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Visual Assistant for Blind People using Raspberry Pi

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ABSTRACT

Blind people face the problem in daily life. They can't even walk without any aid. Many times they rely on others for help. Several technologies for the assistance of visually impaired people have been developed. Among the various technologies being utilized to assist the blind, Computer Vision-based solutions are emerging as one of the most promising options due to their affordability and accessibility. This paper proposes a system for visually impaired people. The proposed system aims to create a wearable visual aid for visually impaired people in which speech commands are accepted by the user. Its functionality addresses the identification of objects and signboards. This will help the visually impaired person to manage day-to-day activities and navigate through his/her surroundings. Raspberry Pi is used to implement artificial vision using python language on the Open CV platform.

Keywords :- Navigation, Open CV, Python, Raspberry Pi, speech commands, Video capturing.

I. INTRODUCTION

Artificial Intelligent and the Internet of Things gained immense traction due to a large amount of data and ease of computation. It is possible to make these people's life much easier. The goal is to provide a super sight until they have enough resources required to treat them. People with visually impaired people or blindness can use this to make their everyday tasks much easier in their life. There are many difficulties faced by Blind People. This project is designed to help blind people in their world using the sense of hearing. It's a visual-based project consisting of few main components such as a Camera, Raspberry Pi, Sensors, Microphones, and Vibrators mounted together and additional working technologies of the internet interlinked. The input of the project will be an image/video (multiple frames), the image captured and analyzed with the help of the camera interfaced to the raspberry pi/IoT and AI technology. Hence the object is detected and information is sent through audio and is conveyed to the blind person through earphones. This system makes a better life for blind people as it will work

with the latest technology and it is meant to aid the visually impaired to live a life without constraints. Visual deficiency is a condition of lacking visual recognition because of physiological or neurological components Virtual impairment may cause people difficulties with normal daily activities. According to a recent estimation 285 million people live with vision impairment. 39 billion are blind & 217 million have moderate to severe vision impairment. The loss of sight causes enormous human suffering for the affected individuals and their families. Vision allows a human being to view the surrounding world.

II. PROBLEM DEFINITION

According to World Health Organization (WHO) in 2012, out of the 7 billion population, there were over 285 million people are visually impaired and 39 million were blind. Blind people face the problem in daily life. They can't even walk without any aid. Traditional tools like white cane and guide dogs do solve the problems completely. They cannot perceive enough knowledge to avoid all the obstacles. They are not able to search and pick up any objects they want to get.

II. LITERATURE SURVEY

1. A Low-cost smart glove for visually impaired people mobility

Giuseppe Bernieri, Luca Faramondi, and Federica Pascucci collaborated with blind people to understand their requirements. What they came to know is white cane does not solve all the problems. It cannot detect the obstacle above the hip level e.g. tree branch. Also, white cane has some blind spots which of which care should take by the device. This System is an add-on to the white cane. The glove is the core of the system represented by the Arduino nano board. It also has other components- three rangefinders, three vibration motors, an accelerometer, a power supply unit, and a computation unit. A rangefinder is nothing but the HY-SRF05 ultrasonic sensor which perceives the obstacles which are not perceived by the white cane. Each range finder detects an obstacle in the top, left, right directions respectively. The top rangefinder is always on. The other two are switched on alternatively. If an obstacle is detected vibration motor conveys the feedback to the user. Two rangefinders are switched on and off alternatively. Using an accelerometer the direction of the white cane is decided and according to the direction, one of the rangefinders is switched on. The obstacle avoidance algorithm is executed continuously. It collects the data from sensors and properly triggers the vibration motor. They introduced a fast and reliable algorithm to estimate the position of the hand considering only x-acceleration. The algorithm is based on the well-known Zero Velocity Update Approach. This system enhances the functionality of the white cane. The white cane is a symbol for visually impaired people. They are used to it and this system enhances its functionality.

Limitation –This design is the only prototype. A more comfortable design of the glove can be designed. The placement of sensors can be revised so that the computational burden can be reduced.

2.Smart glove for visually impaired

This research conducted by Thai Linn, Ali Junaid, steve Clark is inspired by the concept of the youtube video[3], Visually Impaired Assistant (VIA) which is a creation of freelance industrial designer Mr. Noam Klopper[4]. This is a compact system that uses an ultrasonic sensor to detect the obstacle. If the obstacle is detected, the user is informed with vibrating motors and allows the user to take a different path. LilyPad Arduino is used as a microcontroller to make the device compact. The safe distance is set in the program which is 30 to 80 inches. When the obstacle is less than 30 inches from the user the vibrating motors are switched on. This System is very much handy.

III. ALGORITHM

In this project, the Yolo algorithm is used to detects and recognizes various objects in real-time. Object detection in YOLO is done as a regression problem and provides the class probabilities of the detected images. YOLO algorithm works using the following three techniques:

Residual blocks

Bounding box regression

Intersection Over Union (IOU)

Instead of predicting the absolute size of boxes writes to the entire image, Yolo introduces what is known as Anchor Box, a list of predefined boxes that best match the desired objects. The predicted box is scaled write to the anchors. More specifically:

predict the box center (tx and ty in figure 1) write to the top left corner of its grid scaled by grid width and height.

Predict the width(tw) and height(th) of the box write to an anchor box (pw and ph).

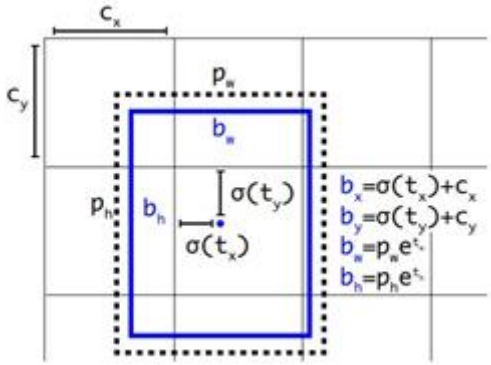

Figure1: Bounding boxes with dimension priors and location prediction.

Box center offset (tx)	Box center offset(ty)	Box width(tw)	Box height(th)	Obj score	Class A prob.	..	Class K prob.

Figure2 : YOLO Format

We predict the width and height of the box as offsets from cluster centroids. We predict the center coordinates of the box relative to the location of the filter application.

Now you know YOLO predicts several bounding boxes per grid instead of just one. The output shape would be something like 13 x 13 x NUM_ANCHOR X (BOX INFO), where the last dimension looks just like an upgraded version of the naive approach.

And the final result as shown in Figure 3

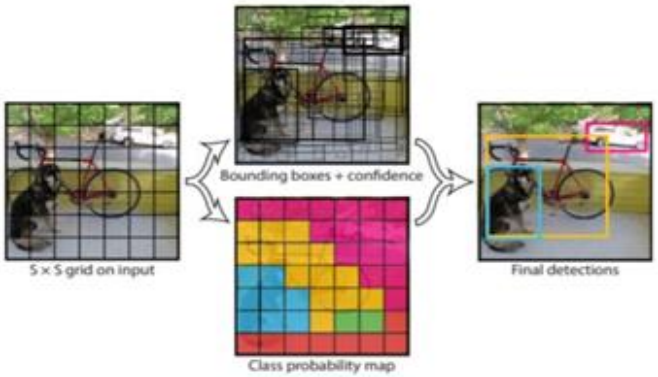

Figure3 : Final Output

IV. METHODOLOGY

We propose the following methodologies for identified problems:

Object Detection and Recognition:

With the help of object detection, the system solves the problem of object identification for a blind person. Object detection algorithm can identify the category of object and object name also. Accuracy of object detection is a minor issue faced in this methodology and can be overcome with the training of models with different data sets.

Object Tracking: The Problem of navigation to an object is solved with the object tracking algorithm which continuously locates the object in the video frame and helps to get closer to the object. The efficiency of this methodology depends on the algorithm we used.

Voice Assistant: The problem of interaction with the system for a blind person is solved with the help of voice assistance. The user simply gives voice commands to search the required object and can be navigated to the object with the use of voice assistance and vibration on the fist. The efficiency of

voice assistant depends on pronunciation of words as well as API used for voice assistant.

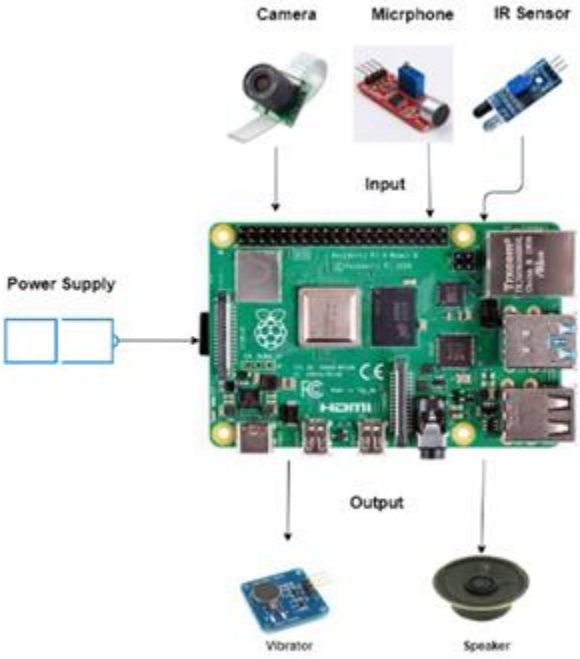

Figure 4. System Architecture

A. Raspberry Pi

The raspberry pi is a single-board computer based on Broad-com BCM2837 system-on-chip. It has a 1.2GHz CPU onboard. It uses a 64-bit quad-core ARMv8 architecture-based CPU. The raspberry pi version features 1GB of RAM. It uses an SD card to store the OS. It has a USB port through which a USB microphone is connected and speech input is given. It has a CSI port through which the Pi camera is connected. The Raspberry PI features a 3.5 mm universal headphone jack for audio out. The Raspberry pi performs the task of taking video input, converting it to frames, does suitable image processing in the Open CV platform using Python language.

B. Pi camera

Raspberry Pi camera module is used to take high-resolution video, as well as still images. It has a resolution of 8 megapixels and 30 frames per second (fps). The output from the camera is fed to Raspberry Pi for further processing.

C. IR Sensor

An IR sensor measures the distance to an object by using sound waves. It does so by sending out a sound wave at a specific frequency and listening for that wave to bounce back. The elapsed time between the sound wave being

generated and the wave bouncing back is recorded and the distance between the sonar sensor and the object is calculated. In this system, it is used to notify the user about any obstacle that is ahead of him/her.

D. Open CV and Python

It is a library of programming functions mainly aimed at real-time computer vision. It is used for various applications such as augmented reality, gesture recognition, feature matching, etc. It is imported by using the command "import cv2" in python. Python is a widely used high-level programming language that has a dynamic type system and automatic memory management and supports multiple programming paradigms including object-oriented, imperative, functional programming, and procedural styles. Python is a lightweight programming tool that has many built-in functions and does not consume many resources while operating on the Raspberry pi.

V. PROJECT SCOPE

Blind`s Vision Fist enables a visually impaired person to detect, recognize and track the object. Blind`s Vision Fist also avoids the user from touching the hot object. Input given to Blind`s Vision Fist is a live video feed with a frame rate of 60-70fps. The output from the system is given in the form of voice assistance and vibration on the fist. Blind`s Vision Fist will navigate the user close to the object but the task of picking the object depends on the user

VI. FUTURE WORK

In the domain of Artificial Intelligence, there was only the capturing the object using Arduino Uno in

the existing system. At present, the work was successful to detect, recognize and track the object. And is used to avoids the user from touching the hot object. Input given to Blind`s Vision Fist is a live video feed with a frame rate of 60-70fps. The output from the system is given in the form of voice assistance and vibration on the fist Thus, in the future, Character recognition, Navigation to multiple objects, Moving object catching would be undertaken.

VII. CONCLUSION

This paper presents a novel technique for assisting visually impaired people. The proposed system has a simple architecture and makes it user-friendly thus, making the subject independent in his/her home. The system also aims at helping the blind to navigate in his/her surroundings by detecting obstacles, locate his necessities, read signboards and texts. Preliminary experiments show promising results the user can freely navigate in his surroundings safely. The system is made much more user-friendly by accepting speech as the input to access his basic necessitate.

VIII. REFERENCES

[1]. Kiran G Vetteth, Prithvi Ganesh K, Durbha Srikar “Collision Avoidance Device For Visually Impaired”, INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 2, ISSUE 10, OCTOBER 2013

[2]. S. Sivakumar, T. M. Pavithra, K. Pooja Shree, S. Reshma “Intelligent Virtual Assistant for Visually Impaired People using Raspberry Pi”, International Journal of Engineering Science and Computing, Issue 3, March 2020.

[3]. The Linn, Ali Jwaid, Steve Clark, “Smart Glove for Visually Impaired”, IEEE, Issue 18, July 2017.

[4]. Steven Edwin Moore, "Drishti: An Integrated Navigation System for the Visually Impaired and Disabled”, IEEE, Issue 8 October 2002.

[5]. Anitha. J, Subalaxmi. A Vijayalakshmi. G, “Real-Time Object Detection For Visually Challenged Person”, International Journal of Innovative Technology and Exploring Engineering, Issue-8 June 2019.

[6]. Heika Gada, Vedant Gokani, Abhinav Kashyap, Amit Deshmukh, "Object Recognition for the Visually Impaired " IEEE, Issue 4 January 2019.

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