Smart Optical Assist for the Visually Impaired Person

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Abstract- People who are completely blind or have limited vision typically struggle to navigate unfamiliar situations by themselves. It might be tough to travel or even stroll through a busy street. As a result, many persons with impaired vision seek the help of a sighted friend or relative. It is also harder for them to maintain track of their daily routines, and the typical blind walking stick has its own set of problems and restrictions. It is of little use to these members of our society. This study was inspired by the inability of physically disabled persons to walk, and therefore attempted to make their daily lives as pleasant and trouble-free as possible. By combining several sensors with the Raspberry Pi, proposed system is created a smart glass. The functionality and working principle of smart glasses, and the variety of activities it may perform, are presented in this article. This work is unique in that it processes data from the device to give a better navigation and day-to-day activity solution.

Index Terms- object detection, face recognition, voice processing, OpenCV, Raspberry Pi

I. Introduction

Over the last few decades, the number of visually impaired persons has increased across all age categories. According to the WHO, there are 285 million individuals worldwide who are visually impaired, 39 million of whom are blind, and 246 million who have poor vision [1]. Losing one's sight or eyesight makes it harder to communicate with people and to expand one's knowledge and experience. The visually impaired are often placed in separate courses and treated differently, which has resulted in them being isolated from society and prohibiting them from engaging with others and obtaining the same amount of information as a regular person.

On the other hand, according to the EnableMart online website, new aids and technologies created for the visually impaired are deemed costly, with prices ranging from $200 to $3000 or more. The cost is determined by the work that the device or program is doing, with the majority of them being built for single-task use. Considering the above, visually impaired persons are the focus of numerous academics who are attempting to make their life easier in a variety of ways.

This study introduces a novel spectacles that are designed to assist visually impaired persons in broadening their horizons by describing live situations in front of them. The scenarios are categorized into a mode format that users may alter as needed, such as speech processing, object detection, and facial recognition.

II. IDENTIFY, RESEARCH AND COLLECT IDEA

A. Quantitative Research

Quantitative data was gathered for this research using existing data by analyzing research publications based on blind people. Further, to identify the best tools and techniques, used some publications and other internet resources. Those studied resources are [18] [19] [20] [21] [22] [23]. These resources describe the best tools to carry out the research with current technology.

B. Qualitative Research

Interviews with patients, parents, and guardians from various family background were used to collect qualitative data, and the predicted device was assessed according to the patient, parent, and guardian. The study of each research's benefits and drawbacks aided in improving the predicted device's performance.

C. Experimental Research

The system consists of two circuits. One circuit for the Raspberry pi 4 and the other one is for Arduino.
Raspberry pi 4 used to monitor the distance between patient and object, to identify the face and objects. The Raspberry pi 4 connected with laptop using Ethernet cable. Installed Raspbian OS to the SD card and create SSH folder in SD card. Then power on the Raspberry Pi. OpenCv is the suitable software for image processing. Therefor Installed OpenCV software and OpenCV libraries which use image-processing and installed eSpeak to voice output. Create wire connections after completing the installations.

Figure 1: Camera module connection to Raspberry pi

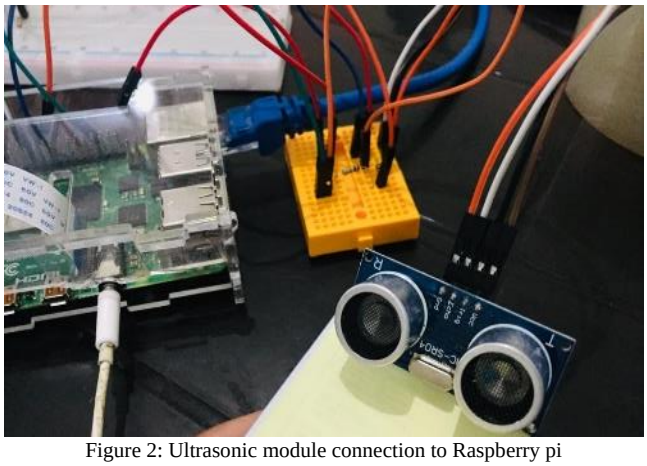

Figure 2: Ultrasonic module connection to Raspberry pi

TABLE 1: RASPBERRY PI MODULE AND POWER CONNECTION

Module	Raspberry pi	Power
Camera cable	Camera module port	_
Headset	Audio Jack	_

_	Micro USB power port	C model Cable

Created the file named as “haarcascade_frontalface_default.xml” file created to train real-time dataset. Then created a file named “ssd_mobilenet_v3_large_coco_2020_01_14.pbtxt and “frozen_inference_graph.pb” which includes a trained data set to face recognition and objects detection.

Arduino is using to send a message to parent or guardian during any emergency situation by clicking on a button. Then created a connection between Arduino Uno board with limit switch and GSM module.

TABLE 2: ARDUINO UNO MODULE AND POWER CONNECTION

Ultrasonic sensors	**Raspberry pi**
Vcc Pin	5v pin
Trig Pin	18 Pin
Eco Pin	24 Pin
Ground Pin	Ground Pin

TABLE 3: ARDUINO CIRCUIT CONNECTION

GSM	**Adopter**	**Arduino Uno**	**Limit Switch**
Pin Vcc	+ Side	-	-
Pin Tx	-	11 Pin	-
Pin Rx	-	12 Pin	-
-	-..Side	Ground	-
-	-	5v Pin	Normally on
-	-	9 Pin	Common

By using android studio and firebase, implemented the mobile app for the parents and guardian to find the place of the blind person. Further, patient can send a message to the parent or guardian by clicking on the button in Arduino.

```
package com.example.blineman;

public class LocationHelp {

    private double Longitude;
    private double Latitude;

    public LocationHelp(double longitude, double latitude) {
        Longitude = longitude;
        Latitude = latitude;


    }

    public double getLongitude() { return Longitude; }

    public void setLongitude(double longitude) { Longitude = longitude; }

    public double getLatitude() { return Latitude; }

    public void setLatitude(double latitude) { Latitude = latitude; }
}
```

Figure 3: Get location details

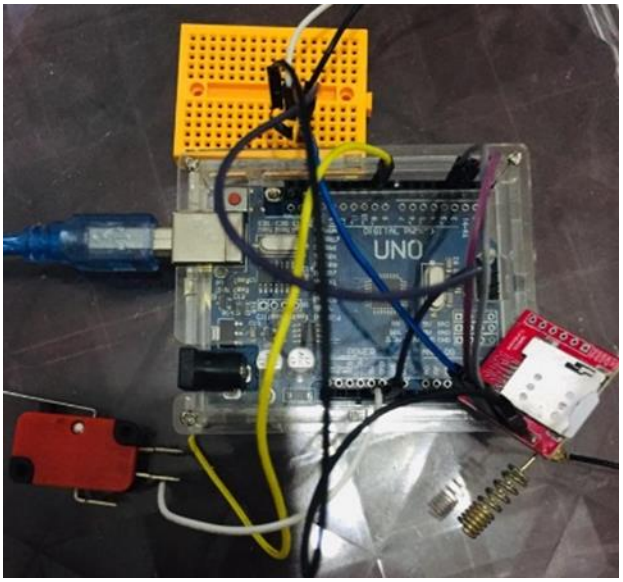

Figure 4: Connection between GSM Module, Arduino Uno board and Limit switch.

III. WRITE DOWN YOUR STUDIES AND FINDINGS

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Using Raspberry pi 4, Camera module pi 3, Ultrasonic sensors and headphones this system developed for object recognize, facial recognize and distance measuring.

Object detecting

Raspberry Pi 3 camera identify the objects which is in front of the camera. Also Result provides a voice output.

Figure 5: display the result of recognized object

Facial recognize

Figure 6: Identify as known person

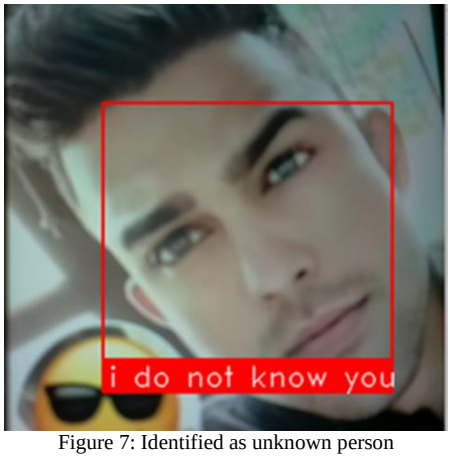

Figure 7: Identified as unknown person

Raspberry pi3 camera module able to identify person in front of the pi 3 camera and identifies whether the person is known or unknown. Also Result will provide voice output.

Distance Measuring

Ultrasonic sensor measures the distance between each object. When measurement of object less than 18cm then system will provide voice output as “Obstacle nearby ‘the Distance’ ”.

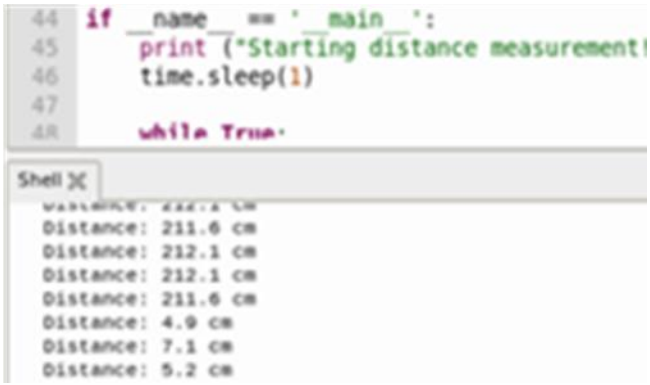

Figure 8: Output the distance

Send emergency message

When the blind patient clicks on the limit switch GSM Module, it sends a message to the related guardian. That will help to the blind person to respond in emergency situations.

Figure 9: Sent messages

Tracking Application

The Application developed using Java, Google API and Android studio send the location of blind person to the parent or guardian.

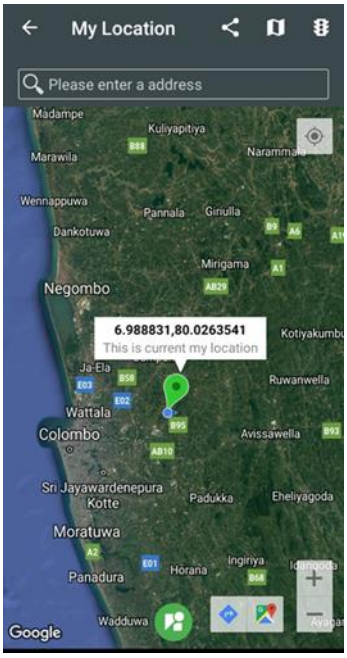

Figure 10: Shows location

Prototype model

The smart optical assist project is implemented with the use of perfect software solution and perfect module, and it reduces difficulties which are faced by the blind persons and giving them more independence in their day-to-day life. Therefore, this proposed system is the best solution for visually impaired people.

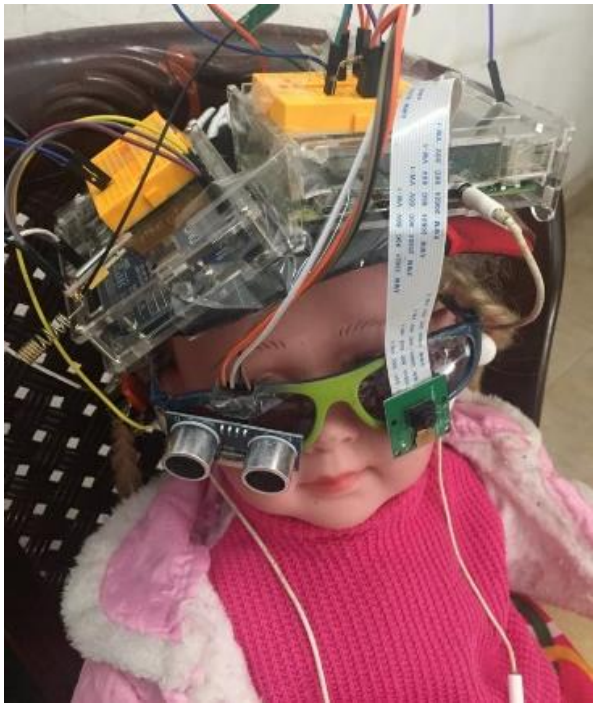

Figure 11: Prototype design of the system

IV. IMPROVEMENT AS PER REVIEWER COMMENTS

More optimization functions should be introduced in the future, and user testing data and comments should be provided for greater development. As a consequence of the experiment findings, it has been determined that camera quality is a critical component; thus, a better camera should be added to the system as a recommendation to increase the accuracy of the results. It may also be used with a neo PI camera to take photos in low-light conditions.

Furthermore, by implementing text- reading technology and a waterproof design, blind people will be able to read books and use this device underwater and on rainy days.

V. CONCLUSION

People who are visually impaired are either completely blind or have very low vision that is legally defined as blindness. The number of visually impaired persons has risen in recent decades, and the challenges they confront in daily life are getting increasingly severe as a result of new technology, population growth, buildings, , and other factors. This initiative aims to assist these individuals in expanding their independence by providing them with an audio description of live situations provided through an earphone. The main software package for the project is OpenCV, and the single board computer Raspberry Pi 4 serves as the platform.
The project also makes use of a Camera Module Pi 3 to capture real-time objects and an earphone to speak the descriptions out loud. Also, it is developed an Android application to track the blind person using Android studio platform. The project is being conducted

with a focus on cost effectiveness, which is maintained as low as feasible; as seen in the cost analysis table above, the final prototype only cost $105.

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