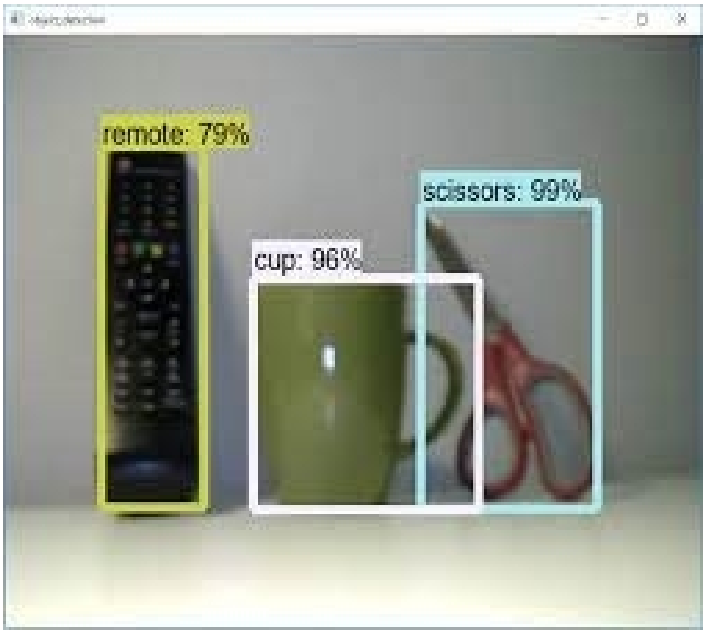

Fig:III - Recognition of objects

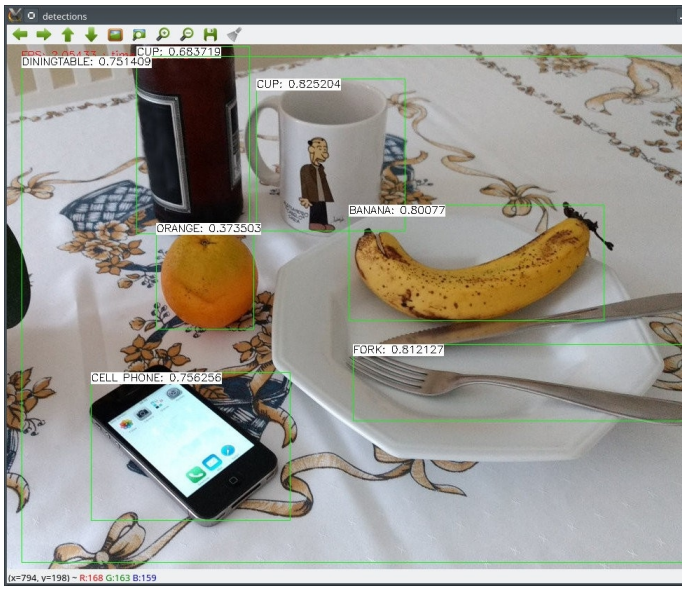

Fig IV: Object detection using traditional algorithm(YOLO)

Figure III shows the accuracy of the detection is as high as 76% whereas the Figure IV shows the traditional object detection algorithm, where the recognition of the object (which is static) is only as high as 56%.
The implementation that we have done shows an increase in recognition as high as 30.8%. We should also consider that the results given for our implementation also proivides the distance between the person and the object and also provides the location of the person. whereas the result of the (YOLO) traditional algorithm only provides the result of the objects only. For a static dataset using our implementation, the increase in accuracy can be estimated to be as high as 45-55%.

V. Conclusion

According to this technique, the blind individuals act with the system through voice.The most necessary good thing about this {can be} that it will be used as a sttick which will observe and acknowledge objects in order that the blind individuals can carry this with none different.. however we tend to do have some process limitations and with higher process power a lot of correct and higher results will be found. more we've got used restricted knowledge set that the accuracy was tight, however with larger knowledge set, accuracy of the system will be exaggerated.Test results show that the planned system will give a lot of abundant surrounding info and a lot of more navigation, and verify the utility.

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