3rd Eye: A Smart Glass For The Blind

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Contents

Chapter 1

Introduction

The objective of this project is to build an inexpensive eye glass, typically for the blind, with which they can, not only feel the object, but hear the name of the object through a headphone. The project is named **3rd Eye**, which was chosen from the idea that the glasses were the 3rd eye for the blind people.

The blind people always need the support of another member of their family to help them in performing daily chores. But, at times, when other members are busy at their work, it becomes difficult for them. So, in these kinds of situation, the **"3rd Eye"** glasses will aid them by telling them about an object in front of them, which by hearing he/she will know where to go and what to touch or not to touch so that they can be safe and not hurt themselves.By wearing the glasses, he/she can press a button attached to the glasses and this will take a picture of the object in front of them. Then the microprocessor attached to the glasses performs "Image Recognition" technique and informs the person about the object through a headphone, which is also attached to the glasses.

We plan on approaching this project through several steps. First we will study the existing works on the same. Then we will gather the hardware required and then, we will start with the Coding part of our project. Lastly, we will attach all the hardware and combine it with the software.This report presents the background information about the project **"3rd Eye"**, description, budget of our project and expected timeline of our progress.

Chapter 2

Related Works

Our project is motivated from a project we found on a website "hackster.io" during our research period. It is called SIGHT: For The Blind, which is powered by Android Things and TensorFlow.

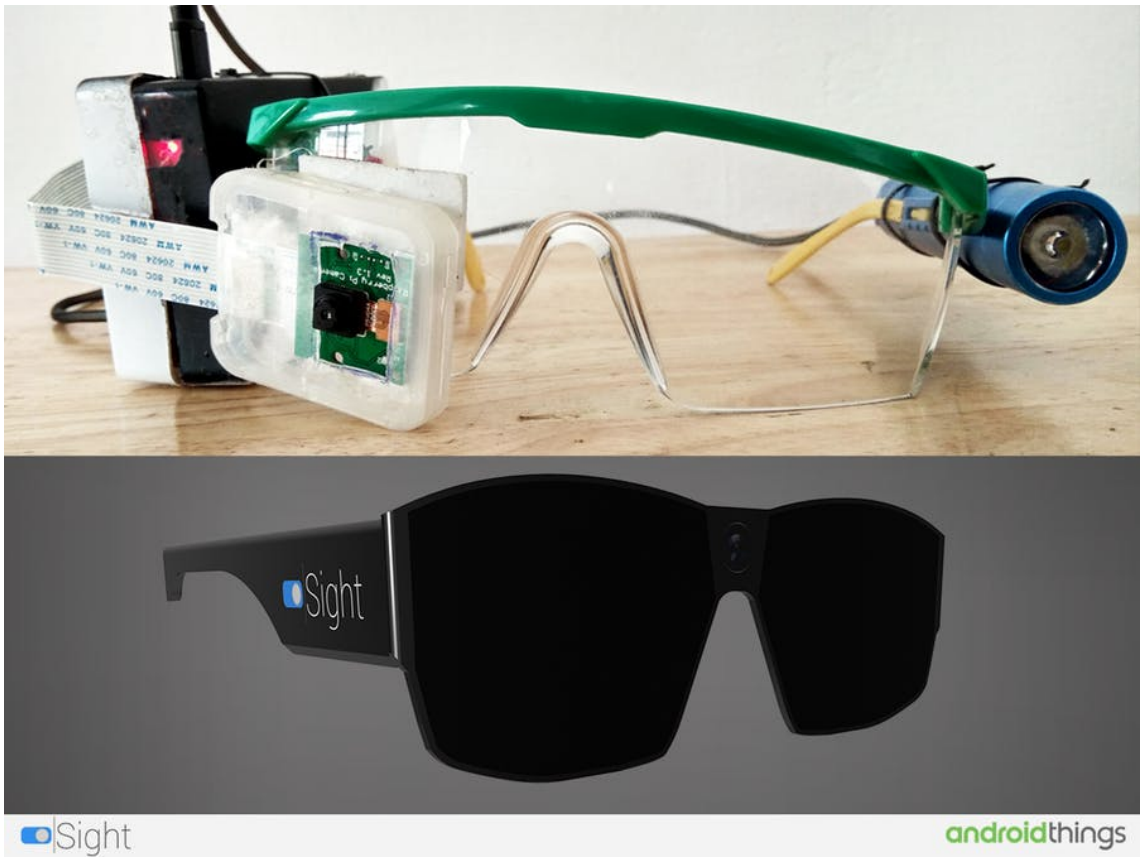

Figure 2.1: SIGHT

2.1 Review of SIGHT

The SIGHT is built with Raspberry Pi 3 and Raspberry Pi Camera Module and on the software side, Android Things and TensorFlow is used. It has a SparkFun Push button which is pressed by a person to activate the camera and take a picture. The picture taken is analyzed using TensorFlow and detect the picture. Then, the Sight will voice assist the person about that picture using a headphone.

2.2 Limitations of SIGHT

Though the SIGHT is a powerful tool, it has its own limitations. The glasses will not work with old Raspberry Pi Versions, like Raspberry Pi Zero, as Google Android Things is not supported by the old Raspberry Pi microprocessors.

2.3 Dominance of 3rd Eye over SIGHT

Our project, 3rd Eye, will work with all types of Raspberry Pi microprocessors. Also, our future work will include Face Recognition Techniques which can detect a person's face by taking a picture of the person and comparing it to the database. If the face is not available in the database, the user will hear "Unknown" through the headphone.

Chapter 3

Solutions & Methods

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3.1 System Overview

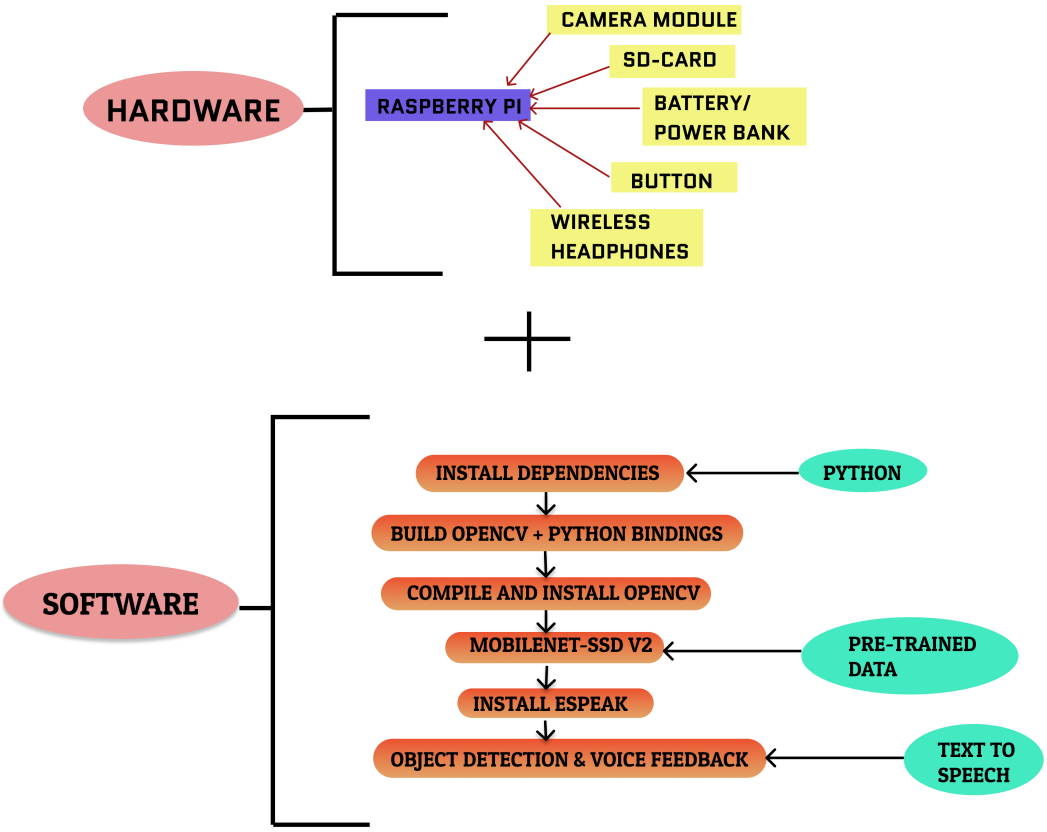

Figure 3.1: WORK FLOW

The above diagram illustrates the Work Flow Model of the '3rd Eye'. For the Hardware, we will have **Raspberry Pi 3** and we will be connecting **a Camera Module, SD card, Battery, a push button**

and a wireless headphone to the Raspberry Pi. For the Software, we will be using the **Python** Language and **OpenCV**. First, we will install all the Dependencies in Python and build OpenCV and Python Bindings. We will use a pre-trained data from **MobileNet-SSD V2** and perform Object detection and have a voice feedback through the headphone.

3.1.1 Detailed Design

(i) RASPBERRY PI 3

Figure 3.2: Raspberry Pi 3

It is an ARM based credit card sized SBC(Single Board Computer) created by Raspberry Pi Foundation. Raspberry Pi runs Debian based GNU/Linux operating system Raspbian and ports of many other OSes exist for this SBC.

Challenges: Sometimes, it is not possible to access the Pi over SSH because communication over SSH is disabled for a raspberry pi running a fresh install of the raspbian stretch.

Solution: We need to activate communication over SSH under the raspberry pi's settings, with the PI connected to a monitor.

Figure 3.3: Camera Module

(ii) **CAMERA MODULE**

The Pi camera module is a portable light weight camera that supports Raspberry Pi. It communicates with Pi using the MIPI camera serial interface protocol. All current models of Raspberry Pi have a port for connecting the Camera Module. There are two versions of the Camera Module:

1. **The standard version**, which is designed to take pictures in normal light.

2. **The NoIR version**, which doesn't have an infrared filter, so you can use it together with an infrared light source to take pictures in the dark.

Challenges: Raspberry Pi Camera not working. OR the picture taken by the Camera might be blacked out.

Solution: To be able to use the pi camera, it has to be enabled on the pi. This should, however, be done after the PI has been updated and upgraded.

(iii) **SD Card**

The SD card is a key part of the Raspberry Pi; it provides the initial storage for the Operating System and files. Storage can be extended through many types of USB connected peripherals.

(iv) **Battery/Power Bank**

To power up the Raspberry pi, we use a power bank and connect it via a USB port. We can also use batteries.

(v) **Wireless Headphone**

We will need a headphone so that the person can hear the name of the object in front of them.

(vi) **Push Button**

Figure 3.4: Push Button

The push button will act as a trigger for the camera to click a picture.

3.1.2 Implementation

I. **Python**

Python is an interpreted, high-level, general-purpose programming language. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects. Python is dynamically typed and garbage-collected. It supports multiple programming paradigms, including structured (particularly, procedural,) object-oriented, and functional programming.

II. **OpenCV(Open source Computer Vision)**

OpenCV (Open source computer vision) is a library of programming functions mainly aimed at real-time computer vision. The library is cross-platform and free for use under the open-source BSD license. OpenCV supports some models from deep learning frameworks like TensorFlow, Torch, PyTorch (after converting to an ONNX model). It promotes OpenVisionCapsules. which is a portable format, compatible with all other formats. **We will bind Python and OpenCV for Image Processing and Object Detection.**

III. **Mobilenet SSD V2**

Mobilenet SSD V2 is a pre-trained data set using which we will train our own dataset for object detection.

IV. **Object Detection With Python and OpenCV** Object Detection is a computer technology related to computer vision, image processing and deep learning that deals with detecting instances of objects in images and videos. We will use Python and OpenCV for object detection.

V. How the work is split among team members

Chapter 4

Limitations & Challenges

4.1 Budget

Price List		
Items	Quantity	Price
Raspberry Pi 3 Model B	1	Tk. 4,500
Transcend 32GB MicroSD Card	1	Tk 400
Raspberry Pi Camera Module V2 - 8	1	Tk 1,200
HDMI Cable	1	Tk 200
Push Button, Wires	3, 1 Set	Tk 100
OTG Cable	1	Tk 200

4.2 TimeLine

Project Timeline			
SL	Date	Task(s)	Responsible Person(s)
1	Week 1	Research related to topic	All
2	Week 2	Circuit Diagram,Task list	Marjan
4	Week 3	Collecting Hardware Components	Marjan,Sumon,Syed
5	Week 4	Workflow diagram	Keya
6	Week 5	Study on Python,OpenCV	All
7	Week 7	Setting up Raspberry PI	Marjan
8	Week 8	Installing OpenCV on PI	Marjan
9	Week 9	Coding	Marjan
10	Week 10	Project Proposal	Keya,Marjan
11	Week 11	Project Proposal	Keya,Marjan
12	Week12	Push Button implementation , coding	Marjan

4.3 Overheads

A. Our Design Overhead includes buying hardware components from shops or online. The components will cost around Tk. 7,000

B. We will be working over the 2 semesters, that is, approximately 8 months on this project. Hence, our implementation overhead will be 8 months.

C. Our computational overhead will be coding the object detection process in Python and OpenCV and implementing it on the Raspberry PI.

Chapter 5

Conclusion

The 3rd Eye Smart Glass will be a user-friendly glass for the disabled, especially the blind. The glass will be able to detect objects in front of it and the person wearing it will be able to hear the name of the object through the wireless headphone. We are studying the necessary programming language and the necessary materials. We will also try to enable face recognition capabilities in our smart glass. We will try our best to bring up the project together and make it work.

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[1, 2, 3, 4, 5, 6, 7]

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