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Proposed System on Object Detection for Visually Impaired People

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ABSTRACT

Walking safely and confidently without any human assistance in urban or unknown environments is a difficult task for blind people. Blind people face several problems in their life, one of these issues that is the most vital one is identification the hindrances when they are walking. When moving from one place to another, they need help of other people around. Their independency in strolling is lost. Sticks can be usable but are not that reliable nor does everyone have it. A visually impaired person needs absolution to help him overcome problems in navigation due to his disability. The project is mainly focused on providing a type of visual aid to the visually impaired people. With the current advances in comprehensive innovation, it is conceivable to stretch out the help given to individuals with visual hindrance during their mobility. In this context we propose system in which an Android smartphone is used to help a blind user in obstacle detection and navigation. Today, smartphones are available to anyone. In fact, they have become the most common device available everywhere. Hence, this project uses an Android smartphone that uses its camera to identify objects in surroundings and gives an audio output. The hearing ability of the user tries to fulfil his seeing ability.

Keywords :- Detection circuit, MATLAB, Ultrasonic, Pixel, Chromaticity, SIFT, SURB, ORB

I. INTRODUCTION

Visually Impaired People confront many problems in moving from one place to another, i.e., navigation. Vision is human's power to notify him of the obstacles in his way. A solution which is easily available is needed to solve the problems of blind people.

The application developed can detect the objects in the user's surroundings. It can alert the user of the obstacles in his pathway and this way helps the user to navigate from one place to another saving him from tripping anywhere. It will also solve the problem of keeping a special device or a walking stick. The reason it is more reliable is because it is developed on the Android operating system and Android-based smartphones are very common and highly available almost everywhere. In fact, it's one of the most used mobile operating system. This makes the application convenient to get.

Thus in this paper a model has been proposed which makes the use of smartphone, a common device available to anyone and used technology to make an application which can help the blind user detect objects in his surroundings and help him in navigating from one place to another. The output of the system is in audio form that can be easily understandable for a blind user.

II. LITERATURE REVIEW

This paper [1] proposes a system in which two cameras are put on the glasses of a blind person.

The proposed work has a wearable device and consists of a blind stick and sensor based detection circuit. It uses an infrared sensor which uses infrared waves to scan the surroundings of a person. It uses object detection and gives them audio information about it. [1]

The system must be trained about object information. Feature extraction is also a part of the process. [1]

Another system [2] proposed in this paper focuses on giving the information about what are the different types of obstacles in front of the user, their size and their distance from the user. [2]

MATLAB Software is used for signal processing. The camcorder is used for recording videos. Video processing methods are used after that. [2]

The output of this system not only gives output in audio format but also vibration. A vibrating motor has been connected with an ultrasonic sensor. The ultrasonic sensor detects objects coming in its range and this makes the vibrating motor vibrate. [2]

This system [3] tries to detect multiple objects in an image. That is the core specialty of the system. It is a system where N object detectors are trained for N different objects. [3]

When an image is sent to the system, all object detectors do their work. If an object is found by a detector, it will mark its boundary and label the object name. After the process completes for all N detectors, the image is displayed with all the tags. Moving a cursor over an object in the image shows the complete boundary of the object with its label beside. [3]

This system is a little slower than other systems because a lot of object detectors are working on a single image. The performance can increase by allowing more than one object detectors to run in parallel. [3]

Yet there is another system [4] which first subtracts the current frame from the previous one and obtains a maximum value of the difference between two pixel values. Maximum value > given pixel = Foreground. Maximum value < given pixel = Background. [4]

The brightness distortion and Chromaticity distortion are also taken care of in this project by using shadow detection technique theory. [4]

From a video, objects are detected by taking templates out of the video. Of course this is not the best way. It works if the object is present in the whole video. [4]

Compared to other features like SIFT, Shape features are better used to detect objects in images. Hence, in this project, the local features are replaced by Shape features. [4]

III. ARCHITECTURE DIAGRAM

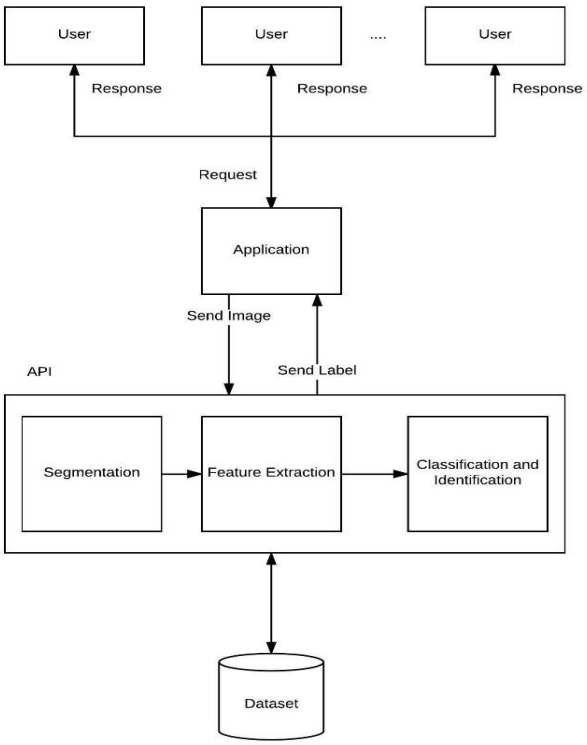

Fig. 1. Architecture of System

The above diagram is the architectural / conceptual diagram of our system. It is a four layered architecture. Through this conceptual design we are trying to show the interaction between the different layers of our system, mainly dividing into four main components as mentioned above.

The first layer depicts the users, which is the external layer of our entire architecture. The figure shows an interaction between the users and the middle layer which is the Android application.

All the requests of the users are taken by the Android application and are given to the API for processing. The API uses a dataset which contains thousands of labelled images and compares the current image with the images in the dataset.

After classification and identification, the API sends the label of the current image to the application.

IV. ABOUT SYSTEM

The output of the system is in audio form, which can be easily understandable for a blind user.

The application developed can detect the objects in the user's surroundings. It can alert the user of the obstacles in his pathway and this way helps the user to navigate from one place to another saving him from tripping anywhere. It will also solve the problem of keeping a special device or a walking stick. The reason it is more

reliable is because it is developed on the Android operating system and Android-based smartphones are very common and highly available almost everywhere. In fact, it's one of the most used mobile operating system. This makes the application convenient to get.

For Image Processing purposes, we use the OpenCV Library. Apart from OpenCV the well-known Google Cloud Vision API which is used for interpret the contents within a photo has the power to have our pictures compared with images from Microsoft's COCO Dataset. The information about external modules used for creating the application are as follows:

A. OpenCV

OpenCV (Open Source Computer Vision) is a library of programming capacities which for the most part went for constant PC vision. Initially created by Intel, it is currently kept up by Itseez and supported by Willow Garage. The library is cross- platform and free for use under the open-source BSD license. OpenCV bolsters the Deep Learning Structures Torch/PyTorch, Caffe & TensorFlow. [5]

B. Google Cloud Vision API

Google Cloud Vision API empowers experts to comprehend an object in an image or a photo by speaking to fruitful machine learning models in a simple to utilize REST API. It rapidly characterizes pictures into a large number of classifications (e.g., "sailboat", "Eiffel Tower"), distinguishes singular questions and faces inside pictures, and finds printed words contained inside pictures. One can build metadata on picture index, direct hostile content, or empower new advertising scenarios through picture assessment investigation. Analyze images uploaded in the request or integrate with your image storage on Google Cloud Storage. [6]

C. Microsoft COCO Dataset

Microsoft is proceeding to beat the enterprise piece chain drum, revealing on Aug. 10 an open structure intended to enhance its execution, secrecy, and administration. [8]

The Coco Framework - another approach to state "ordered consortium" - is proposed to work with any record tradition and work on any working structure and hypervisor that sponsorships a perfect Trusted Execution Environment (TEE), or secure area of a processor. The Framework can be used on-premises and/or in various vendors' clouds, officials said. [8]

V. IMPLEMENTATION METHODOLOGY

The application mainly uses Android along with many supported libraries. The camera on an Android smartphone will be used to capture an image of the surrounding which will be stored in Android's memory. This image will be processed by using libraries like OpenCV and Google Cloud Vision API.

Google Cloud Vision API uses Google Cloud. The Image is sent to the cloud through the internet. It uses COCO dataset to compare the input image with millions of other images. The process gets completed and the objects are identified in the image. The user gets informed about the identified objects present in his surroundings via an audio output.

Fig. 2 ahead shows the Module Diagram of the system.

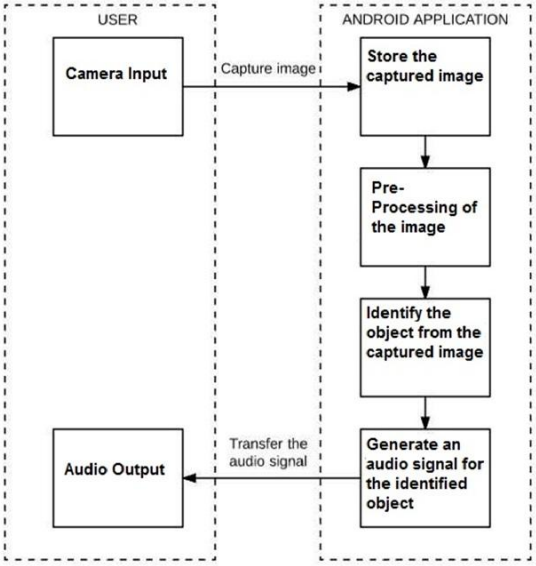

Fig. 2. Module of System

VI. MOTIVATION

The need of navigation help among blind people and a broader look at the advanced technology becoming available in today's world motivated us to develop this project. Technology is something which is there to ease tasks for human beings. Hence, in this project, we use technology to solve the problems of visually impaired people. The project aims to help users in navigation with the use of technology and our engineering profession motivates us to use the technology we have.

VII. SEQUENCE DIAGRAM

Sequence diagram is a communication outline that shows how objects work with each other and in what order. It is a develop of a message sequence chart. A sequence diagram indicates question cooperation masterminded in time arrangement. It portrays the items and classes engaged with the situation and the arrangement of messages traded between the articles expected to complete the usefulness of the situation.

Sequence diagrams are normally connected with use case realizations in the Logical View of the framework a work in progress. Sequence diagrams are ordinarily connected with utilize case acknowledge in Logical View of the framework being worked on. Sequence diagrams are sometimes called event diagrams or event scenarios.

The above sequence diagram of our framework clarifies the stream of the framework, that is, what action takes place first and what action will follow the previous action. First, the user starts the application and captures the image of the surrounding in front of him or of the object in front of him which he wants to identify. The application digitizes and stores the captured image in the memory. It is then used to detect objects in other images. This image will be processed by using libraries like OpenCV and Google Cloud Vision API.

The OpenCV library contains many Image Processing algorithms and Google Cloud Vision API has the power to compare the input image with millions of other images using Microsoft's COCO Dataset. The API receives image data, performs image segmentation, feature extraction, classification & identification functions and use the COCO dataset to get the image label. The application then converts the label into audio and sends it via the speaker.

The user gets informed about the identified objects present in his surroundings via an audio output.

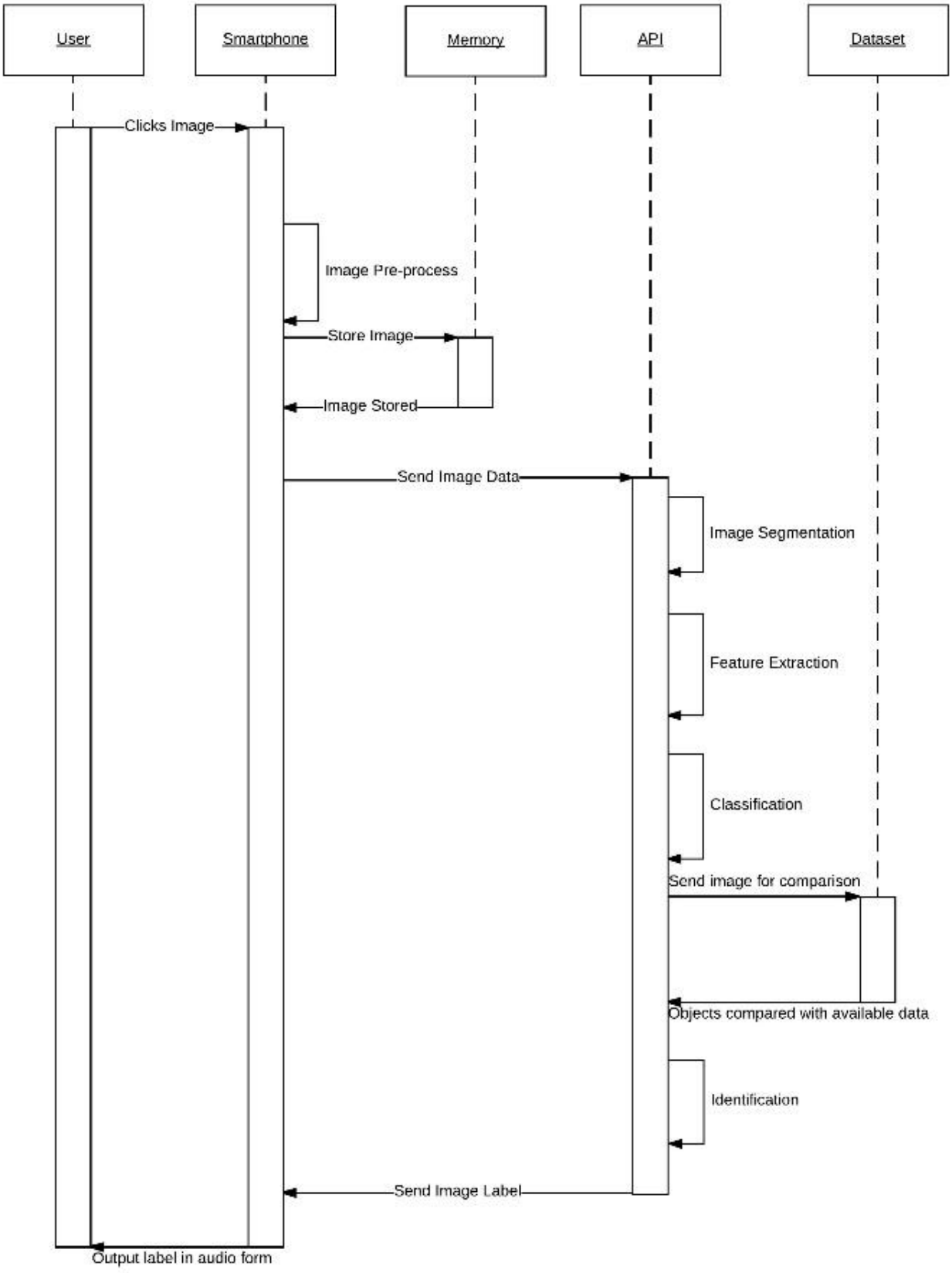

Fig. 3. Sequence Diagram

VIII. CONCLUSIONS

The project started with the motivation and the idea to solve the problems of visually impaired people. Many methods were found to implement object detection and the usage of OpenCV Library and Google Cloud Vision API was the best choice. The OpenCV library contains many useful Image Processing Algorithms like SIFT, SURF, ORB, etc. which can be used to detect objects in the image. Google Cloud Vision API uses Google Cloud and sent the image to the cloud which will use the COCO dataset to compare the input image with millions of other images. The project is developed on Android and since it is developed by Google, there would be almost no compatibility issues.

Some limitations to this system are that the smartphone on which this application will be used will have to be switched on and should have enough battery. It has to be carried by the user with him/her all the time. A wearable device is more convenient as out hands become free in that case.

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