VISION 3.0

20ECTE301 LIVE-IN-LAB 1 PROJECT REPORT

Submitted by

Dhanush Kumar. V	**-**	**412520106026**
Kishore. K	**-**	**412520106076**
Sriram Santhosh Rajkumar	**-**	**412520106168**

In Partial fulfilment of Live-in-Lab 1

Project work in

ELECTRONICS AND COMMUNICATION ENGINEERING

SRI SAIRAM ENGINEERING COLLEGE (AUTONOMOUS),

SAI LEO NAGAR, CHENNAI-44

ANNA UNIVERSITY: CHENNAI 600 025

MARCH - 2022

ANNA UNIVERSITY: CHENNAI 600025

BONAFIDE CERTIFICATE

Certified that this project report **“VISION 3.0”** is the bonafide work of **“Dhanush Kumar. V (412520106026), Kishore. K (4125201062), and Sriram Santhosh Rajkumar (412520106168)”** who carried out the Live in Lab-1 project work under my supervision.

Submitted for project Viva – Voce Examination held on **2nd March 2022**

SIGNATURE

DR. J THAMILSELVI

PROJECT SUPERVISOR,

Associate Professor,
Department of Electronics
and Communication
Engineering, Sri Sairam
Engineering College,
(Autonomous)
Chennai-600 044

SIGNATURE

DR. S SUMATHI

LIVE IN LAB INCHARGE,

Associate Professor,
Department of Electronics
and Communication
Engineering, Sri Sairam
Engineering College,
(Autonomous)
Chennai-600 044

SIGNATURE

DR. J RAJA

PROFESSOR,

Head Of the Department,
Department of Electronics
and Communication
Engineering, Sri Sairam
Engineering College,
(Autonomous)
Chennai-600 044

INTERNAL EXAMINER **EXTERNAL EXAMINER**

ACKNOWLEDGEMENT

We thank our Founder, Chairman **Thiru. MJF. Ln. LEO MUTHU** for his great endeavour to establish this institution and stand as a guidance figure.

We also thank our CEO, **Mr. J. SAI PRAKASH LEO MUTHU,** and Principal **Dr. K PORKUMARAN** for their kind cooperation and inspiration.

We thank **Dr. J. RAJA**, Head of the Department, Electronics and Communication Engineering, for giving us the freedom to carry out the project work in the chosen domain.

We thank our Project Coordinator **Dr. S. SUMATHI**, Associate Professor, for her constant support right from the commencement of the project work and for providing us with necessary details about the presentation and documentation.

We thank our project guide **Dr. J. THAMILSELVI**, Associate professor, for encouraging and guiding me in each step of my project progress and providing necessary insight on respective fields related to the project.

Our gratitude extends to the Staff of the ECE Department, whose words of encouragement kept our spirits high throughout the course of the project. We thank the entire people who contributed directly and indirectly to the completion of this project.

ABSTRACT

People blind have difficulties moving around, reading text, and recognizing objects and humans. They are not much aware of the objects, text, and proximities in their surroundings necessary to be safe and secure. White canes and assistive technologies to detect proximities exist as products in the market, but they don't help identify the object. They use touch, sound, smell, and taste sensations to identify an object. People may be visually impaired since birth or because of accidents, and they are in all age categories. Visually Impaired children have a difficult time recognizing unknown objects. Still, once the child becomes an adult, they can detect objects because of constant exposure to various objects. Here, the person takes a decent amount of time to store how the object feels, smells, sounds, and tastes. In the future, the person may later use all of this data stored in his brain to identify the object next time. People who are blind can read only Braille text, and Braille is not available everywhere they go. They can't read, interpret signs, logos, maps, text on paper, or all forms of text available publicly. That's where our project comes in.

Our project is object recognition, text recognition, and proximity detection systems that any adult or child can wear. With the press of the first button, the person can detect anything, and at other times the device is on standby to avoid unwanted recognition and confusion. Object detection works based on processing images captured by a camera module connected to a controller. With the press of a second button, text from the captured image is recognized based on the Optical Character Recognition (OCR) technique. Both object detection and OCR give an audio output to the individual via headphones connected to the controller. Ultrasound sensors are interfaced with the controller to detect the proximity of an obstacle to the individual. Proximity detection is always enabled, and no button is physically present to switch on or off this process. Hence, this project will make the life of a visually impaired person more independent, safe, stress-free, and hassle-free.

TABLE OF CONTENTS:

1. INTRODUCTION

1.1 Objective …………………………………………………………….. 1

1.2 Motivation ..………………………………………………………… 1

1.3 Relevance of the Project …………………………………………….. 2

1.4 Design Methodology ………………………………………………... 2

2. LITERATURE SURVEY ………………………………………………… 3

3. PROJECT DESCRIPTION

3.1 Existing System …………………………………………….......... 10

3.2 Proposed System ………………………………………………...... 11

3.2.1 Hardware Components ……………………………………… 12

3.2.2 Software Requirements …………………………………….... 22

3.2.3 Working Principle ……………………………………….…..... 25

3.2.3.1 Proximity Detection ……………………………….... 25

3.2.3.2 Object Detection …………………………………… 26

3.2.3.3 Optical Character Recognition (OCR) ……………... 27

4. RESULTS AND DISCUSSION …………………………………………... 29

5. CONCLUSION AND FUTURE SCOPE

5.1 Conclusion ……………………………………………………….... 30

5.2 Future Scope ……………………………………………………… 31

6. REFERENCES ………………………………………………………… 32

CHAPTER - 1

1. INTRODUCTION

1.1 Objective:

To make a device that will help the visually impaired people:

- Detect surrounding objects
- Detect proximities between objects and themselves
- Hear text with the help of OCR and text to speech converter.

1.2 Motivation:

Visual impairment refers to vision loss or any functional limitations in the visual system. Citing WHO reports, around 2.2 billion people worldwide have near or distance vision impairment. At least 1 billion people have a severe or moderate visual impairment that could have been prevented or has yet to be addressed. The National Health Portal of India (NHP) says, “The leading causes of chronic blindness include cataract, refractive errors, glaucoma, corneal opacities, age-related macular degeneration, trachoma, childhood blindness, and diabetic retinopathy.”

Nearly 40 million people in India, including 1.6 million children, are blind or visually impaired due to uncorrected refractive error. India has 20.5% of the world’s blind and 22.2% of the world’s low-vision population, and 21.9% of the population with vision impairment. Children have had difficulties in their day-to-day lives and face discrimination due to their illnesses. A device that will contribute to making a part of their life independent by aiding them in hearing text from print or digital media, detecting objects, and detecting proximities will significantly help them live the negativities of society.

1.3 Relevance of project:

Blind people aspire to be independent, and navigation is one of their most significant difficulties. In their front view, they need to understand how far an obstacle is from them. Their proximity to obstacles is essential for their safety from colliding with objects and tripping over them. Knowledge can be obtained from books, but they are print media with information printed in the text.

Visually impaired people can't read the text, and it is convenient for them to get a narration of the content held in front. Distinguishing and determining day-to-day objects is a tremendous challenge without practice and experience. The person has to touch the object for a prolonged period and use other senses like taste, smell, and sound to determine objects. Eliminating risks and difficulties helps them live with confidence and better mental health.

1.4 Design Methodology:

- Ultrasonic sensors are used to detect proximities
- Camera module along with an object detection algorithm is used is to detect objects
- Camera module along with Tesseract OCR, text to speech converter, and OpenCV is used to convert from image to text to audio.
- Raspberry pi, a small SBC, is used to process the functions.

CHAPTER - 2

2. LITERATURE SURVEY

2.1 Rajendran, P. S., Krishnan, P., & Aravindhar, D. J. (2020, November). Design and Implementation of Voice Assisted Smart Glasses for Visually Impaired People Using Google Vision API. In 2020 4th International Conference on Electronics, Communication and Aerospace Technology (ICECA) (pp. 1221-1224). IEEE.

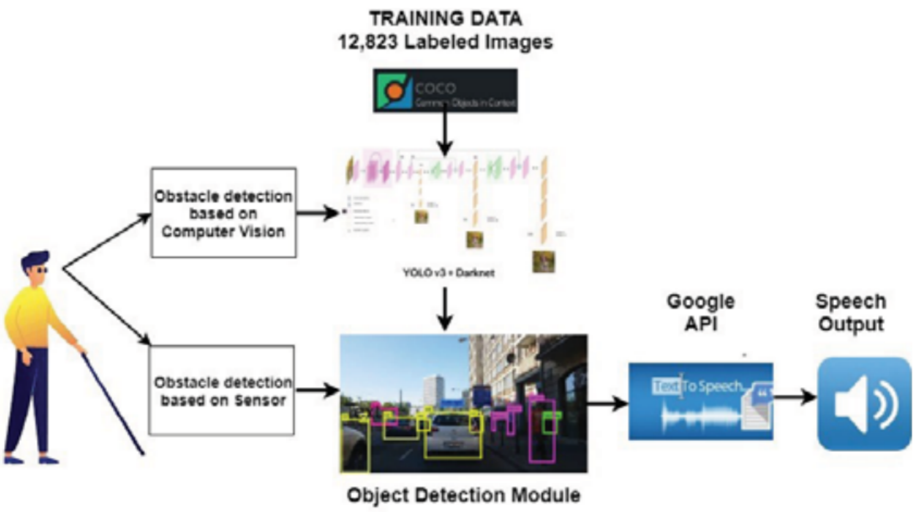


Figure 2.1 - Architecture diagram of Designing of voice Assisted Smart Glasses

This research work focuses on the development of a guidance system that uses smart glass paired with a sensor to continually capture images from the environment by the user wearable smart glass. The smart glass is equipped with a processor to process the captured images and objects will be detected to inform the user about the results of the image and the user would have a much more comprehensive view of the method. This system allows visually impaired people not only to inform about the travelling route and distance to the obstacle, but it also can inform about what the obstacle is. This smart glass can sense the distance from the obstacle and produce a warning to alert the user in advance. This application is developed to provide such a speech-based interface for the user.

2.2 Murali, M., Sharma, S., & Nagansure, N. (2020, July). Reader and Object Detector for Blind. In 2020 International Conference on Communication and Signal Processing (ICCSP) (pp. 0795-0798). IEEE.

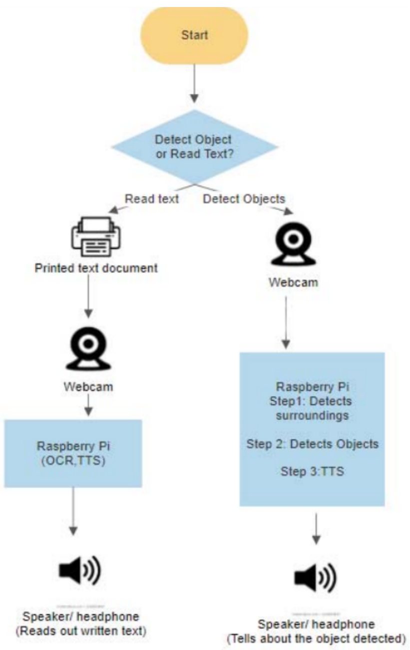


Figure 2.2 - Procedure of the Proposed System

This work aims to assist visually impaired people in reading text material and detecting objects in their surroundings. The input is taken in the form of an image captured from the web camera. This image is then processed either for the purpose of text reading or for object detection based on user choice. The Raspberry Pi acts as the microcontroller for processing the entire process. The text reading is supported by software named OCR. The read text is changed into an audio output using the TTS Synthesis. Other dependencies required for the process include Tesseract Library. Object Detection is another aspect of the project which is implemented using a TensorFlow Object Detection API. It is able to detect various objects in its surroundings and provide audio feedback about the same. The dataset can be trained on various different situations depending on the user's needs, thus making it scalable

2.3 Kumar, A., Reddy, S. S. S., & Kulkarni, V. (2019, November). An object detection technique for blind people in real-time using deep neural network. In 2019 Fifth International Conference on Image Information Processing (ICIIP) (pp. 292-297). IEEE.

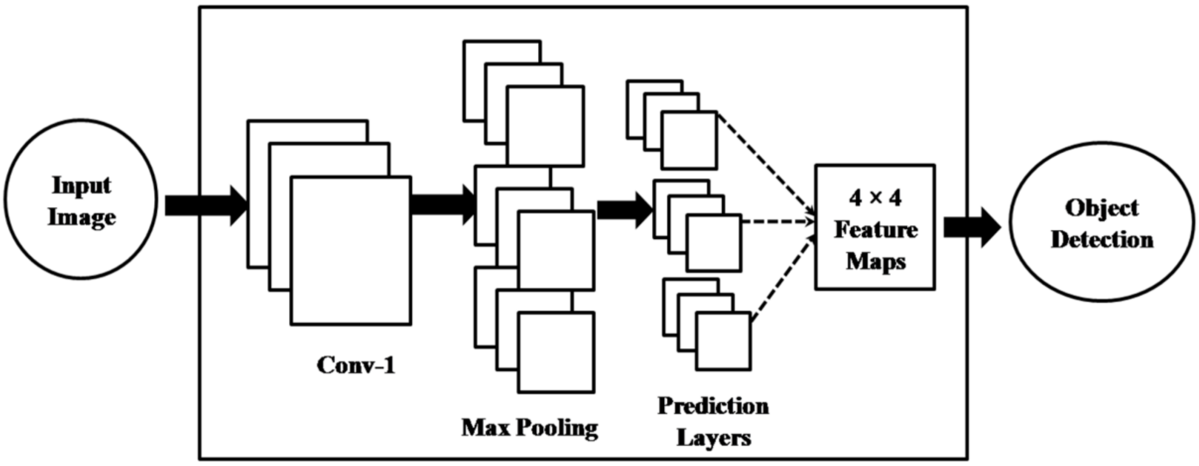


Figure 2.3 - The proposed approach

This project uses a convolutional neural network along with a single shot multibox detector algorithm to develop the proposed model. This model is composed of multiple layers to classify the given objects into any of the defined classes. Recent advancements in deep learning with image processing, enable us to develop this model. Our model takes colour images as input and train the mode until the error rate is less. We have tested our model by supplying some sample images. To increase the computational performance of the model we have used a single-shot multibox detector algorithm along with the help of the architecture of a faster region convolutional neural network. We also have calculated the accuracy for detecting the objects and found that the accuracy is acceptable compared to other existing schemes. For that, we have considered different parameters like mean average precision (MAP) and frames per second (FPS). The single-shot multibox detector algorithm uses standard VOC and COCO datasets. This model integrates the audio device, which will be helpful for blind people.

2.4 Nasreen, Jawaid, et al. "Object Detection and Narrator for Visually Impaired People." 2019 IEEE 6th International Conference on Engineering Technologies and Applied Sciences (ICETAS). IEEE, 2019.

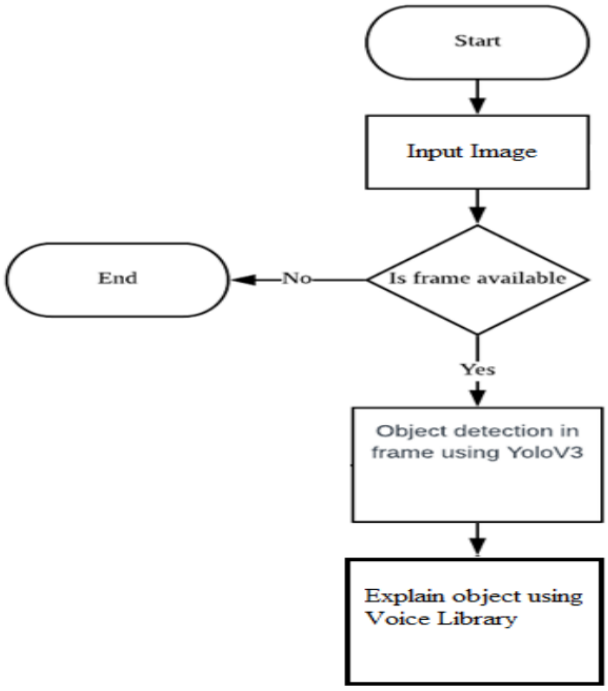


Figure 2.4 - Conceptual diagram for Application Backend

Machine Learning has gained attention since the introduction of high computing machines and the availability of huge amounts of data also known as big data. Today, machine learning is used in many types of industries from medical image processing to autonomous cars. Detecting objects in images has also become one of the important research areas and now computers are able to not only detect objects but also are able to draw bounding boxes on it. This is also known as computer vision. In this paper, we proposed the implementation of computer vision machine learning algorithms to detect objects and use it to aid visually impaired and blind persons. This paper explains how convolution neural networks are trained on ImageNet dataset that can detect objects and narrate detected objects information to the visually impaired person.

2.5 Ali, S. F., Muaz, M., Fatima, A., Idrees, F., & Nazar, N. (2013, December). Human fall detection. In INMIC (pp. 101-105). IEEE.

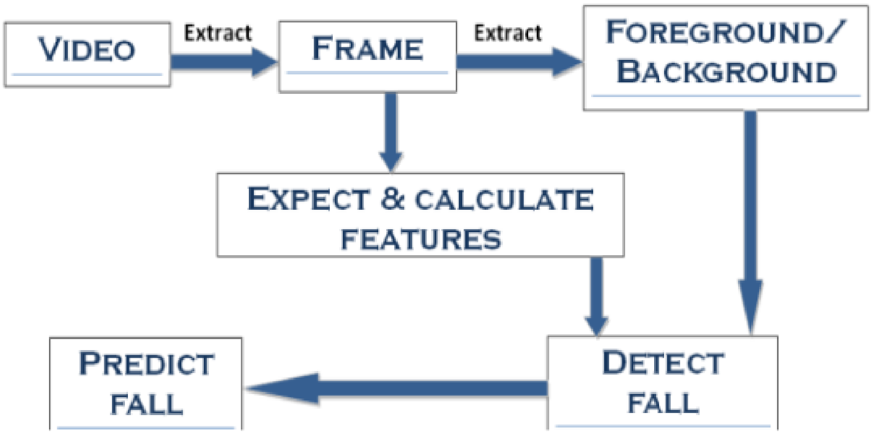


Figure 2.5 - Methodology Flow Chart

Fall-induced injuries are common in the elderly population. Delay or lack of medical care after the occurrence of a fall often results in injuries, sometimes severe, and can also lead to death in some cases. Falls, therefore, are critical occurrences for the elderly. Detecting falls automatically, as they occur, can lead to better timed medical care which can, in turn, reduce the subsequent medical complications. In this paper, we describe an effective fall detection system based on a videos dataset generated using multiple cameras. The approach proposed in this paper outperforms in accuracy as compared to the other existing approach. It uses several image descriptors or features that are fed to a number of classifiers to detect falls.

2.6 Agarwal, R., Ladha, N., Agarwal, M., Majee, K. K., Das, A., Kumar, S., ... & Saha, H. N. (2017, October). Low cost ultrasonic smart glasses for blind. In 2017 8th IEEE Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON) (pp. 210-213). IEEE.

Figure 2.6 - Ultrasonic Smart Glass

This device includes a pair of glasses and an obstacle detection module fitted in it in the centre, a processing unit, an output device i.e. a beeping component, and a power supply. The Obstacle detection module and the output device are connected to the processing unit. The power supply is used to supply power to the central processing unit. The obstacle detection module basically consists of an ultrasonic sensor, the processing unit consists of a control module and the output unit consists of a buzzer. The control unit controls the ultrasonic sensors and gets the information of the obstacle present in front of the man and processes the information and sends the output through the buzzer accordingly. These Ultrasonic Smart Glasses for Blind people is portable device, easy to use, light weight, user friendly and cheap in price. These glasses could easily guide blind people and help them avoid obstacles.

2.7 Kim, J. H., Kim, S. K., Lee, T. M., Lim, Y. J., & Lim, J. (2019, October). Smart Glasses using Deep Learning and Stereo Camera. In 2019 IEEE 8th Global Conference on Consumer Electronics (GCCE) (pp. 294-295). IEEE.

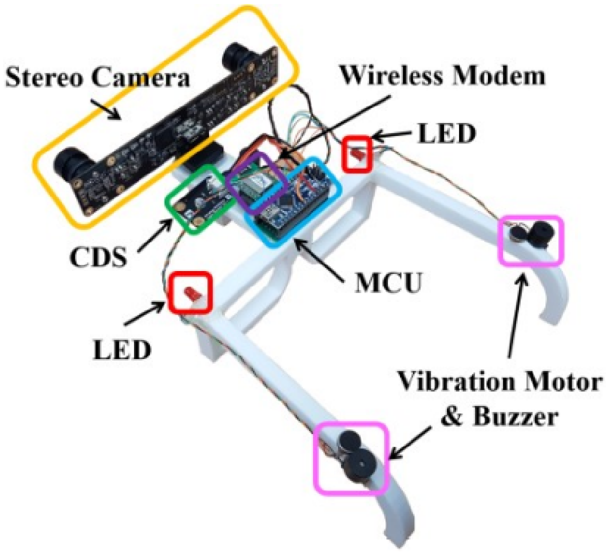


Figure 2.7 - The developed smart glasses using a stereo camera and deep learning

Blind people generally use a cane or highly trained guide dogs for safe walking. In the case of the existing blind cane, there is a disadvantage that it cannot cope quickly with each changing situation. There is a cost for managing guide dogs. In this paper, we propose smart glasses using deep learning and stereo cameras to overcome these disadvantages. A stereo camera calculates the distance between the user and the obstacle and then informs the dangerous level by the vibration motor and sound. In addition, the location of the user is informed using LED to prevent accidents at night. We use YOLO v3 (You Only Look Once version 3), one of the deep learning algorithms, to inform the user of the type of obstacle to the user.

CHAPTER - 3

3. PROJECT DESCRIPTION

3.1 Existing System

There is an existing system that is capable of detecting objects and reading text using OCR. Other than that, there is another system that has proximity detection and object detection systems together. The proximity detection system is present in smart white canes and gives a buzzing sound when the individual gets close to an obstacle above a certain limit. The system gives audio output for the object detection and OCR text to the individual in English and a few other languages. These three technologies will be beneficial to visually impaired people to a great extent but are not present together in one device.

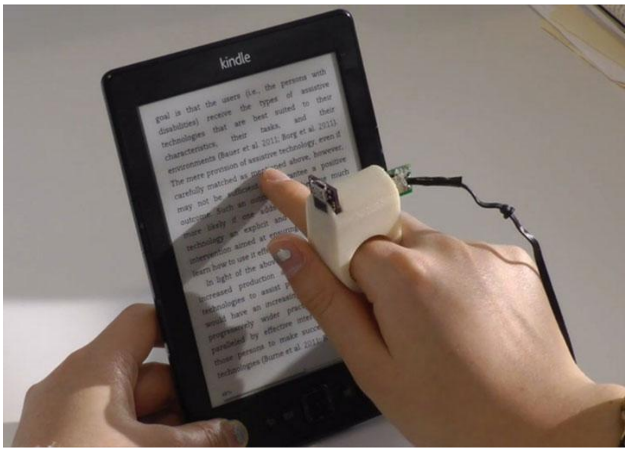


Figure 3.1 - OCR

Figure 3.2 - Objection Detection

As of now no Indian Languages are present in the existing system. In India there is a widespread population of visually impaired people and having English and foreign languages as options for the Indian community is not at all a good choice. The object detection process can be made faster by limiting the training dataset to the everyday objects that a blind individual may come across. Hence, the user may have a smoother and quicker experience.

3.2 Proposed System

This is a diagram of the proposed work in this project.

Figure 3.3 - Glass

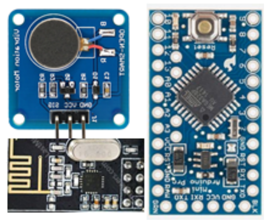


Figure 3.4 - Watch

- This project consists of glass and a watch. Both communicate with the help of the NRF24LO1 module.
- This project is object recognition, text recognition and proximity detection system.
- The proximity detection process is done in the glass and the watch on the person's hand vibrates according to the distance calculated.
- This device can be utilised by any adult or child unless the person is not deaf.
- With the press of the 1st button, the person can detect any object.
- With the press of the 2nd button, the person can hear text using OCR.
- At other times the device is on standby to avoid unwanted recognition and confusion.
- But, the proximity detection stays on the whole time the device is powered on.

3.2.1 Hardware Components

3.2.1.1 Raspberry Pi Zero W

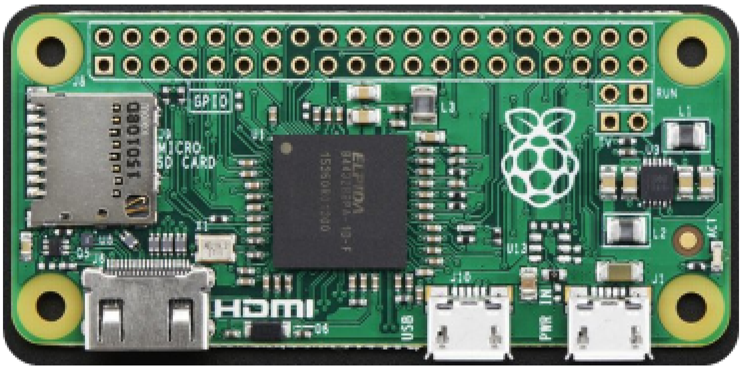


Figure 3.5 - Raspberry pi zero W

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do.

<u>Features:</u>

Dimensions: 65mm × 30mm × 5mm

RAM: 512MB

Wireless: 2.4GHz 802.11n wireless LAN

Bluetooth: Bluetooth Classic 4.1 and Bluetooth LE

Video & Audio: 1080P HD video & stereo audio via mini-HDMI connector

Power: 5V, supplied via micro USB connector

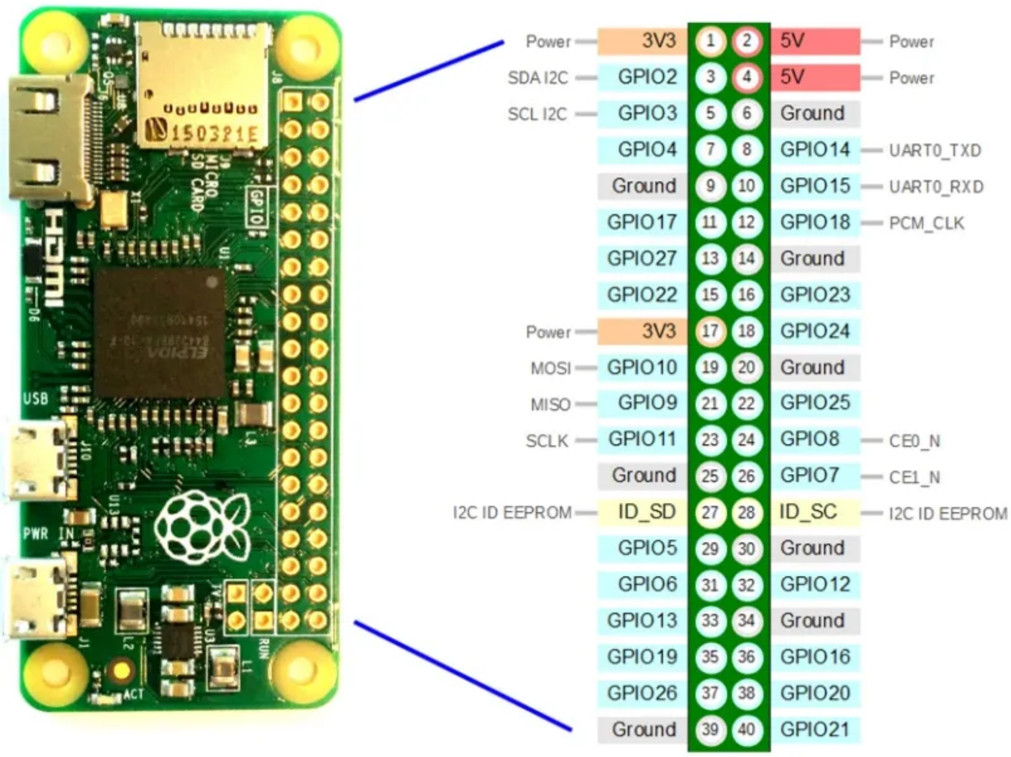
Output: Micro USB

GPIO: 40-pin GPIO, unpopulated

Benefits of Raspberry-Pi 0W:

Due to its size and low power consumption, it can be used effectively for DIY projects such as drones, electric skateboards, Gameboy, switchable power strip, and many more. Raspberry pi uses python programming language which is considerably less complicated than other languages available. The code is cleaner which allows readability and allows the user to solve problems within a few lines of code.

Pin Configuration:



3.1.2.2 Pi-Cam Module

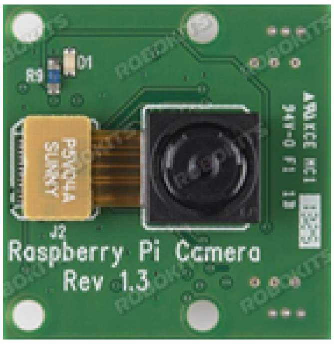


Figure 3.6 - Pi Camera

The Pi camera module is a portable lightweight camera that supports Raspberry Pi. It communicates with Pi using the MIPI camera serial interface protocol. It is normally used in image processing, machine learning or in surveillance projects. It is commonly used in surveillance drones since the payload of the camera is very less. Apart from these modules, Pi can also use normal USB webcams that are used along with computers.

Features:

Dimension: 25mm x 23mm x 8mm

Resolution: 5 MP

Interface Type: CSI(Camera Serial Interface)

Supported Video Formats: 1080p @ 30fps, 720p @ 60fps and 640x480p 60/90 video

Fully Compatible with Raspberry Pi Zero W.

Directly plug into Raspberry Pi Board (besides HDMI port).

3.1.2.3 Ultrasonic Sensor

Figure 3.7 - Ultrasonic Sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves and converting the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound. Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

Features:

Dimension: 50mm x 25mm x 16mm.

Power Supply: 3.3V – 5V.

Operating Current: 8mA.

Working Frequency: 40Hz.

Ranging Distance : 3cm – 350cm/3.5m.

Resolution: 1 cm

Measuring Angle: 15-degree

Trigger Input Pulse width: 10uS TTL.

3.1.2.4 Arduino pro mini

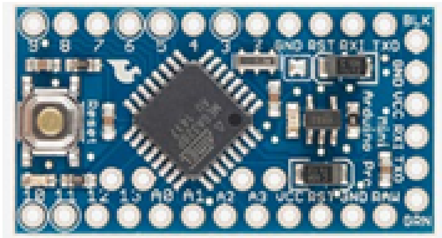


Figure 3.8 - Arduino Pro mini

The Arduino Pro Mini is a microcontroller board based on the ATMEGA328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, an onboard resonator, a reset button, and holes for mounting pin headers. A six pin header can be connected to an FTDI cable or Sparkfun breakout board to provide USB power and communication to the board.

<u>Features:</u>

Microcontroller: Atmega328p – 8 BIT AVR controller

Operating Voltage: 5V

Maximum current through each I/O pin: 40mA

Maximum total current drawn from the chip: 200mA

Flash Memory: 32 Kilobytes

EEPROM: 1 Kilobytes

Internal RAM: 2 Kilobytes

Clock Frequency: 16 MHz

Operating Temperature: -40ºC to +105ºC

Analog Pins: 8

Digital I/Os: 14

Supports auto-reset

3.2.1.5 Vibrator Module

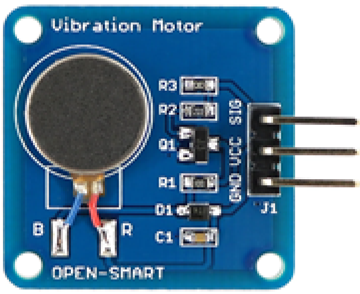


Figure 3.9 - Arduino Pro min

Vibration sensors are piezoelectric accelerometers that sense vibration. They are used for measuring fluctuating accelerations or speeds or for normal vibration measurement. Maintenance professionals use the sensors in order to predict the maintenance of the machinery, reduce overall costs and increase the performance of the machinery.

Features:

Dimension: 23.5mm x 21mm x 8mm

Operating Voltage: 3 5.3 VDC

Motor Diameter: 10mm

Rated Speed: 9000 RPM (min)

Rated Voltage: 5 VDC

Rated Current up to 60 mA

Starting Current up to 90 mA

Starting Voltage: 3.7 VDC

Insulation Resistance: 10 M

Weight (gm): 3 gm

3.2.1.6 LIPO Batteries

Figure 3.10 - Lipo Battery

A lithium-ion polymer battery is a rechargeable battery of lithium-ion technology using a polymer electrolyte instead of a liquid electrolyte. High conductivity semisolid (gel) polymers form this electrolyte. These batteries provide higher specific energy than other lithium battery types and are used in applications where weight is a critical feature, such as mobile devices, radio-controlled aircraft and some electric vehicles.

<u>Features:</u>

Capacity (mAh): 2500

Output Voltage: 3.7V

3.2.1.7 NRF24LO1 module

Figure 3.11 - NRF24LO1 module

An RF module (short for the radio-frequency module) is a (usually) small electronic device used to transmit and/or receive radio signals between two devices. In an embedded system it is often desirable to communicate with another device wirelessly. This wireless communication may be accomplished through optical communication or through radio-frequency (RF) communication. For many applications, the medium of choice is RF since it does not require a line of sight. RF communications incorporate a transmitter and a receiver. They are of various types and ranges. Some can transmit up to 500 feet. RF modules are typically fabricated using RF CMOS technology.

<u>**Features**</u>

Ultra-low power operation (26µA Standby-I mode, 900nA power-down mode)
SPI Interface with Microcontroller

Integrated RF Transmitter, Receiver and Synthesiser

Operating voltage: 1.9 V – 3.6 V

Input Pin Voltage Toleration: 5V

Range: 100 metres

3.2.1.8 Push-Buttons

Figure 3.12 - Push Buttons

A Push Button switch is a type of switch which consists of a simple electric mechanism or air switch mechanism to turn something on or off. Depending on the model they could operate with momentary or latching action function.

3.2.1.9 Battery Charging Module

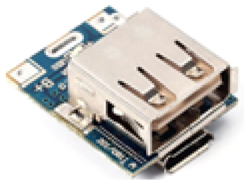


Figure 3.13 - BMS Module

This module is made for charging rechargeable lithium batteries using the constant-current/constant-voltage (CC/CV) charging method. In addition to safely charging a lithium battery, the module also provides.

Features:

BAT Discharging Stop Voltage: 2.9V.

Discharging Efficiency: 85%(input 3.7V output 5V/1A).

Intelligent temperature control and over-temperature protection.

3.2.1.10 Earphones

Figure 3.14 - Earphones

Headphones are a pair of small loudspeaker drivers worn on or around the head over a user's ears. They are electroacoustic transducers, which convert an electrical signal to a corresponding sound. Headphones let a single user listen to an audio source privately, in contrast to a loudspeaker, which emits sound into the open air for anyone nearby to hear.

<u>Features</u>

Connector type: 3.5 mm jack

Immersive Audio

Lightweight Adaptive Design

Magnetic Earbuds

Integrated Multifunction Control

3.2.2 Software Requirements

3.2.2.1 Raspberry Pi OS

Figure 3.15 - Raspberry Pi OS

Many operating systems are available for Raspberry Pi, including Raspberry Pi OS, our official supported operating system, and operating systems from other organisations. Raspberry Pi Imager is the quick and easy way to install an operating system to a microSD card ready to use with your Raspberry Pi.

3.2.2.2 Python IDLE

Figure 3.16 - Python IDLE

IDLE (Integrated Development and Learning Environment) is an integrated development environment (IDE) for Python. The Python installer for Windows contains the IDLE module by default. IDLE can be used to execute a single statement just like Python Shell and also to create, modify, and execute Python scripts. IDLE provides a fully-featured text editor to create Python script that includes features like syntax highlighting, autocompletion, and smart indent. It also has a debugger with stepping and breakpoints features.

3.2.2.3 Tesseract OCR

Figure 3.17 - OCR Algorithm

Tesseract is an open-source optical character recognition (OCR) platform. OCR extracts text from images and documents without a text layer and outputs the document into a new searchable text file, PDF, or most other popular formats. Tesseract is highly customizable and can operate using most languages, including multilingual documents and vertical text.

3.2.2.4 YOLO v4

Figure 3.18 - YOLO Algorithm

Image classification is one of the many exciting applications of convolutional neural networks. Aside from simple image classification, there are plenty of fascinating problems in computer vision, with object detection being one of the most interesting. YOLO ("You Only Look Once") is an effective real-time object recognition algorithm. Yolo v4 algorithm can able to detect 80+ basic objects, since it has 80 COCO dataset and it is the faster than other object detection algorithm such as CNN, R-CNN etc

3.2.2.5 OpenCV

Figure 3.19 - OpenCV Library

OpenCV is the huge open-source library for computer vision, machine learning, and image processing and now it plays a major role in real-time operation which is very important in today’s systems. By using it, one can process images and videos to identify objects, faces, or even the handwriting of a human. This focuses on detecting objects.

3.2.2.6 Text to Speech

Figure 3.20 - google text-to-speech Library

The text-to-speech (TTS) is the process of converting words into a vocal audio form. The program, tool, or software takes an input text from the user, and using methods of natural language processing understands the linguistics of the language being used, and performs logical inference on the text. Using many algorithms and transformations this processed text is finally converted into a speech format. This entire process involves the synthesising of speech. The gTTS API supports several languages including English, Hindi, Tamil, French, German and many more.

3.2.3 Working Principle

3.2.3.1 Proximity Detection

Proximity detection uses ultrasonic sensors to detect the distance between the object and the subject. Ultrasonic sensors have a transmitter and receiver to send and receive ultrasonic sound waves. Ultrasonic sound waves are emitted from the emitter and these emitted sound waves travel till they get reflected back by an obstacle. Ultrasonic sensors work by a sound wave at a frequency above the range of human hearing (20,000 Hz). The reflected waves are detected by the detector. The sensor works by measuring the time the waves took to reflect from the object.

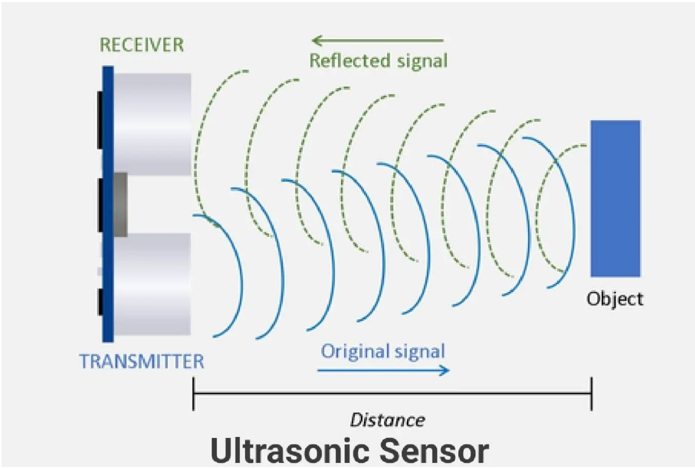


Figure 3.21 - Ultrasonic Waves Transmission

The proximity detection is done using the ultrasonic sensor present in the glass. The ultrasonic sensor and the raspberry pi work together to find the proximity between the person and the obstacle. The NRF24L01 module is used to send the data from raspberry pi to the Arduino mini present in the watch. If the distance between the obstacle and the individual is less then the vibration intensity is high and if the distance between the obstacle and the individual is more then the vibration intensity is low. This process is always enabled.

Proposed Work

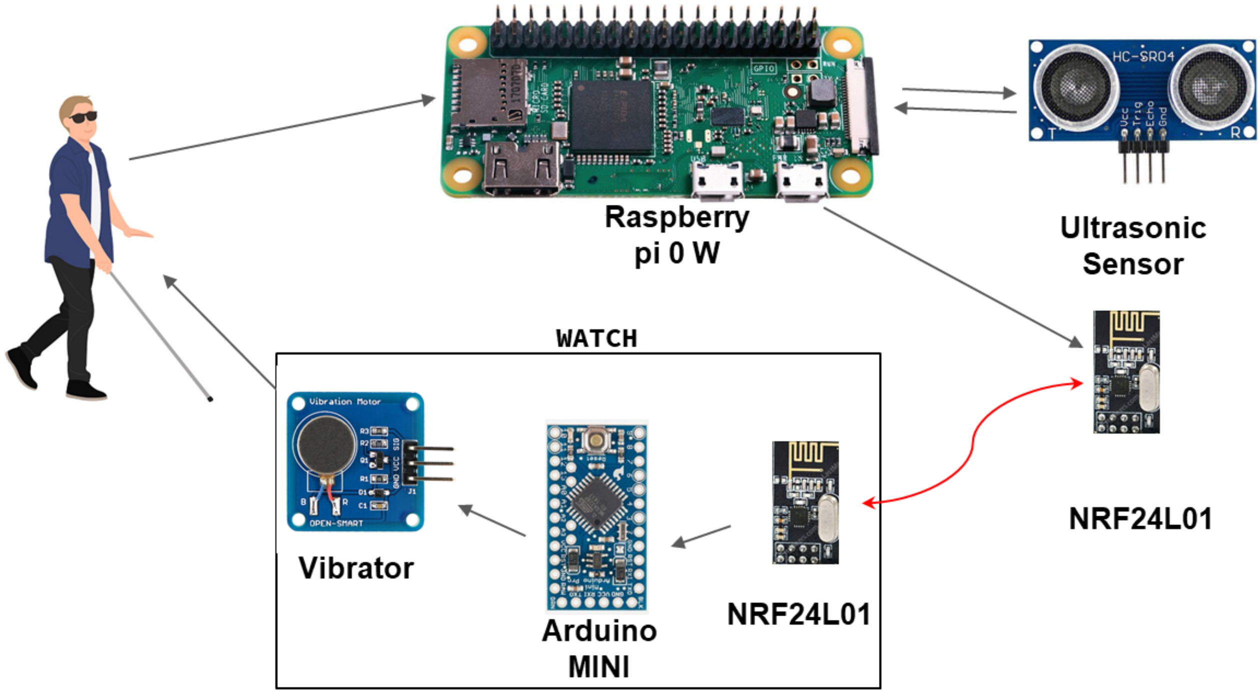


Figure 3.22 - Proposed Work - Proximity Detection

3.2.3.2 Object Detection

Object detection is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class in digital images and videos. Well-researched domains of object detection include face detection and pedestrian detection.

When button 1 is pressed, the image is captured by the camera module and is sent over to the raspberry pi. It is processed by the YOLO v4 object detection algorithm to detect and recognize the object. The audio output is given to the user via earphones.

Proposed Work

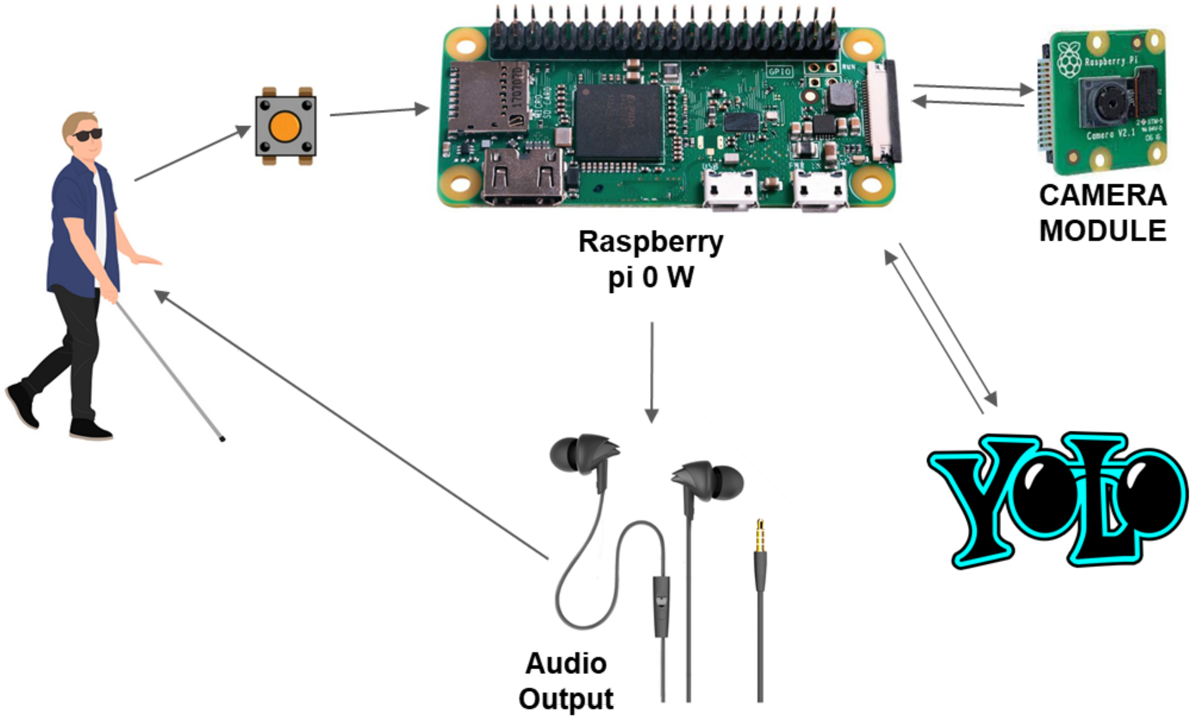


Figure 3.22 - Proposed Work - Object detection

3.3. OPTICAL CHARACTER RECOGNITION (OCR)

OCR stands for "Optical Character Recognition." OCR software processes a digital image by locating and recognizing characters, such as letters, numbers, and symbols. It is commonly used to recognize text in scanned documents and images. OCR software can be used to convert a physical paper document or an image into an accessible electronic version with text.

When button 2 is pressed, the camera module captures an image and the digital image is converted to text using Tesseract OCR. The text is converted to audio format using gTTS.

Proposed Work

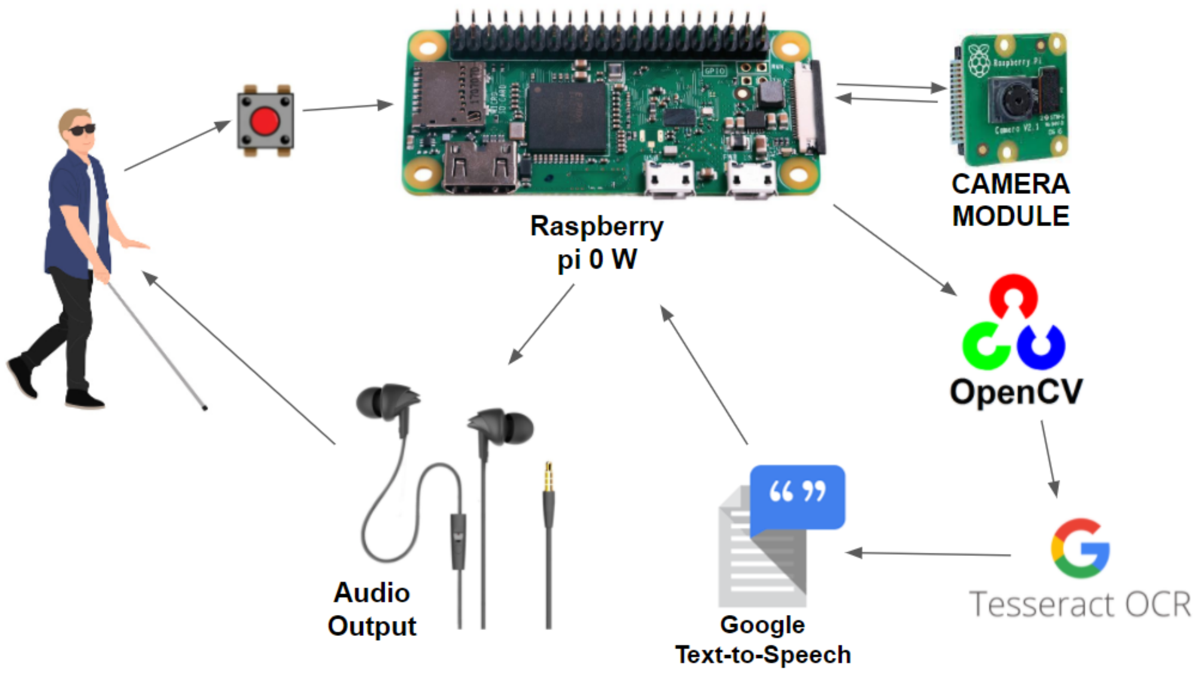


Figure 3.22 - Proposed Work - OCR

CHAPTER 4

4. RESULTS AND DISCUSSION

With the integration of hardware and software components, the OCR algorithm was implemented and the following results were obtained as shown in figure 4.1. We had noticed that the algorithm worked better with Serif Fonts and had recognition issues with Sans Serif fonts.

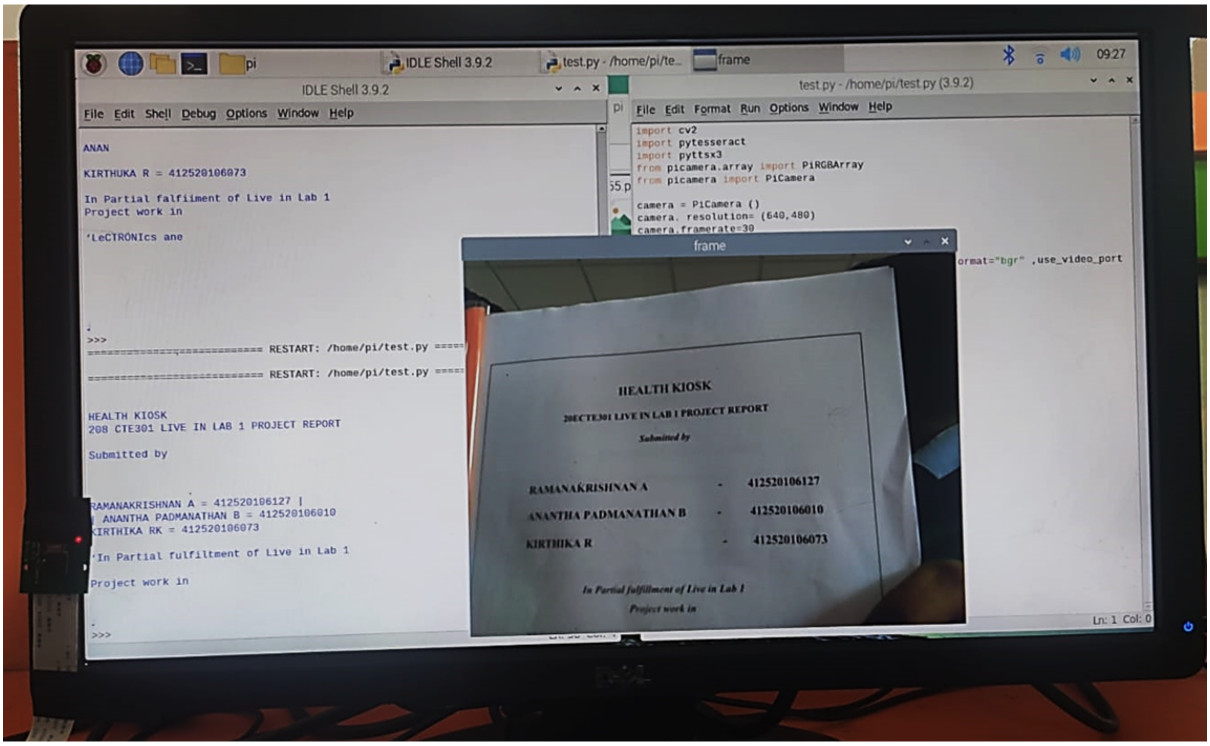


Figure 4.1 - OCR Testing and Results

CHAPTER 5

5. CONCLUSION AND FUTURE SCOPE

5.1 Conclusion

There is a huge population of visually impaired people in the world. Implementation of regional languages will help people significantly. Upon proper government subsidies, the cost of this system reduces significantly.

A proximity detection, object recognition and text recognition system was proposed to help visually impaired people. The YOLO v4 algorithm is used to recognize objects. Open CV, Tesseract OCR and GTTS libraries are used to read the text and provide audio output to the user. Ultrasonic Sensors are used for reasonable proximity detection.

VLSI and 3D designing can be used to make the system more compact and less heavy.

5.2 Future Scope

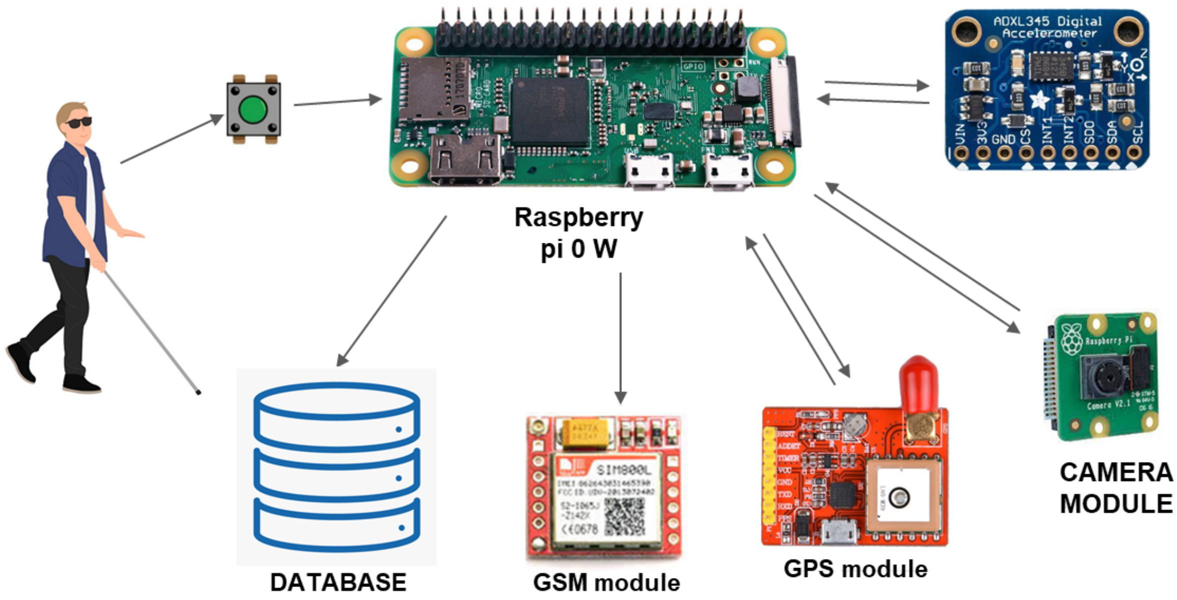


Figure 5 - Future development - Emergency mode

- Uses fall detection algorithm to detect falls.
- When the person falls, a 10-second timer starts.
- If the person does not press button 3 within 10 seconds, then an image of the surrounding is captured and GPS coordinates are sent over to a database.
- The GPS coordinates are sent over to the person's family members via SMS.
- The database can be accessed by family members, hospitals and government officials like the police.

REFERENCES:

1. Murali, M., et al. “Reader and Object Detector for Blind.” IEEE Xplore, 1 July 2020, ieeexplore.ieee.org/document/9182201.

2. Wong, C., et al. “A Novel Design of Integrated Proximity Sensors for the White Cane.” IEEE Xplore, 1 Nov. 2001, ieeexplore.ieee.org/document/974075. Accessed 1 Mar. 2022.

3. Kumar, Ashwani, et al. “An Object Detection Technique for Blind People in Real-Time Using Deep Neural Network.” IEEE Xplore, 1 Nov. 2019, ieeexplore.ieee.org/document/8985965. Accessed 1 Mar. 2022.

4. Ali, Syed Farooq, et al. “Human Fall Detection.” IEEE Xplore, 1 Dec. 2013, ieeexplore.ieee.org/document/6731332. Accessed 1 Mar. 2022.

5. Nasreen, Jawaid, et al. “Object Detection and Narrator for Visually Impaired People.” IEEE Xplore, 1 Dec. 2019, ieeexplore.ieee.org/document/9117405. Accessed 1 Mar. 2022.

6. Neto, Roberto, and Nuno Fonseca. “Camera Reading for Blind People.” Procedia Technology, vol. 16, 2014, pp. 1200–1209, 10.1016/j.protcy.2014.10.135. Accessed 18 Nov. 2021.

7. Dandona, R, and L Dandona. “Childhood Blindness in India: A Population Based Perspective.” The British Journal of Ophthalmology, vol. 87, no. 3, 1 Mar. 2003, pp. 263–265, www.ncbi.nlm.nih.gov/pmc/articles/PMC1771525/. Accessed 1 Mar. 2022.

8. Rahi, J S, et al. “Childhood Blindness in India: Causes in 1318 Blind School Students in Nine States.” Eye, vol. 9, no. 5, Sept. 1995, pp. 545–550, 10.1038/eye.1995.137. Accessed 12 Nov. 2019.

9. P, Jinoy Jose. “A Cam for an Eye.” Www.thehindubusinessline.com, www.thehindubusinessline.com/specials/technophile/orcam-myeye-2-is-a-gadget-for-the-visually-impaired/article24513608.ece. Accessed 1 Mar. 2022.