A
Project Report
on

"Third Eye for Blind"

Submitted By

Rohan Raju Repal	2020BTEEN00012
Purva Pavan Pawar	2020BTEEN00033
Arpita Santosh Pujari	2020BTEEN00060
Joya Riyaz Shahdiwan	2020BTEEN00062
Pranjal Prakash Hilage	2020BTEEN00080

Under the guidance of

Mr. R.G. Mevekari

Department of Electronics Engineering

WALCHAND COLLEGE OF ENGINEERING, SANGLI

(Government-Aided Autonomous Institute)

2023-2024

WALCHAND COLLEGE OF ENGINEERING, SANGLI

(Government-Aided Autonomous Institute)

DEPARTMENT OF ELECTRONICS ENGINEERING

CERTIFICATE

This is to certify that the Project Report entitled

'Third Eye for Blind'

Submitted by

Rohan Raju Repal (2020BTEEN00012)
Purva Pavan Pawar (2020BTEEN00033)
Arpita Santosh Pujari (2020BTEEN00060)
Joya Riyaz Shahdiwan (2020BTEEN00062)
Pranjal Prakash Hilage (2020BTEEN00080)

in partial fulfilment for the award of the Degree of

Bachelor of Technology

in

Electronics Engineering

is a record of students own work carried out by them under our supervision and guidance during the academic year 2023-2024.

Date: 13/05/2024
Place: Sangli

Mr. R. G. Mevekari
(Project Guide)

Dr. S. D. Ruikar
(HOD)

CONTENTS

Acknowledgement

We would like to express our special thanks of gratitude to our project guide Mr. R.G.Mevekari and our HOD Dr. S.D.Ruikar who gave us the golden opportunity to do a project on "**Third Eye for Blind**". It helped us in doing a lot of research and we came to know about a lot of new things related to this topic. At last but not the least, we would like to thank everyone who helped and motivated us to work on this project.

Abstract

Every day, people perform numerous actions, but visually impaired individuals often struggle to identify objects without assistance. However, there is an emerging technology that aims to help the blind locate objects. One prototype is a smart blind stick that incorporates an ultrasonic sensor for alerting the presence of an obstacle. A camera connected to a Raspberry Pi via a cable for detecting the object present by giving a voice command. Also a water sensor is used to detect the presence of water on the surface so as to avoid the slippery surface. The camera records realtime images, capturing objects as the ultrasonic sensor detect an obstacle. These captured images are then processed using a Yolov5 algorithm to detect the objects. Through this system, the user can determine the desired object, and the information is conveyed through voice commands played through speakers. All of this is achieved by connecting the camera, ultrasonic sensor, and headphones to the Raspberry Pi 4 model B, utilizing machine learning techniques to process inputs from the camera and ultrasonic sensor and provide results through the headphones.

List of Figures

List of Tables

1. Introduction

According to survey by WHO (World Health Organization) carried out in 2011 estimates that in the world, about 1% i.e. about 70 million people are visually impaired and amongst them, about 10% i.e. about 7 million people are fully blind and 90% (about 63 million people) with low vision. Also, there are about 2.2. billion visually impaired people. This indicates that blindness is a very common disability all over the world.

The main problem with blind people is how to navigate their way to wherever they want to go. Obstacle detection is one of the major concerns for a blind person (e.g. person suffering from night-blindness). Such people need assistance from others with good eyesight. As described by WHO, 10% of the visually impaired have no functional eyesight at all to help them move around without assistance and safely. So, through this system – "Third Eye for Blind", we aim to detect nearby obstacles and notify the user, thereby enabling the user to determine the corrective direction tobe headed.

The system consists of ultrasonic sensor, moisture sensor, camera module. Ultrasonic sensor is used to detect obstacles by using ultrasonic waves. By sensing the obstacles, the sensor passes the received data to the raspbeery pi. If the obstacle is close enough to the person, buzzer will start beeping.g upon. If the obstacle is not close, the circuit does not do anything.

A moisture sensor is used to detect the presence of water in the user's path.Camera module is used to detect household objects like table, computer which are not able to detect by ultrasonic sensor. A buzzer and headphones are used to alert the user about the obstacle/object.

Thus, we will be able to alert the user by detecting the obstacles and presence of water so that he/she can perform the daily life activities independently.

1.1 Project Idea

Problem Statement

Design a system to assist blind people to walk with ease and to alert them whenever their walking path is obstructed by other people or an object.

The solution we propose

The project looks into developing a smart blind stick which acts as a Third eye for blind. The idea behind developing this system is to assist blind people to walk safely with ease and to alert them whenever they encounter any obstruction around them. In the world of technology where people strive to live independently this work proposes an ultrasonic stick for blind people to aid them in achieving personal independence.

Different sensors like ultrasonic sensor, water sensor with other devices like Raspberry Pi, buzzer, Camera Module, Headphones have used to make this project. We used Raspberry Pi as it is able to serve a number of different sensors at the same time. Ultrasonic sensor is used as a proximity sensor to detect the obstacle present around or in the path of a person walking. The water sensor is used to detect the presence of water on the floor, so as to prohibit walking on the slippery areas. As soon as the obstacle is sensed by an ultrasonic sensor the buzzer will beep. Then the water sensor will check for the water detection and if water is present on the floor the buzzer will start beeping. Pi camera module used for image processing purpose so that we can specify the object and be able to give appropriate voice commands.

Thus, in this project we try to solve the problems of the visually impaired people by providing them safe walks with ease.

1.2 Objectives

- To detect an obstacle as well as presence of water.

  The aim is to detect obstacle using ultrasonic sensor and slippery surfaces using water sensor so that it will navigate the blind person safely. Obstacle will get detected within defined range and for alert mechanism voice commands and buzzer will be used.

- To recognize the object present in front of person.

  For object recognization, USB webcam logi720p will be used and with the help of image processing object (like table, laptop, bottle) will be recognized.

- To assist the blind person.

  Blind person needs help in daily life activities. A secured and an automated assistance will be provided through our system.

- To provide instant alert through buzzer.

  Buzzer will beep when slippery surface get detetced. It will beep for 1 sec and blind person will have to stop at that instance.

1.3 Expected Outcomes

- Obstacles in the path will be detected.
- Slippery surfaces will get detected.
- Image was captured using the USB webcam and voice command will be given.
- Buzzer beeping after detecting slippery surface.

2. Literature Survey

- Akhila, Disha Rani, Divyashree D, Varsharani S. S. "**Smart Stick for Blind using RaspberryPi**", International Journal of Engineering Research & Technology (IJERT), 2016.
  - The idea of providing voice commands was taken from this survey to make the navigation of a blind person more easy.

- Vubbara Deekshitha, Pasupulety Sai Teja, Jakka Madhurima, Shailaja P, 3Pramoda K V, "**Smart Supervisory Stick for Blind using Raspberry Pi** ", Journal of Engineeing Technologiesand Innovative Research (JETIR), March 2020.
  - The above survey was helpful for Object identification by capturing through a Logitech high resolution C series camera. Digital image processing is used for conversion of captured image. This particular camera is used as it is ideal for high definition image capturing with 720 pixels HD quality.

- Arvind Lal, Roshan Acharya, Bal Badhur Sewakoti, Durga Badhur Kami, Binod Niroula, Tseten Namgyal Bhutia, " **Review on Smart Stick** ", International Journal of Science and Research, April 2019.
  - The idea of using a water sensor was taken from this survey for the detection of slippery surfaces.

- Ms.S.Rajeshwari, Mrs.S.Niraja P, " **Smart Blind Stick using LDR and Ultrasonic Sensor**", International Journal of Advanced Research in Basic Engineering Sciences and Technology.
  - This survey helped us with an idea of using the ultrasonic sensor for the detection of an object in the provided range or distance.

3. Design Methodology:

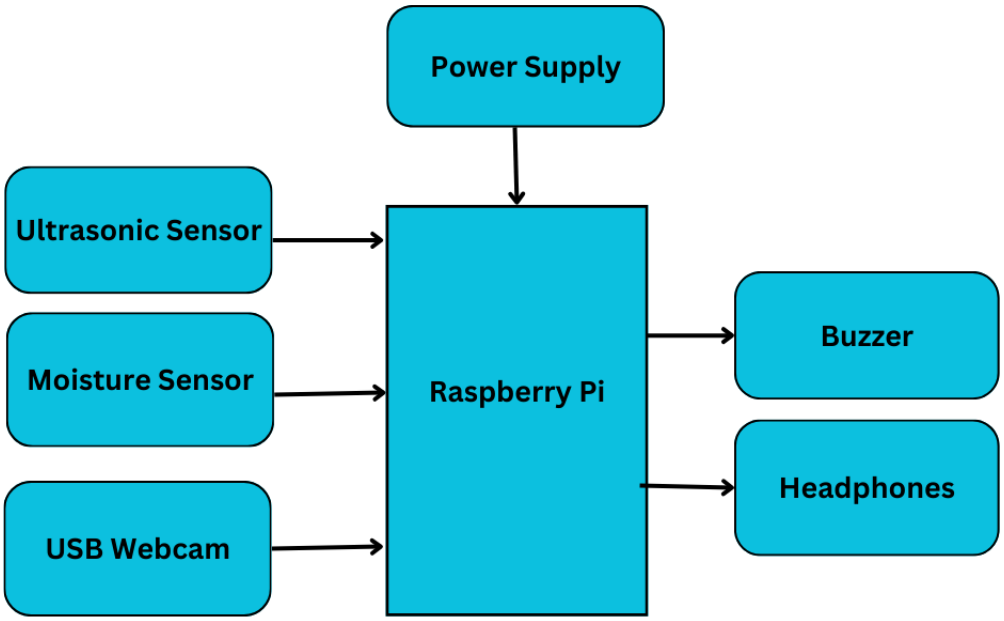


Fig 3.1 Block Diagram

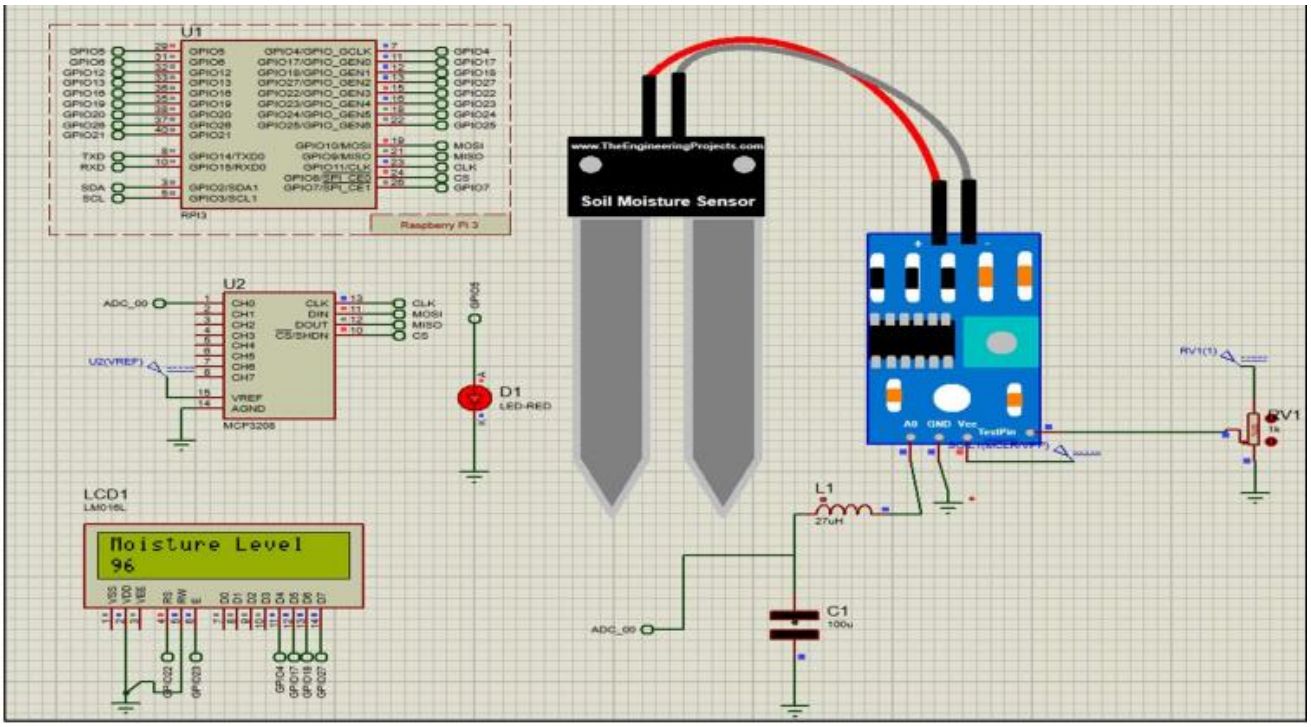


Fig 3.2 Circuit Diagram

4. System Architecture

4.1 Raspberry Pi :

Fig 4.1 Raspberry Pi

- Processor : Broadcom BCM2711, quad-core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
- Memory : 8GB
- Connectivity:
    - 2.4 GHz and 5.0 GHz IEEE 802.11b/g/n/ac wireless
    - LAN, Bluetooth 5.0, BLE
    - Gigabit Ethernet
    - 2 × USB 3.0 ports
    - 2 × USB 2.0 ports
- GPIO : Standard 40-pin GPIO header(fully backward-compatible with previous boards)
- Video & Sound :
    - 2 × micro HDMI ports (up to 4Kp60 supported)
    - 2-lane MIPI DSI display port
    - 2-lane MIPI CSI camera port
    - 4-pole stereo audio and composite video port
- Multimedia:
    - H.265 (4Kp60 decode)
    - H.264 (1080p60 decode, 1080p30 encode)
    - OpenGL ES, 3.0 graphics
- SD card support : Micro SD card slot for loading operating system and data storage
- Input power :
    - 5V DC via USB-C connector (minimum 3A)
    - 5V DC via GPIO header (minimum 3A)
    - Power over Ethernet (PoE)–enabled(requires separate PoE HAT)
- Environment : Operating temperature 0–50ºC
- Compliance : For a full list of local and regional product approvals, please visit

4.2 Moisture sensor :

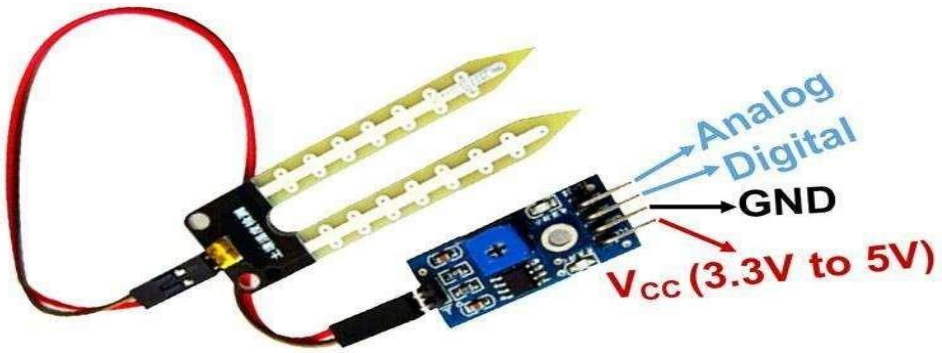


Fig 4.2 Moisture Sensor

Water Sensor Module Pin-out Configuration :

Table 4.2.1

Pin Name	Description
VCC	The VCC pin powers the module, typically with +5V
GND	Power Supply Ground
DO	Digital Out Pin for Digital Output.
AO	Analog Out Pin for Analog Output

Moisture Sensor Module Features & Specifications

- Operating Voltage: 3.3V to 5V DC
- Operating Current: 15mA
- Output Digital - 0V to 5V, Adjustable trigger level from preset

- Output Analog - 0V to 5V based on infrared radiation from fire flame falling on the sensor
- LED's indicating output and power
- PCB Size: 3.2cm x 1.4cm
- LM393 based design
- Easy to use with Microcontrollers or even with normal Digital/Analog IC
- Small, cheap and easily available

4.3 USB Webcam:

Fig 4.3 USB Webcam

Table 4.3.1

Connectivity Technology	USB
Flash Memory Type	CompactFlash
Special Feature	Low Light
Screen Size	2 Inches
Model Name	C270- 1.5m Cable
Camcorder type	Action Camera

- Crisp HD 720p/30 fps video calls with diagonal 55° field of view and auto light correction. Compatible with popular platforms including Skype and Zoom.
- The built-in noise-reducing mic makes sure your voice comes across clearly up to 1.5 meters away, even if you're in busy surroundings.
- C270's RightLight 2 feature adjusts to lighting conditions, producing brighter, contrasted images to help you look good in all your conference calls.
- The adjustable universal clip lets you attach the camera securely to your screen or laptop, or fold the clip and set the webcam on a shelf. You're always ready for your next video call.
- Ideal for laptop or tablet: Compatible with Windows 10 or later, Windows 8, Windows 7, Mac OS 10.10 or later, and Chrome OS via the USB port

4.4 Ultrasonic Sensor :

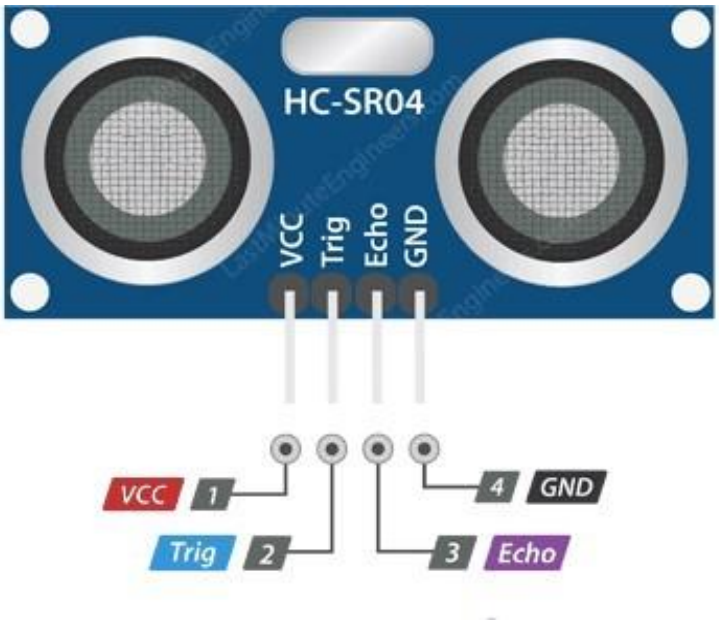


Fig 4.4 Ultrasonic Sensor

VCC supplies power to the HC-SR04 ultrasonic sensor. You can connect it to the 5V output from your Arduino.

Trig (Trigger) pin is used to trigger ultrasonic sound pulses. By setting this pin to HIGH for 10µs, the sensor initiates an ultrasonic burst.

Echo pin goes high when the ultrasonic burst is transmitted and remains high until the sensor receives an echo, after which it goes low. By measuring the time the Echo pin stays high, the distance can be calculated.

GND is the ground pin. Connect it to the ground of the Arduino.

Here are technical specifications of HC-SR04:

Table 4.4.1

Operating Voltage	DC 5V
Operating Current	15mA
Operating Frequency	40KHz
Max Range	4m
Min Range	2cm
Ranging Accuracy	3mm
Measuring Angle	15 degree
Trigger Input Signal	10µS TTL pulse
Dimension	45 x 20 x 15mm

4.5 Buzzer:

Fig 4.5 Buzzer

The **specifications of the buzzer** include the following.

- Color is black
- The frequency range is 3,300Hz
- Operating Temperature ranges from – 20° C to +60°C
- Operating voltage ranges from 3V to 24V DC
- The sound pressure level is 85dBA or 10cm
- The supply current is below 15mA

Pin Configuration :

Table 4.5.1

Pin	Description
+ve Terminal	powered through 6 Volts
-ve Terminal	connected to the ground

5. Implementation

There are three main blocks of project namely input unit, control unit and output unit

A) Input Unit:

1) Ultrasonic sensor: Its main purpose is to sense the proximity. The distance between the sensor and the object will be sensed and the information will be given to the control unit so that the buzzer will beep if the obstacle is detected.

2) Water sensor: It is designed for slippery surface detection. Its output is analog type which will be further given to the control unit and buzzer will beep based on given condition.

3)Camera module: The main purpose is image processing of obstacles which are in front of blind person.

B) Control Unit:

1) Control unit consists of a Raspberry pi where input from the input unit will be received.

2) According to the input sensed, the buzzer which is being used to alert blind people about obstacles will be activated or deactivated using raspberry pi.

3) According to image processing, voice commands will be given through headphones

C) Output unit:

1) Buzzer: Buzzer will beep when an obstacle gets detected. It is a small but effective component for adding audio features.

2) Headphones: It is used to alert the blind person through voice commands.

5.1 Flow Chart

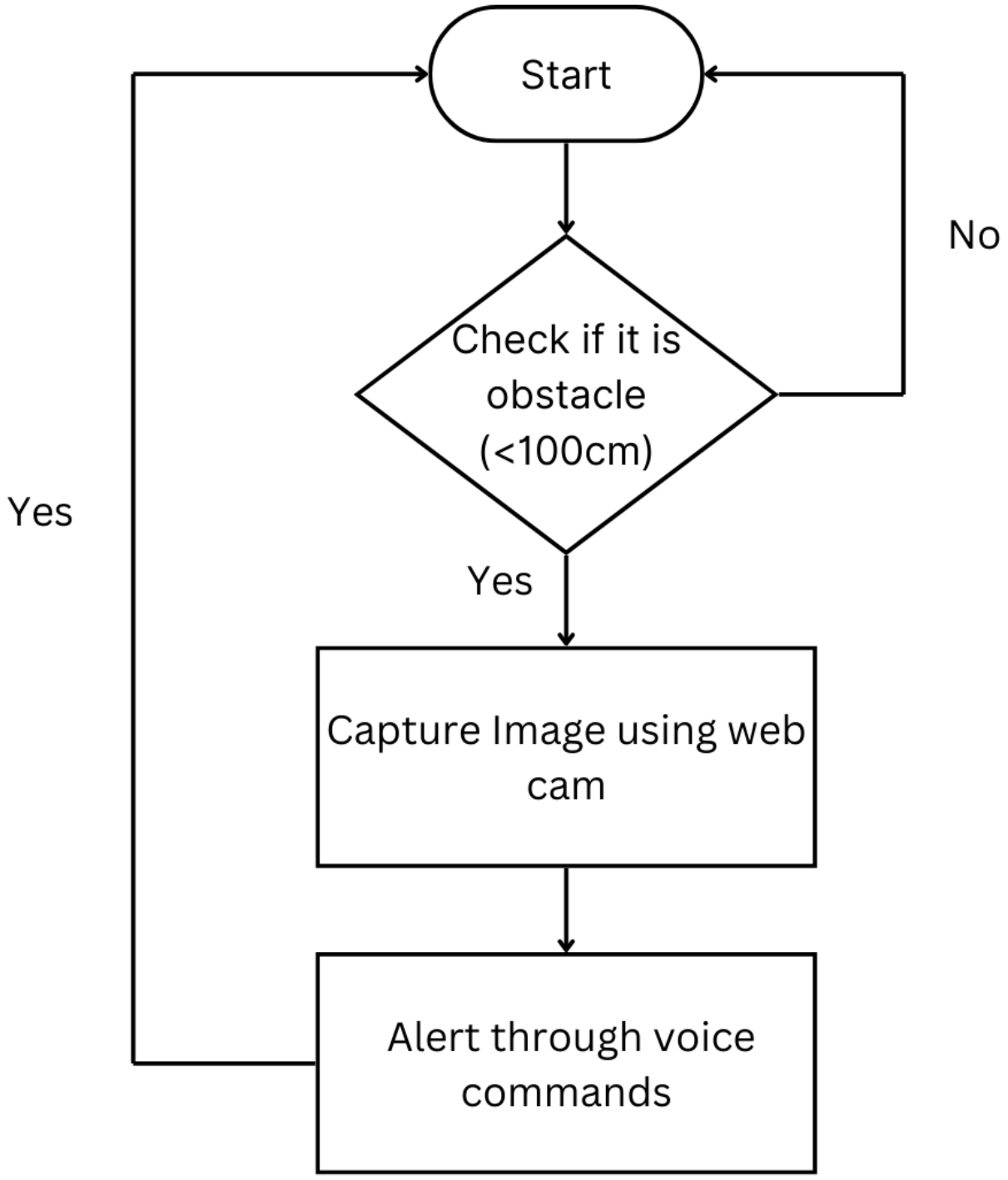


Fig 5.1.1 Flowchart showing functioning of camera module

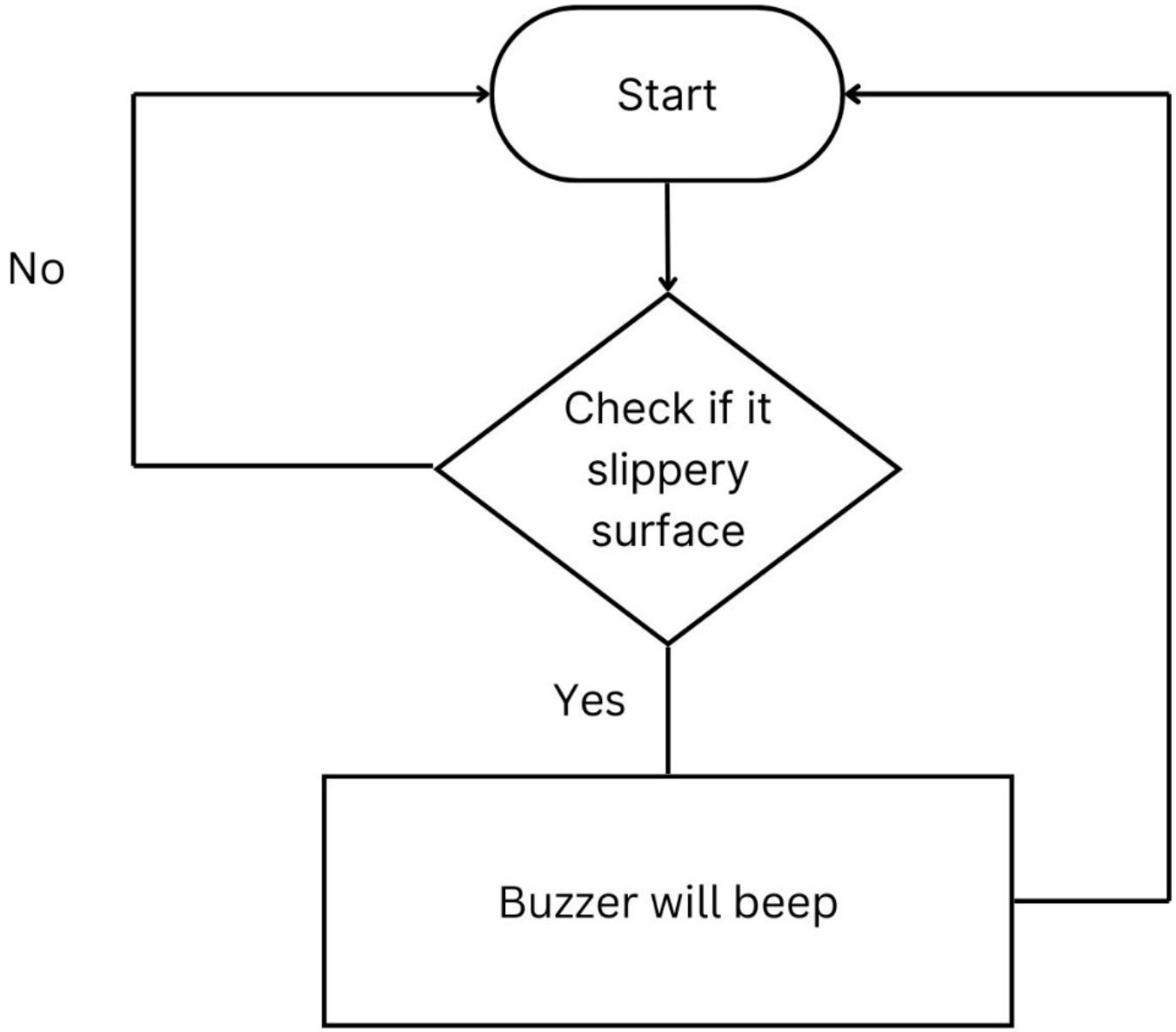


Fig 5.1.2 Flowchart for detecting obstacle and slippery surface

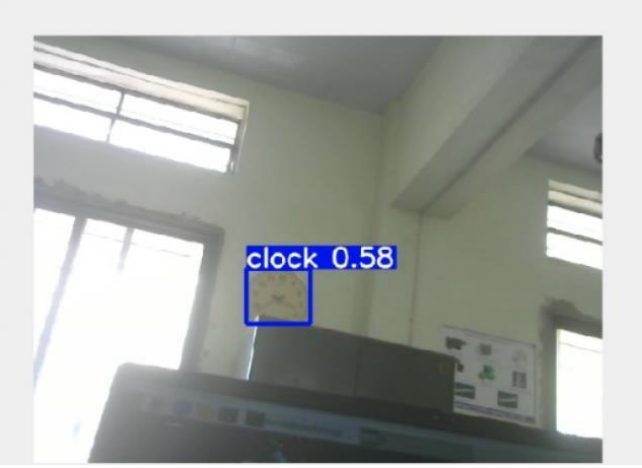
5.2 Hardware Implementation

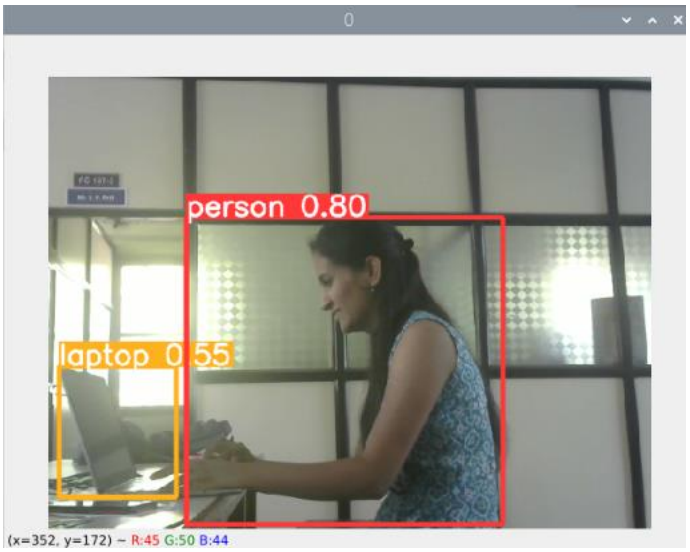
Fig 5.2.1 Blind stick

Fig 5.2.2 Controller(Raspberry Pi4)

6. Results and Discussion:

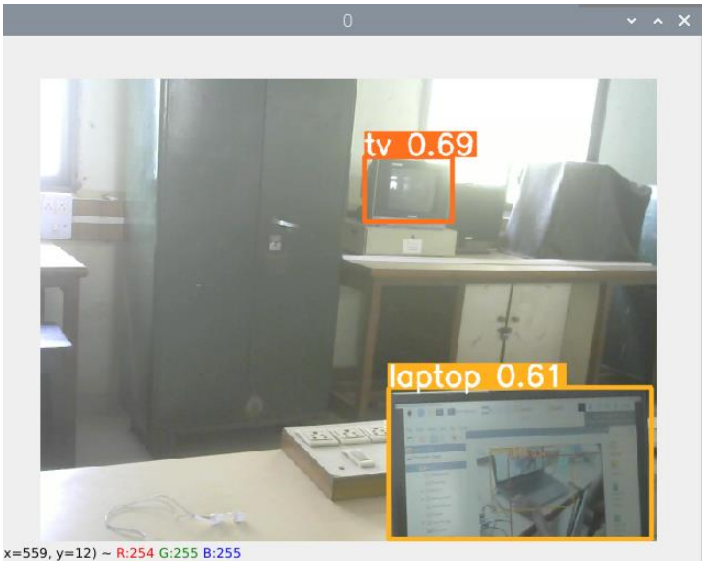
1) The obstacle is detected when found below the defined range of ultrasonic sensor.
2) The USB webcam will then capture the images and detect them.
3) Then the voice command is given using the headphones.
4) The water sensor is used to detect the slippery surfaces.

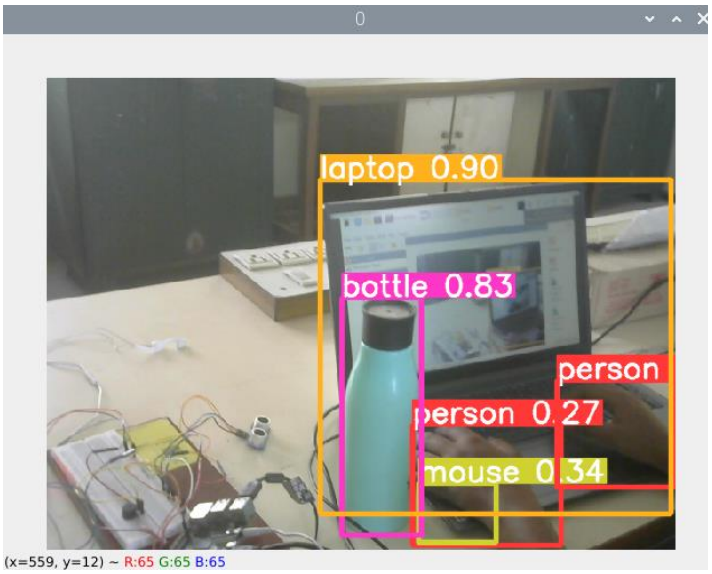



0
person 0.80
laptop 0.55
(x=352, y=172) ~ R:45 G:50 B:44


0
chair Cchair 0.74
(x=352, y=172) ~ R:135 G:137 B:116


0
bottle 0.74
STAY COOL
(x=399, y=145) ~ R:213 G:213 B:213


0
tv 0.69
laptop 0.61
x=559, y=12) ~ R:254 G:255 B:255



Result Table:

Object Detected	Distance (cm)
Clock	39.6
TV	38
Laptop	14.3
Bottle	21
Cell phone	17.8
Chair	31.2
Person , Laptop	33
Bottle, Laptop, person	19.1
TV, Laptop	35.5

7. Conclusion

1) Obstacles in the path were detected.
2) Slippery surfaces were also detected.
3) Image was captured using the camera module and voice command was given to alert.
4) Buzzer beeping after detection of slippery surface .

8. Future Scope

1) Use of multiple ultrasonic sensors to detect obstacles in the right and left side
2) Location tracking system
3) Advanced and faster system can be made for outdoor purpose.

9. References:

1. M.Vanitha, A. Rajiv, K. Elangovan and S.Vinoth Kumar, “A Smart walking stick for visually impaired using Raspberry pi”, International Journal of Pure and Applied Mathematics, 2018.

2. Pratik N K, Poornesh V, Shashikant, Shreedhar Kudva, Saritha A N, “ Smart Blind Stick ”, International Journal of Latest Trends in Engineering and Technology.

3. Vubbara Deekshitha, Pasupulety Sai Teja, Jakka Madhurima, Shailaja P, 3Pramoda K V, “Smart Supervisory Stick for Blind using Raspberry Pi ”, Journal of Engineeing Technologies and Innovative Research (JETIR), March 2020.

4. Rekham Khan,HoorainJaved and Noreen Akbar “Navigation device for the visually impaired which is focused on providing voice output for obstacle navigation using infrared sensors and RFID technology “February 2019.

Website:

1. https://www.electronicwings.com/raspberry-pi