Intrusion Detection and Alerting System

Project Report Submitted in Partial Fulfillment of the Requirements for the Award of Degree of

Bachelor of Technology
in
Electrical and Electronics Engineering

By

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

CVR COLLEGE OF ENGINEERING
(An UGC Autonomous Institution, Accreditated by NBA & NAAC)
(Approved by AICTE & Govt. of Telangana and Affiliated to JNTU, Hyderabad)
Vastunagar, Mangalpalli (V), Ibrahimpatnam (M), R.R District.
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Certificate

This is to certify that this Project Report entitled "**Intrusion Detection and Alerting System"** by **Resu Srisai Kumar (Roll No. 18B81A0251), M Chakri Sai Narayana (Roll No. 18B81A0210), K Sai Teja (Roll No. 17B81A0275),** submitted in partial fulfillment of the requirement for the degree of Bachelor of Technology in Electrical and Electronics Engineering of the CVR College of Engineering, Hyderabad, during the academic year of 2021-22, is a bonafide record of the work carried out under our guidance and supervision.

The results embodied in this report have not been submitted to any other University or Institution for the award of any degree or diploma.

Mr. P. Rajesh Kumar		**Dr. S. Venkateshwarlu**
(Associate Professor, EEE)	**(External Examiner)**	**(Professor & HOD, EEE)**
(Project Guide)		

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Last but not least we thank Almighty for his grace enabling us to complete this work on time.

ABSTRACT

Technology has changed the world. There is a huge growth in technology connected to almost every field. The pace and diversity of advancement are very rapid. Hence, new technology and techniques are coming up and are put to use as per the need. In such an advanced scenario, providing security to the home has also become a major point of concern.

Presently security cameras can be used for the same. But such cameras may be visible to intruders and there is a possibility that cameras may be damaged. And fires in the early detection and early warning are two important ways to extinguish the fire promptly and avoid great casualties and property loss. Therefore, the requirement of placing an intelligent fire alarm system is important within buildings, especially in buildings that contain many people inside or valuable belongings. Hence, in order to serve this purpose, there is a need to find an alternative secure, accurate and quick method. Hence a Home Security System is developed using Ultrasonic/PIR sensors, Flame Sensor and PI Camera. This system will detect the presence of Intruders or possible fire accidents and quickly alert the user by sending him an alert mail. This mail will also contain the Picture of the Intruder, captured by a Pi camera. Raspberry Pi is used to control the whole system.

This system can be installed at the main door of your home or office, and you can monitor it from anywhere in the world using your Email over the internet.

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LIST OF ABBREVIATIONS

PIR	-	Passive Infrared sensor
IoT	-	Internet of Things
RPi	-	Raspberry Pi
IP	-	Internet Protocol
URL	-	Uniform Resource Locator

CHAPTER 1

INTRODUCTION

The project Intrusion Detection and Alerting System is aimed to provide security to the users by detecting a possible intruder and alerting the user. With the perception that an efficient home surveillance system is crucially needed, therefore real-time notification system is so crucial for the home or residence owner.

The fire detection and alarm system are very important to avoid major accidents which are caused due to fire. Fire may cause a big loss or damage to any property, home, companies, warehouses, malls, or bazaar. It also causes severe injuries to human lives.

Therefore, by utilizing the Raspberry Pi device, this project will develop an intelligent system for home surveillance with the intention to help users in taking care of their homes or residence.

The security system is developed using an Ultrasonic/PIR Sensor and PI Camera and Flame Sensor. When an intruder is detected, the developed system will recognize the intruder using a PIR sensor or Ultrasonic sensor and alerts the user by sending an email to the user along with the photo of the intruder and it will also alert the user via email if any fire accident is detected.

Chapter 2

LITERATURE REVIEW

Security is the condition of being protected against danger, loss, and criminals. In the general sense, security is a concept similar to safety. The slight difference between the two is the added importance of being protected from threats or dangers. Individuals or actions that go or act against some intruders will decide not to attempt to break into such areas or vehicles, there can actually be less damage to windows in addition to protection of valuable objects inside. Without such an advertisement, a car thief might, for example, approach a car, break the window, and then flee in response to an alarm being triggered. Either way, perhaps the car itself, the objects inside or both aren't stolen, but with perceived security, even the windows of the car have a lower chance of being damaged, increasing the financial security of its owner(s). Perceived security, however, does not guarantee the security of an area. It is important, however, for signs advertising security not to give clues as to how to subvert or manipulate that security system, for example, a burglar planning to rob a home by reading the name of the manufacturer from the advertisement.

2.1 Concepts in Security:

Certain concepts recur throughout different fields of security

Assurance - Assurance is the level of guarantee that a security system will behave as expected.

Countermeasure – A countermeasure is a way to stop a threat from triggering a risky event.

Defence in depth - Never rely on one single security measure alone.

Exploit - A vulnerability that has been triggered by a threat - a risk of 1.0 (100%).
Risk - Risk is a possible event which could cause a loss.
Threat - A threat is a method of triggering a risk event that is dangerous.
Vulnerability - A weakness in a target that can potentially be exploited by a threat.

2.2 Attributes of a Good Security System:

A good security system must have the following attributes:

Sensitivity: The system must be sensitive enough to detect threats or changes in the environment.
Reliability: The system must be dependable i.e. it must work in the environment its placed in.
Durability: It must be "rugged" i.e. work efficiently for a long time or a reasonable period.
Ease of deployment: It must be easy to transport and set up.

2.3 Survey:

2.3.1 Home Security against Human Intrusion using Raspberry Pi by Raju A Nadafa , S.M. Hatturea , Vasudha M Bonala , Susen P Naikb

In this paper, the proposed system is designed as a smart mirror which will provide both information and home security. The system is developed to accept touch and mobile commands. As soon as the intrusion is detected, an alert message along with the identifiable and clear photo (Face view) of the intruder will be sent to the owner's/administrator's mobile. The mirror owner can also see the video of the deployed environment through the camera fitted to the smart mirror.

2.3.2 **Automatic threat detection and response system** by Ravinder Nath Rajotiya, Pragya Sharma, Nikita Singh, Amanpreet Kaur, Vaibhavi Prerna

In this paper, the proposed system will prove to be a boon to security agencies for detecting vehicular movement and providing security mechanisms in case of suspicion. The necessary automated actions like alert and barricade actions will be automatically taken to immobilize the suspicious vehicle.

2.3.3 **Design of an Automated Intrusion Detection System incorporating an Alarm** by Awodele oludele

This paper shows a means of integrating three devices for physical intrusion detection. This paper thus suggests a means of increasing the level of security in an enclosed area with the use three of the four security layers necessary for optimum security. This paper intends to show that a system with more than one security device in place tends to prevent unauthorized access. This paper would be illustrating the implementation of this in an enclosed area whose security level must be kept on the high at all times.

Chapter 3

ABOUT THE PROJECT

3.1 Working

The concept of intrusion detection is achieved by the ultrasonic sensor or PIR sensor. A Raspberry Pi is in charge of the entire setup. An Ultrasonic sensor is used to identify the object/intruder, a Pi camera is used to capture the image of the intruder, and a Flame sensor is used to detect any fire accidents in the monitoring area.

The Ultrasonic sensor sends data to the Raspberry Pi as soon as an intruder is detected. The Raspberry Pi will then take a picture using the attached camera and save it to the Raspberry Pi memory card.

And an email is delivered to the user, along with a photo of the intruder captured by the Pi camera. This system can be installed at the main door of your home or office and you can monitor it from anywhere in the world using your Email over the internet.

Early detection and warning of fires are two critical techniques to quickly extinguish the fire and minimize major casualties and material loss. To identify a potential fire, a flame sensor module is employed; which can detect flames in the 760 - 1100 nanometre wavelength region. Small flames, such as a lighter flame, can be recognized at 0.8m. The detection angle is around 60 degrees, and the sensor is especially sensitive to the flame spectrum.

As soon as a flame is detected, it sends signals to Raspberry Pi and then the Raspberry Pi sends voice alerts using a speaker to alert the locality and an email is also sent to the user to alert the user.

Using an open-source service called RPI Cam Web Interface, users can start real-time video streaming from any device anywhere. The latency of this video streaming will be very low and it can be accessed from any smart device using the web.

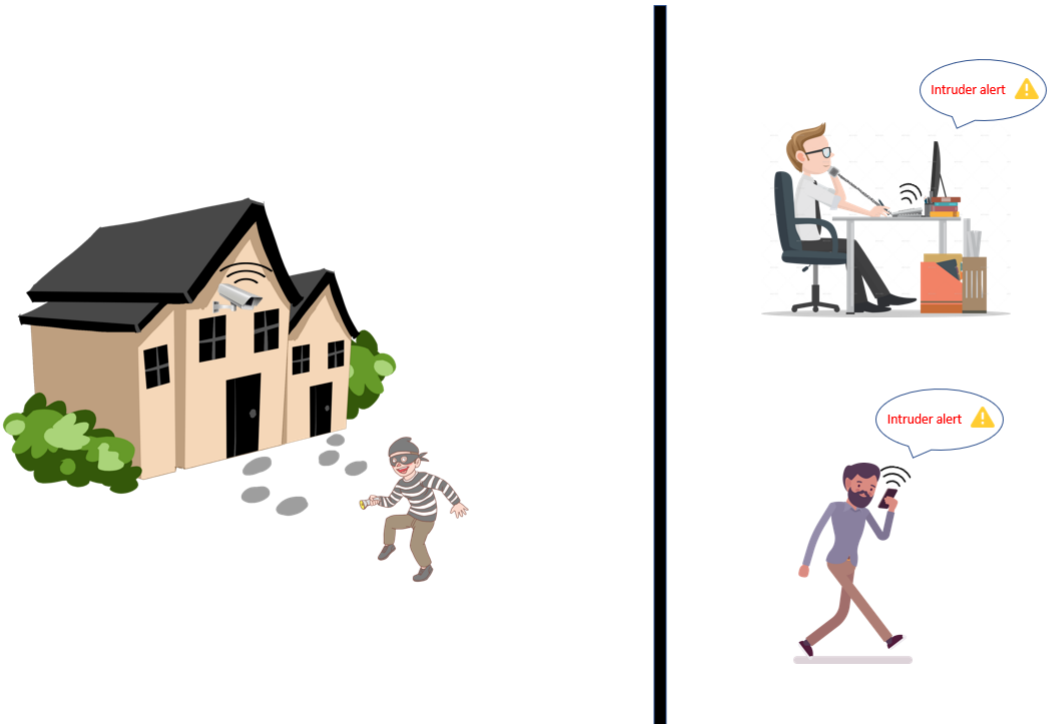

Fig 1 Intrusion Detection Working Explanation

Fig. 2 Fire Detection working Explanation

3.2 Schematic Diagram

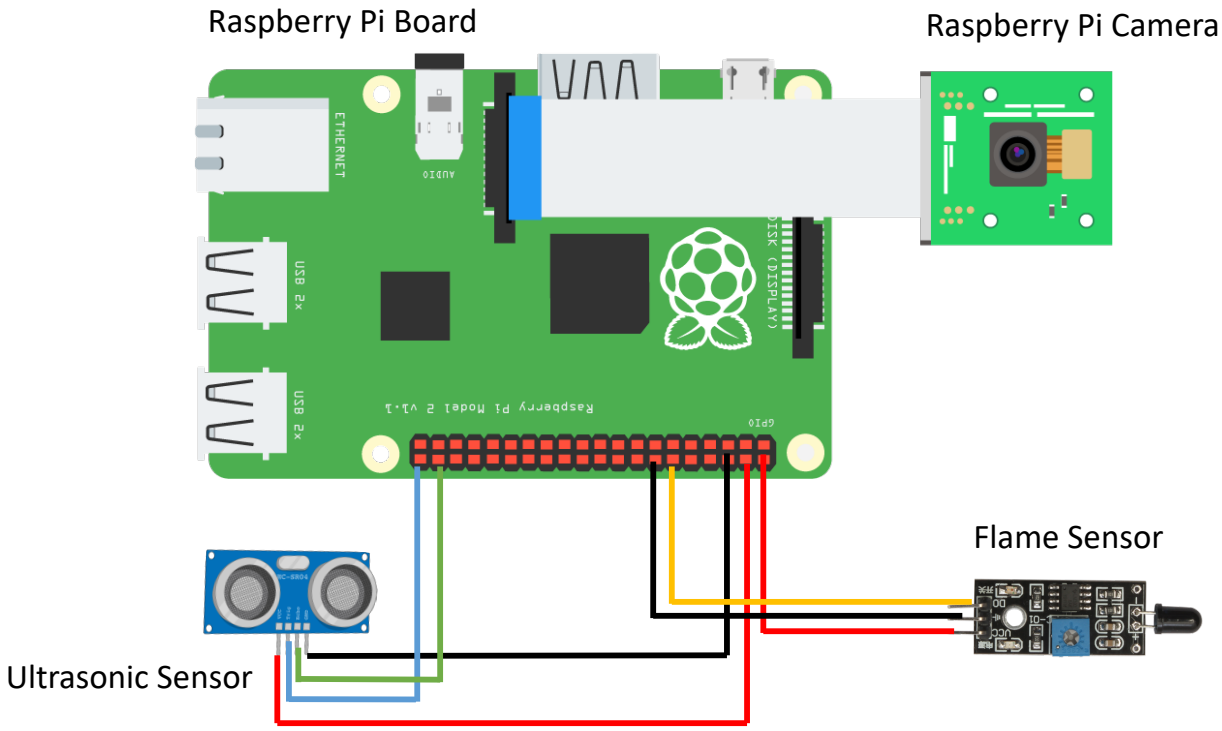

Fig. 3 Schematic Diagram

3.3 Components

The various components used in our project are as follows:

- Raspberry Pi
- Raspberry Pi camera module
- Raspberry Pi camera cable
- Micro SD Card
- Ultrasonic Sensor
- Flame Sensor
- Speaker
- 5V Power Adapter
- LED

3.3.1 Raspberry Pi:

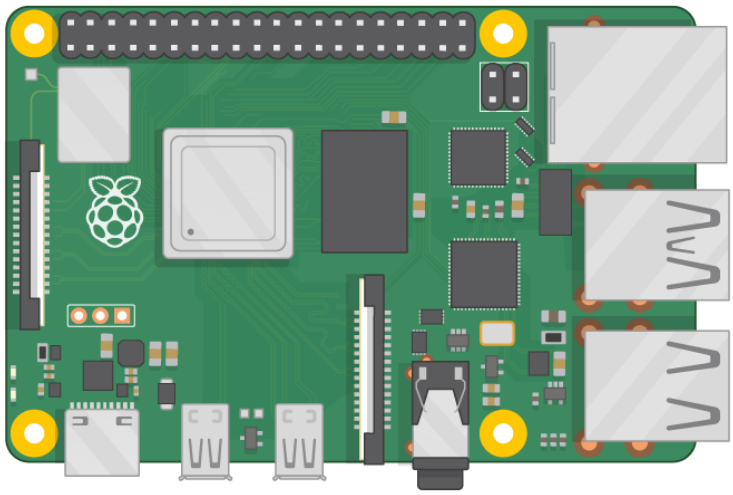

Fig. 4 Raspberry Pi

The Raspberry Pi is a low-cost computer that runs Linux, which has GPIO (general purpose input/output) ports that allow you to control electronic components for physical computing and explore the Internet of Things (IoT). 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.

Raspberry Pi is a line of miniature single-board computers (SBCs) developed in the United Kingdom by the Raspberry Pi Foundation in collaboration with Broadcom. A Raspberry Pi 4 board has 40 pins on it. Among these pins, we have four power pins on the Raspberry Pi, two of which are 5v pins and another two are 3.3v pins. There are 28 GPIO pins, which can be digitally programmed so that they can be turned ON or OFF. The output of any GPIO pin is 3.3v and can be used to control output components like an LED or a motor. And there are eight ground pins and all of these are connected to each other.

Technical Specifications:

Microprocessor	Raspberry Pi 4 Model B
SoC	BCM2711
Operating Voltage	5 V

RAM	4 GB
Clock Speed	1.5-GHz, Quad-Core (Cortex A-72)
Total Pins	40
Digital Pins	28
Input Voltage	4.75 - 5.25 V
GPU	500MHz Video Core-VI
Wired Networking	1x Gigabit Ethernet
Wireless	802.11ac (2.4/5GHz), Bluetooth 5.0
Max Resolution	4K60 + 1080p or 2x 4K30
Power Consumption	540 mA*
Size	3.5 x 2.3 x 0.76 inches
Weight	46 g

3.3.2 Raspberry Pi Camera Module:

Fig. 5 Raspberry Pi Camera Module

The 8MP Raspberry Pi Camera Module v2 can be used to take high-definition video, as well as stills photographs. It uses a high-quality 8-megapixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi, featuring a fixed focus lens. It is capable of 3280 x 2464-pixel static images, and also supports 1080p30, 720p60 and 640x480p60/90 video. It attaches to Pi by way of one of the small sockets on the board's upper surface and uses the dedicated CSI interface, designed especially for interfacing with cameras.

Technical Specifications:

Brand	Raspberry Pi
Model Number	B8-1DP2-E0O2
Lens	1/4 8M
Image Sensor	Sony IMX219
Field of View	72.4 degrees
Power Consumption	420 mA*
Video Resolution	1080p30, 720p60 and 640x480p90
Product dimensions	25mm x 23mm x 9mm
Item Weight	3g

3.3.3 Raspberry Pi Camera Cable:

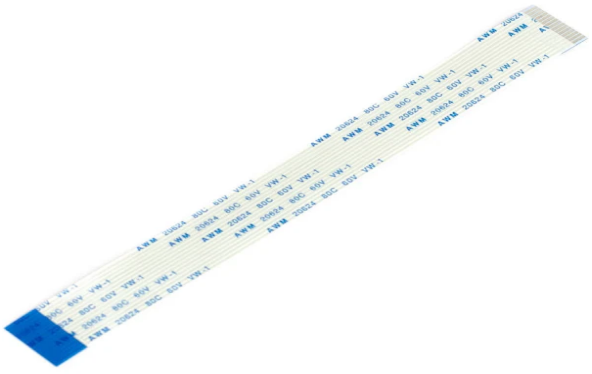

Fig. 6 Raspberry Pi Camera Cable

Raspberry Pi CSI camera connectors come in two varieties: 15-pin and 22-pin. The 15-pin connector is generally found on ordinary Raspberry Pi models

(A&B series) and Pi camera modules, while the 22-pin connector is found on the Raspberry Pi Zero-W and Compute Module IO Board.

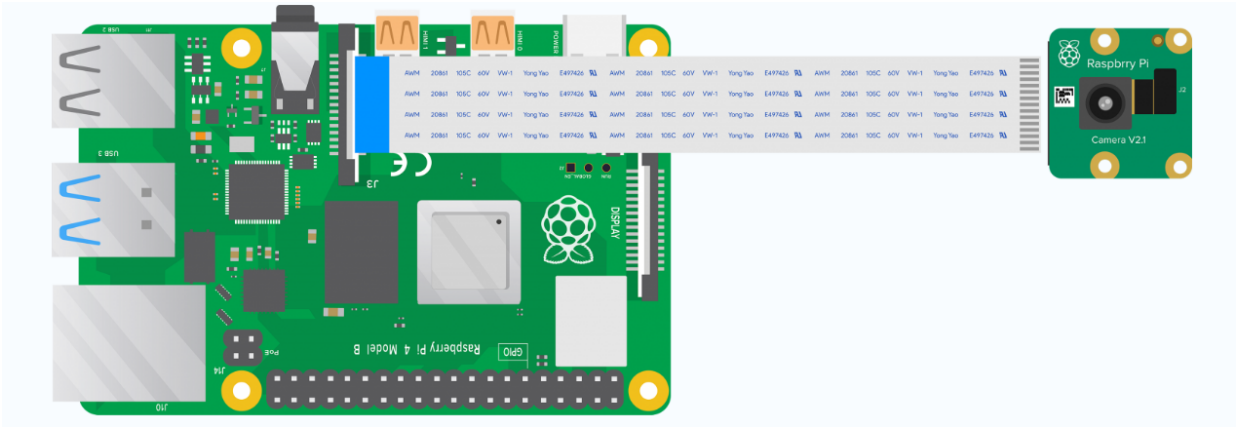

Fig. 7 Raspberry Pi Camera-Cable Connection

Technical Specifications:

Connector type	SFW15R-2STE1LF
Connector Mounting Angle	Right angle
No of Pins	15
Cable length	15 cm
Power Input	3.3 V
Weight	17.97 g

3.3.4 Micro SD Card:

MicroSD is a type of removable flash memory card that is used to store data. SD is an abbreviation for Secure Digital, and microSD cards are sometimes known as µSD.

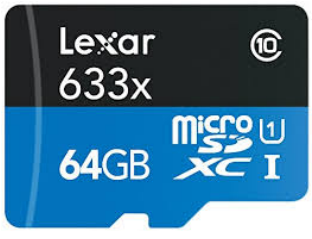

Fig. 8 Micro SD Card

Raspberry Pi does not come with any built-in storage, and in order to load the device's operating system and files, you will need to have a place to store them.

Technical Specifications:

Brand	SanDisk
Memory Size	64
Write Speed	120 Mb/s
Speed Class	UHS-I

3.3.5 Ultrasonic Sensor:

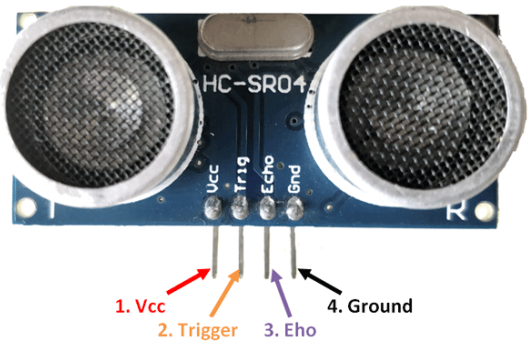

Fig. 9 Ultrasonic Sensor

HC-SR04 Sensor Features:

- Operating voltage: +5V
- Theoretical Measuring Distance: 2cm to 450cm
- Practical Measuring Distance: 2cm to 80cm
- Accuracy: 3mm
- Measuring angle covered: <15°
- Operating Current: <15mA
- Operating Frequency: 40Hz

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture below.

Fig. 10 Ultrasonic Sensor Working Explanation

The Trigger and the Echo pins are both I/O pins and hence they can be connected to the I/O pins of the microcontroller.

To start the measurement, the trigger pin has to be made high for 10uS and then turned off. This action will trigger an ultrasonic wave at a frequency of 40Hz from the transmitter and the receiver will wait for the wave to return. Once the wave is returned after it gets reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.

The amount of time during which the Echo pin stays high is measured by the microcontroller as it gives the information about the time taken for the wave to return back to the Sensor. Using this information, the distance is measured.

3.3.6 Flame Sensor:

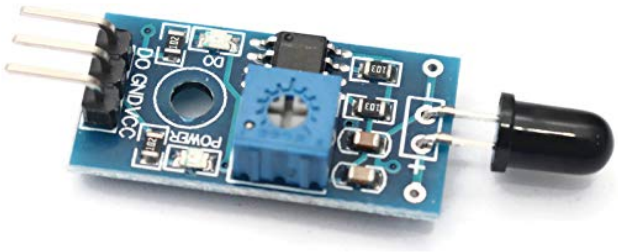

Fig. 11 Flame Sensor

The flame sensor module is used to detect fire/flame sources or other light sources of wavelength in the range of 760nm-1100nm. The detection angle is about 60 degrees, extremely sensitive to the flame spectrum.

It is based on the YG1006 sensor which is a high-speed and highly sensitive NPN silicon phototransistor. Due to its black epoxy, the sensor is sensitive to infrared radiation.

Technical Specifications:

Comparator type	LM393
Operating Voltage	3.3 V-5 V
Operating Current	15ma
PCB size	3.2cm X 1.4cm
Output	DO digital switching outputs (0 and 1) and AO analog voltage output

3.3.7 Speaker:

Fig. 12 Speaker

A speaker is an electroacoustic transducer, that is, a device that converts an electrical audio signal into a corresponding sound. The objective of the speaker in our project is to warn the individuals in the house as well as those in the neighbourhood.

Technical Specifications:

Connection Type	Bluetooth
Speaker Type	Subwoofer

3.3.8 Power Adapter:

Fig. 13 Power Adapter

A type-c power supply for electronic devices. Also called an "AC adapter", power adapters plug into a wall outlet and convert AC to a single DC voltage.

Raspberry Pi is a low-power micro-computer. The official Raspberry Pi USB-C power supply is designed to power the latest Raspberry Pi 4 Model B boards, which were released in June 2019.

Technical Specifications:

Input	AC 100-240V 50Hz/60Hz
Output	DC 5.1V 3A
USB type	Type C
Cable type	1.5m 18 AWG captive cable
Protection	Short circuit, overcurrent, and overtemperature

3.3.9 LED:

Fig. 14 LED

A light-emitting diode (LED) is a semiconductor device that emits light when an electric current flows through it. When current passes through an LED, the electrons recombine with holes emitting light in the process.In our project, we use led to alert the user.

3.4 Functional Block diagram:

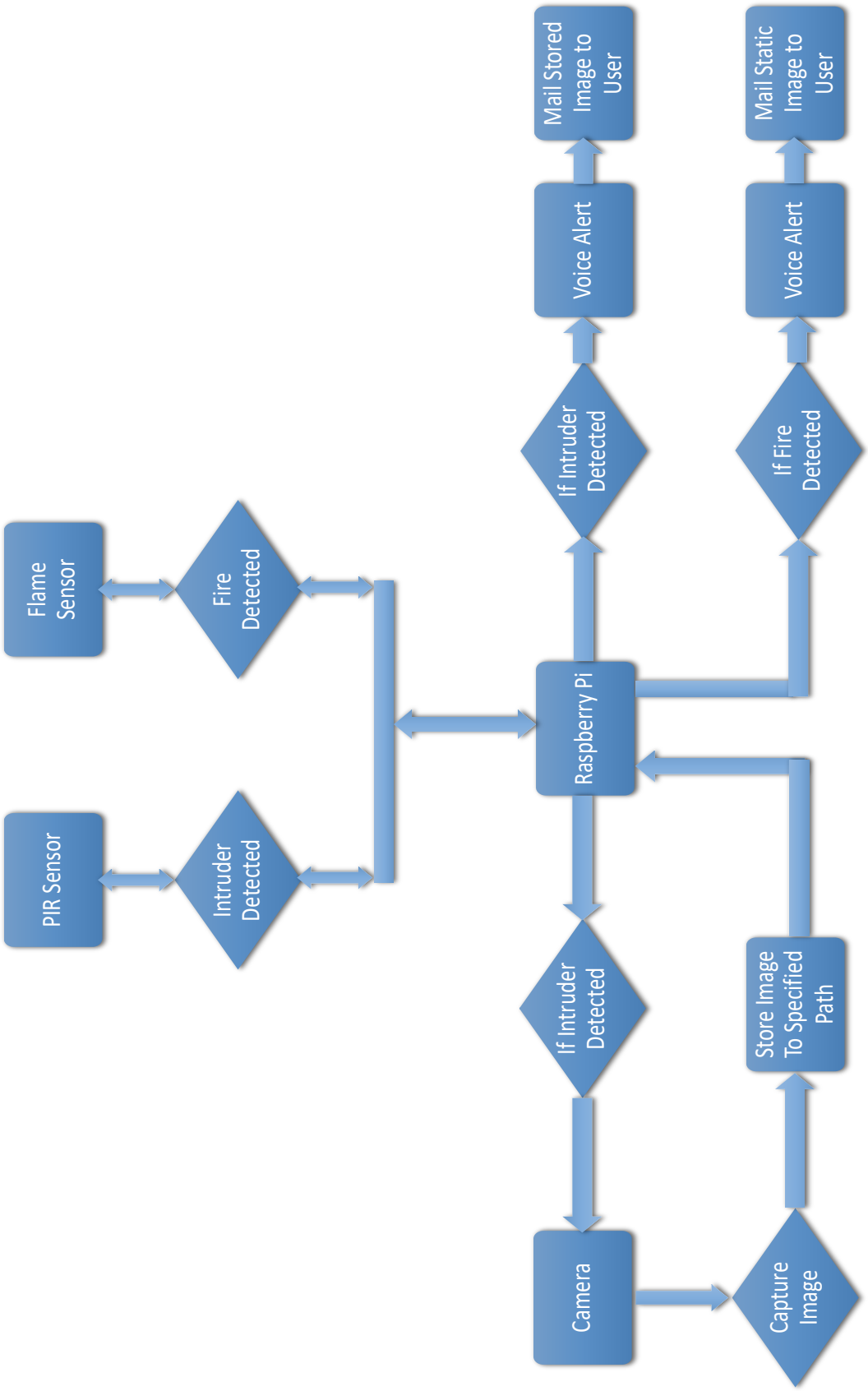

Fig. 15.1 Functional Block Diagram

3.5 Code Flowchart:

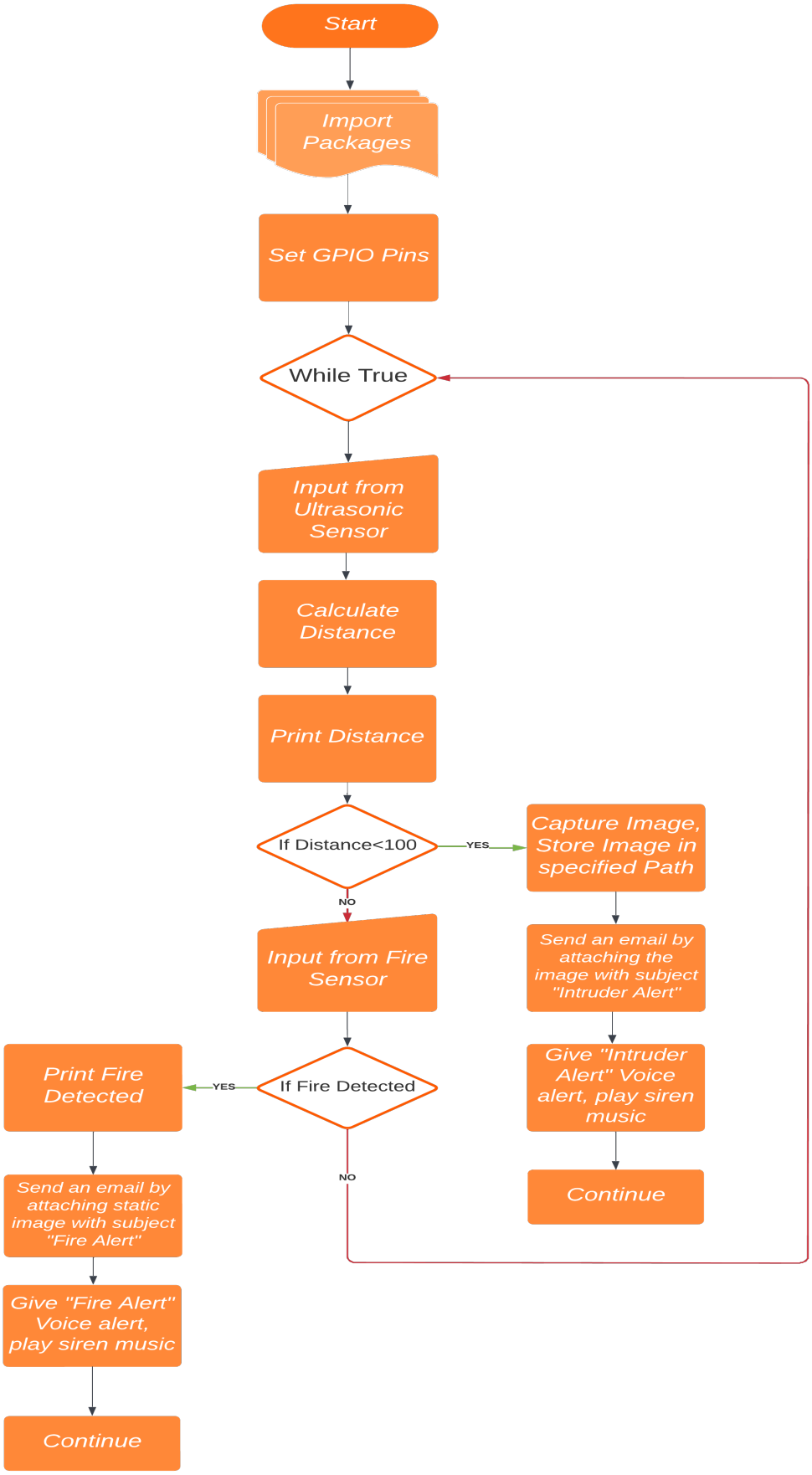

Fig. 15.2 Code Flow Chart

3.6 Working Model:

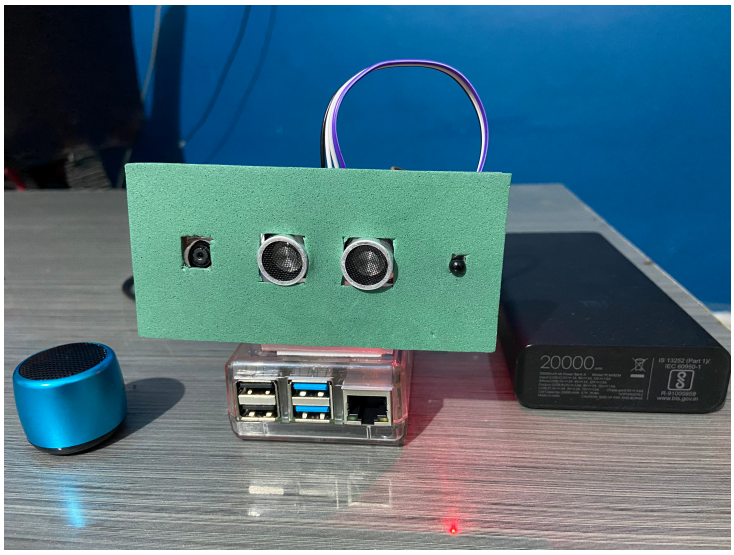

Fig. 16.1 Front View

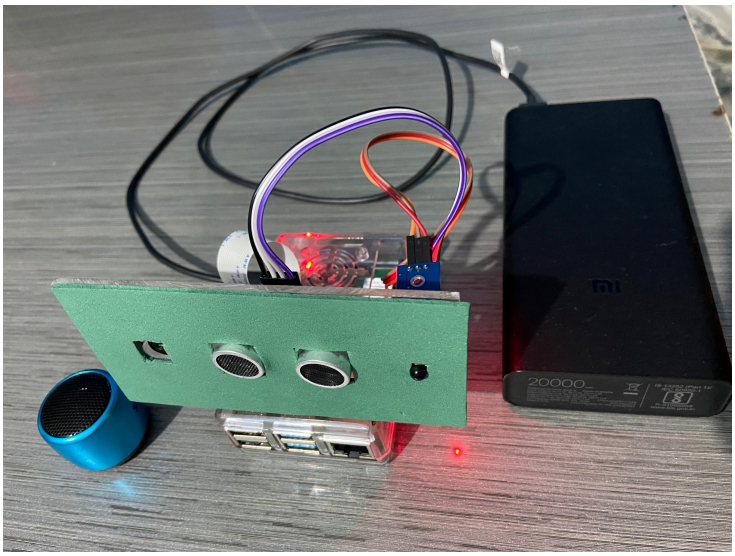

Fig. 16.2 Angled View

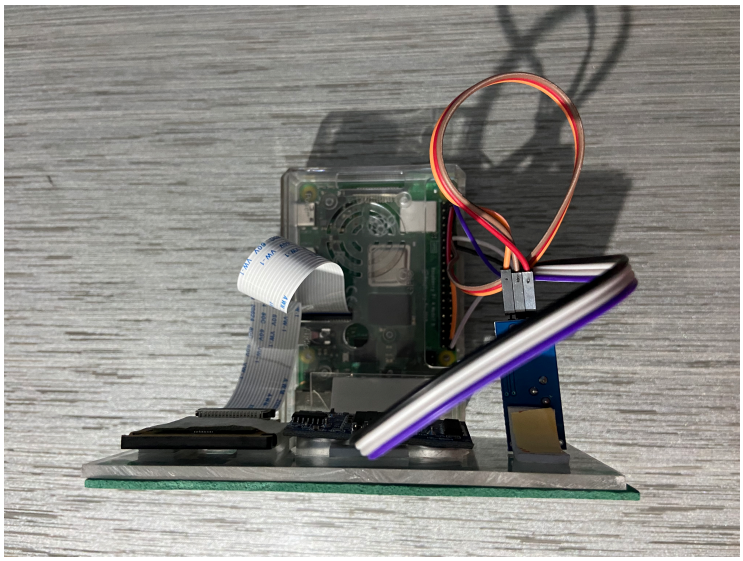

Fig. 16.3 Top View

3.7 Code:

Code For Intrusion Email Alert with Realtime Pic:

```
import smtplib,ssl
from picamera import PiCamera
from time import sleep
from email.mime.multipart import MIMEMultipart
from email.mime.base import MIMEBase
from email.mime.text import MIMEText
from email.utils import formatdate
from email import encoders
import RPi.GPIO as GPIO
import time
TRIG=21
ECHO=20
GPIO.setmode(GPIO.BCM)
while True:
    print("distance measurement in progress")
    GPIO.setup(TRIG,GPIO.OUT)
    GPIO.setup(ECHO,GPIO.IN)
    GPIO.output(TRIG,False)
    print("waiting for sensor to settle")
    time.sleep(0.2)
    GPIO.output(TRIG,True)
    time.sleep(0.00001)
    GPIO.output(TRIG,False)
    while GPIO.input(ECHO)==0:
        pulse_start=time.time()
    while GPIO.input(ECHO)==1:
        pulse_end=time.time()
    pulse_duration=pulse_end-pulse_start
    distance=pulse_duration*17150
    distance=round(distance,2)
    print("distance:",distance,"cm")
    time.sleep(2)
    if distance<100:
```

```
    camera = PiCamera()
    camera.start_preview()
    sleep(5)
    camera.capture('/home/pi/image.jpg')     # image path set
    sleep(5)
    camera.stop_preview()
  def send_an_email():
      toaddr = 'intruderalertingsystem@gmail.com'      # To id
       me = 'intruderalertingsystem@gmail.com'         # your id
       subject = "Intruder Alert!"              # Subject
       msg = MIMEMultipart()
       msg['Subject'] = subject
       msg['From'] = me
       msg['To'] = toaddr
       msg.preamble = "test "
       #msg.attach(MIMEText(text))
       part = MIMEBase('application', "octet-stream")
       part.set_payload(open("image.jpg", "rb").read())
       encoders.encode_base64(part)
      # File name and format name
       part.add_header('Content-Disposition', 'attachment;filename="image.jpg"')
       msg.attach(part)
       try:
          s = smtplib.SMTP('smtp.gmail.com', 587)  # Protocol
          s.ehlo()
          s.starttls()
          s.ehlo()
          s.login(user = 'intruderalertingsystem@gmail.com', password ='jarvis@123')
# User id & password
          #s.send_message(msg)
          s.sendmail(me, toaddr, msg.as_string())
          s.quit()
       #except:
       #   print ("Error: unable to send email")
       except SMTPException as error:
            print ("Error")              # Exception
    send_an_email()
```

Code For Both Email and Voice Alerts with Siren:

```
import RPi.GPIO as GPIO
import time
from subprocess import call
import pygame
import smtplib,ssl
from picamera import PiCamera
from time import sleep
from email.mime.multipart import MIMEMultipart
from email.mime.base import MIMEBase
from email.mime.text import MIMEText
from email.utils import formatdate
from email import encoders


TRIG=21
ECHO=18
#GPIO SETUP
channel = 20
GPIO.setmode(GPIO.BCM)
GPIO.setup(channel, GPIO.IN)
GPIO.setwarnings(False)


while True:
    print("distance measurement in progress")
    GPIO.setup(TRIG,GPIO.OUT)
    GPIO.setup(ECHO,GPIO.IN)
    GPIO.output(TRIG,False)
    print("waiting for sensor to settle")
    time.sleep(0.2)
    GPIO.output(TRIG,True)
    time.sleep(0.00001)
    GPIO.output(TRIG,False)
    while GPIO.input(ECHO)==0:
```

```
    pulse_start=time.time()
  while GPIO.input(ECHO)==1:
    pulse_end=time.time()
  pulse_duration=pulse_end-pulse_start
  distance=pulse_duration*17150
  distance=round(distance,2)
  print("distance:",distance,"cm")
  time.sleep(2)

  if(GPIO.input(20)==False):
    print("flame detected")
    call(["espeak","-s140 -ven+18 -z","Fire Detected"])
    def send_an_email():
      toaddr = 'intruderalertingsystem@gmail.com'      # To id
      me = 'intruderalertingsystem@gmail.com'          # your id
      subject = "Fire Alert"              # Subject

      msg = MIMEMultipart()
      msg['Subject'] = subject
      msg['From'] = me
      msg['To'] = toaddr
      msg.preamble = "test "
      #msg.attach(MIMEText(text))

      part = MIMEBase('application', "octet-stream")
      part.set_payload(open("fire.jpeg", "rb").read())
      encoders.encode_base64(part)
      part.add_header('Content-Disposition', 'attachment; filename="fire.jpeg"')   #
File name and format name
      msg.attach(part)

      try:
        s = smtplib.SMTP('smtp.gmail.com', 587)  # Protocol
        s.ehlo()
        s.starttls()
        s.ehlo()
```

```
            s.login(user = 'intruderalertingsystem@gmail.com', password =
'jarvis@123')  # User id & password
            #s.send_message(msg)
            s.sendmail(me, toaddr, msg.as_string())
            s.quit()
        #except:
        #   print ("Error: unable to send email")
        except SMTPException as error:
            print ("Error")              # Exception

    send_an_email()


  if distance<50:
    call(["espeak","-s140 -ven+18 -z","Intruder Alert"])
    pygame.mixer.init()
    pygame.mixer.music.load("siren.wav")
    pygame.mixer.music.play()
    while pygame.mixer.music.get_busy() == True:
        continue
    def send_an_email():
        toaddr = 'intruderalertingsystem@gmail.com'      # To id
        me = 'intruderalertingsystem@gmail.com'          # your id
        subject = "Intruder Alert"              # Subject

        msg = MIMEMultipart()
        msg['Subject'] = subject
        msg['From'] = me
        msg['To'] = toaddr
        msg.preamble = "test "
        #msg.attach(MIMEText(text))

        part = MIMEBase('application', "octet-stream")
        part.set_payload(open("intruder.png", "rb").read())
        encoders.encode_base64(part)
        part.add_header('Content-Disposition', 'attachment; filename="intruder.png"')
# File name and format name
```

```
        msg.attach(part)

        try:
          s = smtplib.SMTP('smtp.gmail.com', 587)  # Protocol
          s.ehlo()
          s.starttls()
          s.ehlo()
          s.login(user = 'intruderalertingsystem@gmail.com', password =
'jarvis@123')  # User id & password
          #s.send_message(msg)
          s.sendmail(me, toaddr, msg.as_string())
          s.quit()
        #except:
        #   print ("Error: unable to send email")
        except SMTPException as error:
            print ("Error")               # Exception

    send_an_email()
```

3.8 Code Exposition:

Here we are using various python libraries for different functionalities. Python's standard library has 'smtplib' module which defines an SMTP client session object that can be used to send mail via the Python program. A mail server is an application that handles and delivers e-mail over the internet. Pygame is a set of Python modules designed for writing video games. Pygame adds functionality on top of the excellent SDL library. This allows you to create fully featured games and multimedia programs in the python language. Picamera package provides a pure Python interface to the Raspberry Pi camera module for Python.

Here we have used a couple of sensors which are connected to the GPIO pins of raspberry pi, here the trig and echo pins of the ultrasonic sensor are connected to 20 and 18 of the GPIO pins and the digital pin of the flame sensor is connected to the 20 GPIO pin, the Vcc and Gnd pins of the ultrasonic sensor and flame sensor are connected to 5v and ground pins on the raspberry pi board.

When an intruder/object comes close to the sensor which is pre-set to 100cm the ultrasonic sensors detect and sends signals to the raspberry pi then the raspberry pi send signals to the pi camera to take a picture and then mails the pic to the user and using espeak function the raspberry pi gives voice alerts and plays siren music using pygame library. In the same way, the flame sensor detects any fire which is in the range of 760nm - 1100nm and then it will trigger the raspberry pi to send an email to the user and to give voice alerts using the espeak library and by playing siren using the pygame library.

CHAPTER 4

RESULTS AND DISCUSSIONS

We tested and confirmed the sensors against calibrated instruments before building the system. Then, using the developed system and its functionality testing, we confirmed that every sensing action went off without a hitch and that the emails/alerts were delivered to the user on time and accurately.

In future works, we intend to incorporate more features and sensors into the system to expand its capabilities with functions such as smart detection of the object and management of the main power supply.

The cost of the product will be very less compared to the existing surveillance systems, the pie chart figure below gives an understanding of the cost of each component. The overall cost of the device will be less than ₹2500.

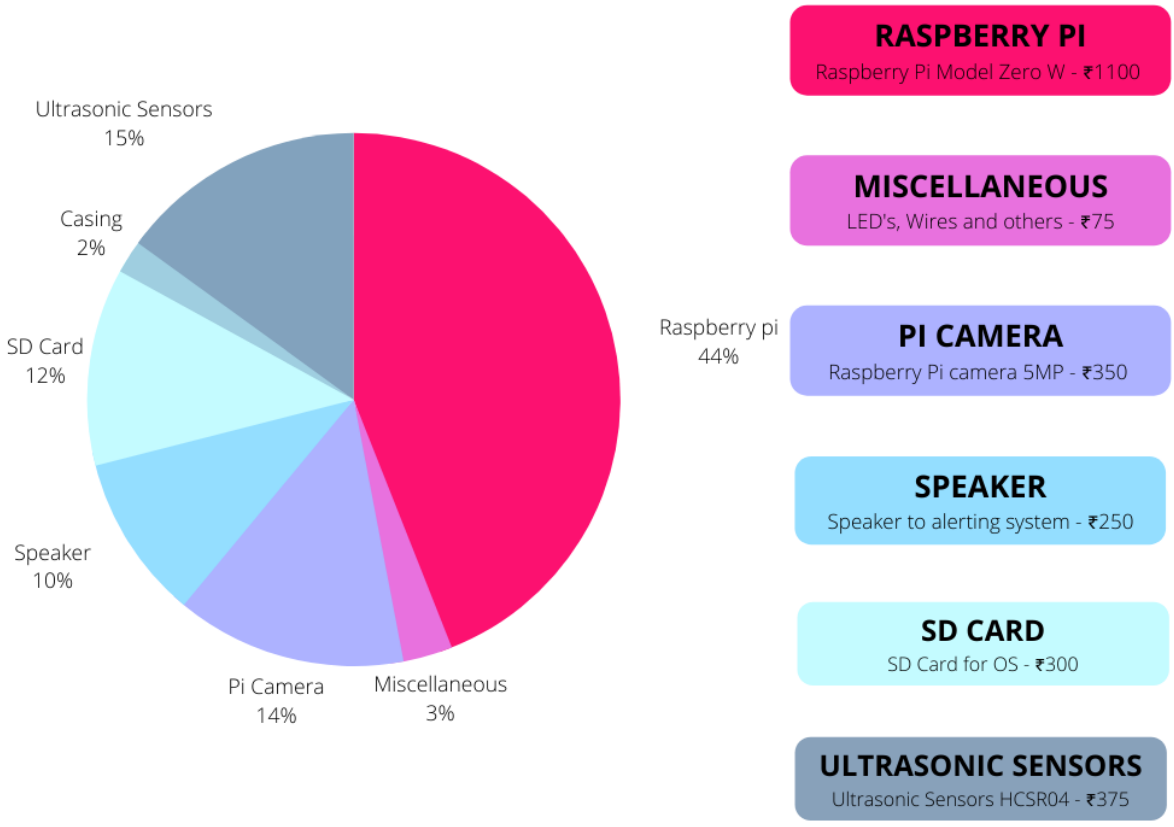

Fig. 17 Breakdown of Device Cost

4.1 Advantages:

The core advantages of the device over existing surveillance systems are:

- Very small space is required as compared to existing available surveillance systems in the market.
- Cost-efficient compared to available surveillance systems.
- The device uses wireless transmission, hence there is minimal data loss and time delay.
- Quick, Easy and inexpensive installation.
- There is no requirement for a surveillance room or centre, one can observe it from anywhere at any time.

4.2 Applications:

The device Intrusion Detection and Alerting System has all-round applications from home surveillance to monitoring traffic, here's the list of all the applications of the device.

Fig. 18 Applications

4.3 Implementation Output:

We have tested and confirmed the output of the system to receive notifications regarding the intrusion detection and fire alerts and fire alarm, we are needed to install an email application such as Gmail. Currently, we have created a specific email id for the project which is intrusionalertingsystem@gmail.com, so you can log in using the same email credentials or the user can change the email id to receive alerts by logging into Gmail using the same. The pictures of the alerts and live stream are attached below.

To view the live stream of the locality using the system, you are required to provide the IP address of the Raspberry Pi to any of the browser URL. Once you enter the URL of the device you will enter into an HTML page which shows the live stream of the locality along with several options. Using this feature you can record and store several videos and capture images and change the camera settings.

The voice alerts will start once the device detects a fire or an intruder, if the device detects an intruder, the system uses a bluetooth speaker to give a voice alert "Intruder Detected" along with siren music to alert the locality. If the device detects a fire, the bluetooth speaker gives a voice alert "Fire Detected" along with the siren music to alert the locality.

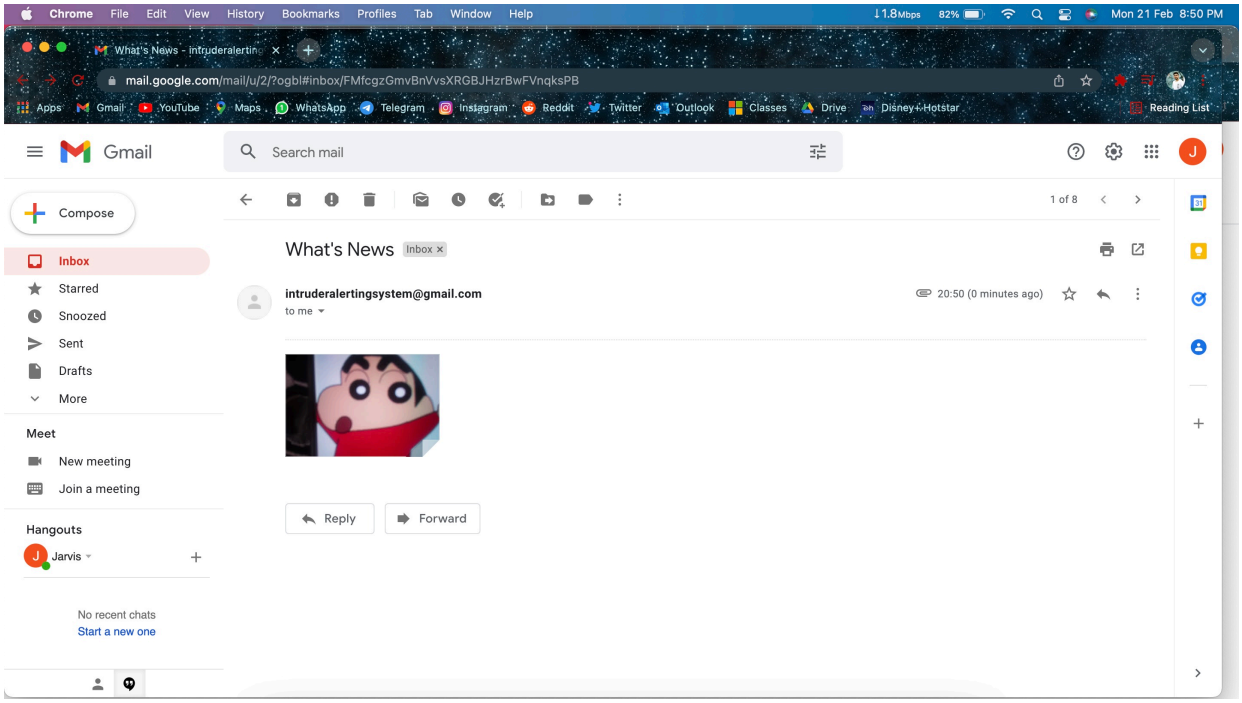

Fig. 19.1 Alerting User via Real-time Photo

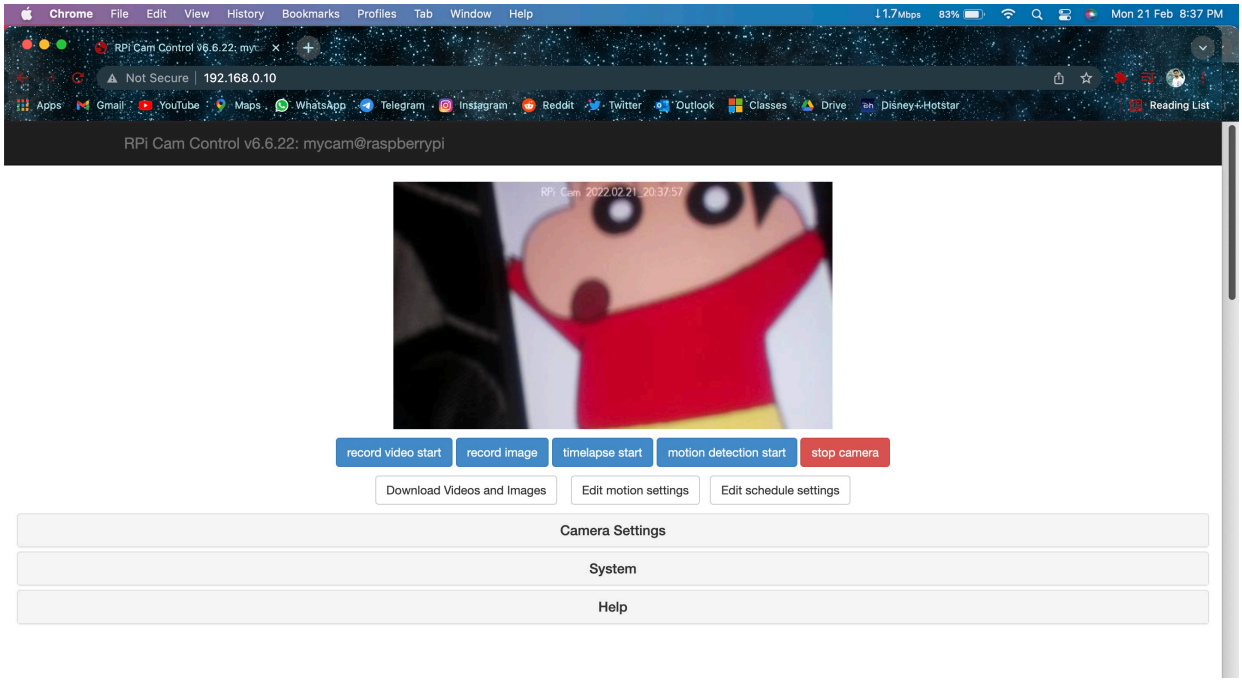

Fig. 19.2 Live Stream Video HTML Page

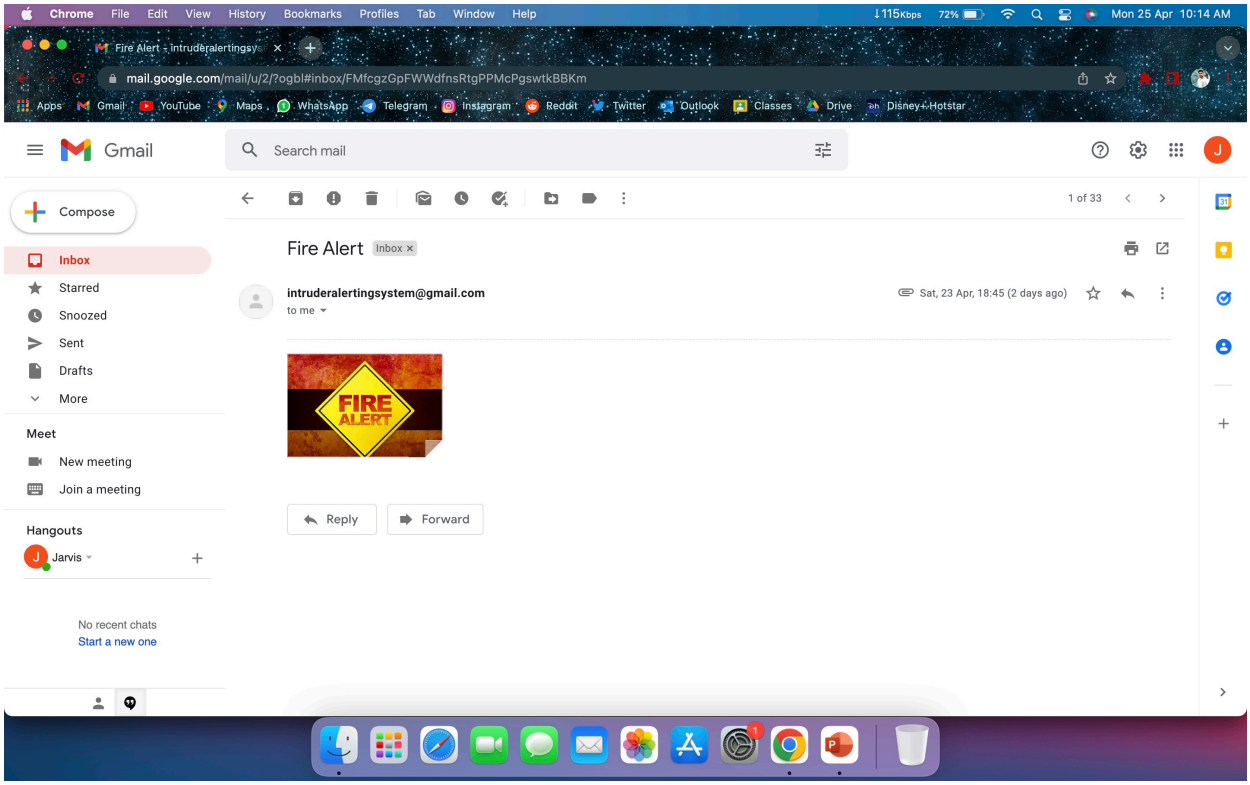

Fig. 19.3 Alerting User Regarding Fire

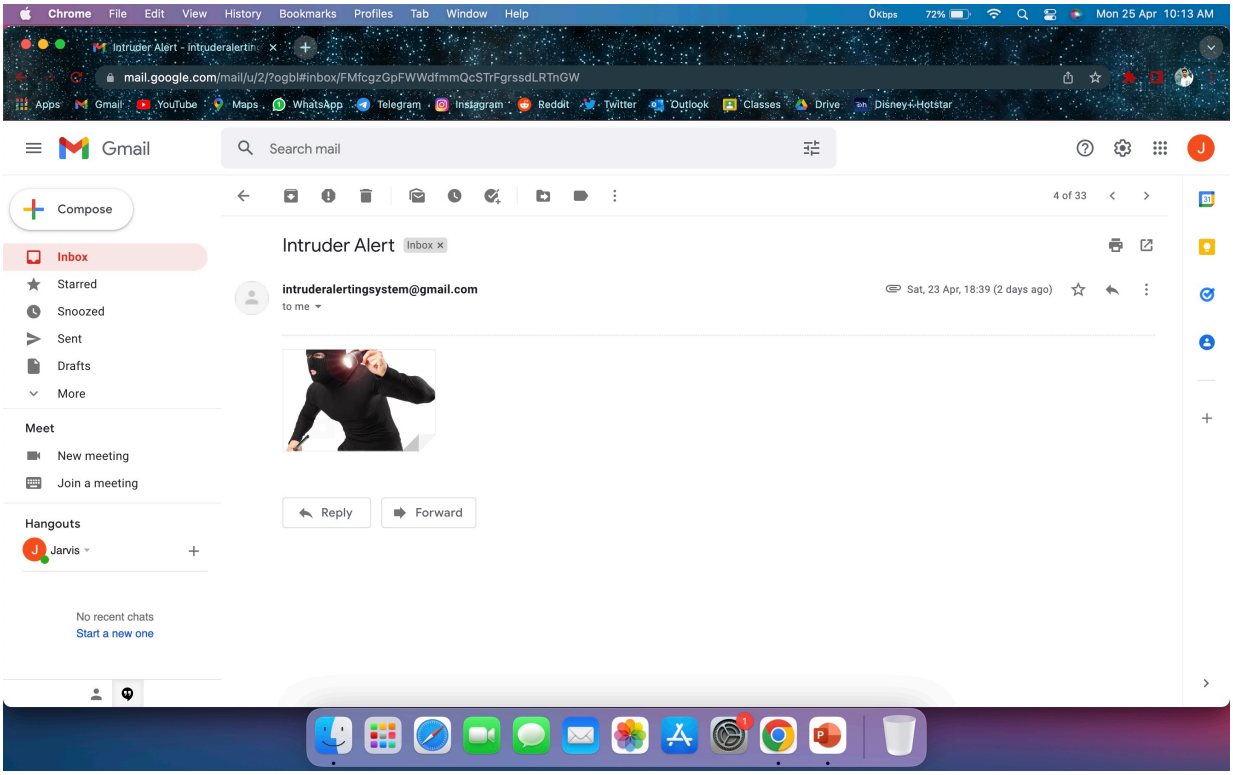

Fig. 19.4 Alerting User Regarding Intruder

Fig. 19 Demonstration Pictures

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

Raspberry Pi opens up a completely new chapter when it comes to technology today, not simply because of its size but because of its capabilities. Security will continue to be an issue for years to come. However, with tools such as The Intrusion Detection and Alerting System using Raspberry Pi countering the threat of home security should be a reliable solution.

The goal of this project is to create a low-cost, low-power-consumption web surveillance system. Because the Raspberry Pi is a microcomputer, this system is incredibly efficient. The camera module is capable of recording high-definition recordings in 720p and 1080p HD, allowing it to capture the intruder and swiftly inform the user. Furthermore, our project is capable of detecting any fires in the surveillance area and assisting in the early detection of big fires. As a result, wherever the system is installed, the camera shoots video in its proximity, and the output can be checked using the IP address received by a raspberry pi, and the necessary action can be made promptly.

Future scope:

The project has a very vast scope in the future. This project can be updated in the future as it is very flexible in terms of expansion. The following are the future scope for the project.

To improve the automation of home security, multiple features can be added in the future, we can add multiple cameras and sensors to provide security around all corners of the house. And multiple speakers can be added to cover the house. And using the OpenCV, which is a great tool for image processing and performing computer vision tasks which is an open-source library that can be used to perform tasks like face detection, objection tracking, landmark detection, and much more.

CHAPTER 6

REFERENCES

1) https://www.analyticsinsight.net/raspberry-pi-the-next-revolution-in-the-internet-of-things/#:~:text=Raspberry%20Pi%20(RPi)%20defines%20as,languages%20like%20Scratch%20and%20Python.
2) https://www.raspberrypi.com/documentation/computers/configuration.html
3) https://projects.raspberrypi.org/en/projects/getting-started-with-picamera/2
4) https://learn.adafruit.com/pir-passive-infrared-proximity-motion-sensor/how-pirs-work
5) https://en.wikipedia.org/wiki/Intrusion_detection_system
6) Journal of Computing, Volume 1, Issue 1, December 2009, ISSN: 2151-9617 Design of an Automated Intrusion Detection System incorporating an Alarm https://www.researchgate.net/publication/45891252_Design_of_an_Automated_Intrusion_Detection_System_incorporating_an_Alarm
7) ICCIDS 2019 Home Security against Human Intrusion using Raspberry Pi Published by Elsevier B.V Raju A Nadafa , S.M. Hatturea , Vasudha M Bonala , Susen P Naikb https://www.sciencedirect.com/science/article/pii/S1877050920306657
8) Conference: ICRAMSTEL-2019 At JIMS Engineering Management Technical Campus, Greater Noida Automatic threat detection and response system https://www.researchgate.net/publication/332752266_AUTOMATIC_THREAT_DETECTION_AND_RESPONSE_SYSTEM_ATDARS