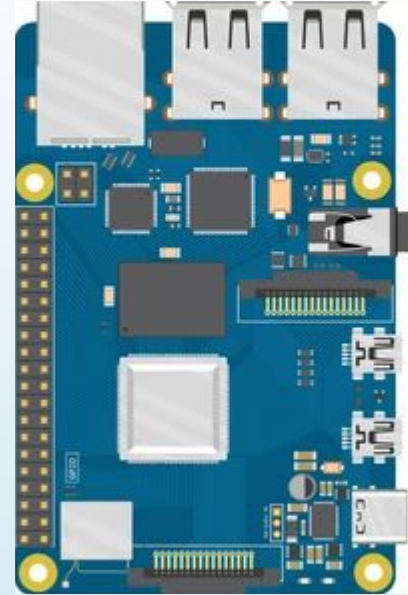


EE330

Semester 05

Intrusion Alert System with Raspberry-Pi

Communication Systems



Introduction

On average, every 3 minutes a burglary or robbery happens in India amounting to several thousand crores of loss annually according to National Crime Records Bureau (NCRB). Yet, nearly 64% of Indians are not equipped to handle home intrusions. Research has shown that burglars are 3 times more likely to target properties that don't use a security system with a camera. With most burglaries happening in the absence of people in the house, it is crucial to:

- Sense the intrusion
- Identify the intruder
- Alert the owner and police
- Deter the intrusion from happening

Drawing inspiration from personal incidents (~~disappearance of edible items from common fridge~~), We were motivated to develop an intrusion system that addresses these problems.

Objective

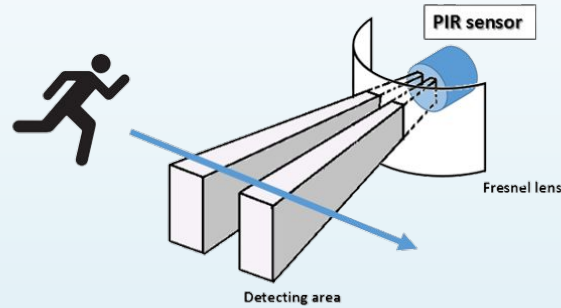


The aim of the project is to develop a system to detect the motion near the doorstep or disturbance to the door (sense the intrusion), capture the image of the intruder (identify the intruder), send a mail to the owner along with the picture (alert the owner), alert the intruder with a buzzer, led and LCD display (deter the intrusion from happening)

Components Required

1. Raspberry Pi 3
2. Pi Camera
3. PIR (Passive Infrared) Sensor
4. LED
5. Passive Piezoelectric Buzzer
6. Resistors
 - 68 Ohm
 - 220 Ohm
7. 16x2 LCD Display
8. i2c Module
9. Jumper Wires
10. Bread Board
11. Power Supply (Power Bank - 5V, 2 Amps)

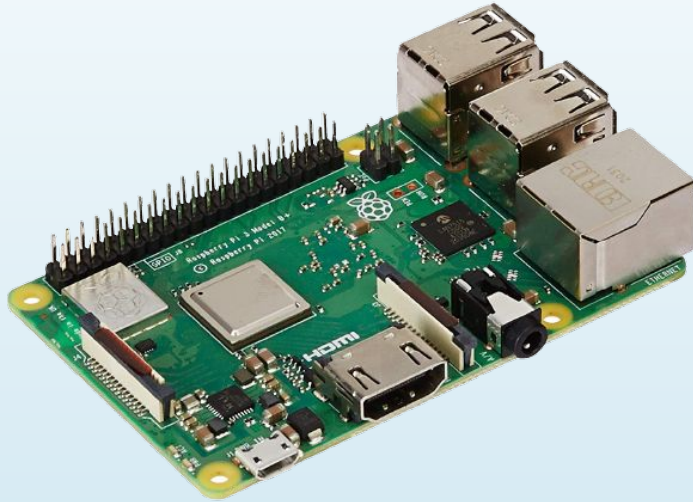
Sensors



PIR (Passive Infrared Sensor)

Many of the security sensors we walk through use passive infrared sensor for motion detection. It uses a pair of pyroelectric sensors to detect heat energy in the surrounding environment. These two sensors sit beside each other, and when the signal differential between the two sensors changes (for example, if a person enters the room), the sensor will engage. We use the output from this in the raspberry pi microcontroller to trigger the camera, LED and Buzzer.

Raspberry Pi 3

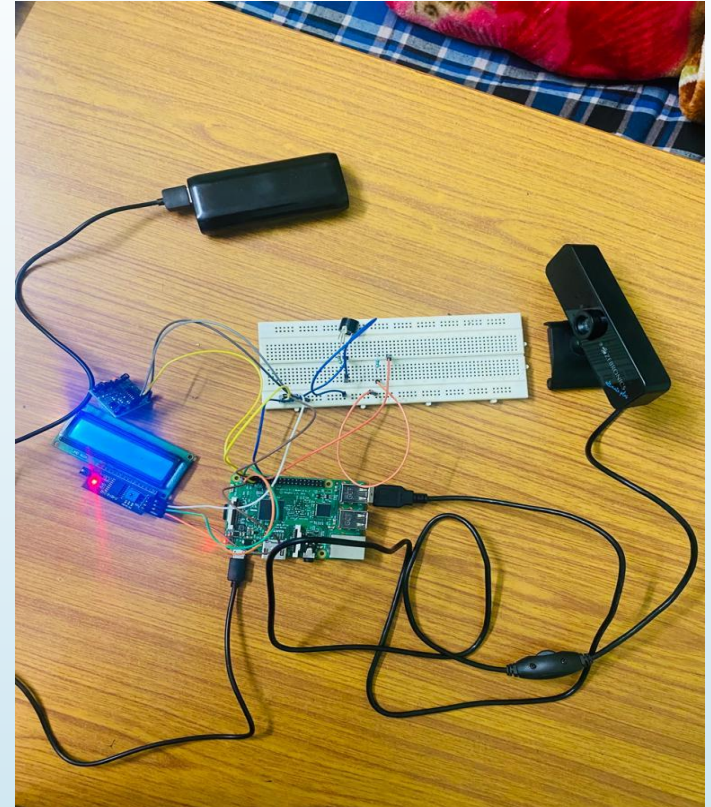
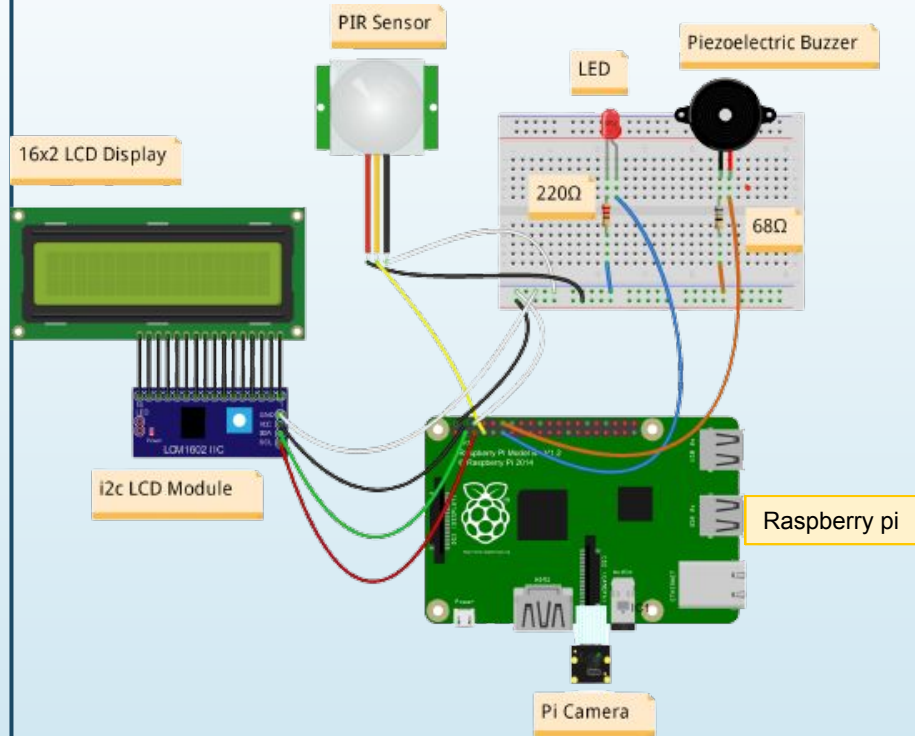


Raspberry pi is a very economical pocket sized computer. There are many ways in which you can make use of it.

It comes with additional I/O pins which helps in interaction of the Pi with external devices like sensors, motors, relays etc. and can easily be used as a media server in many projects.

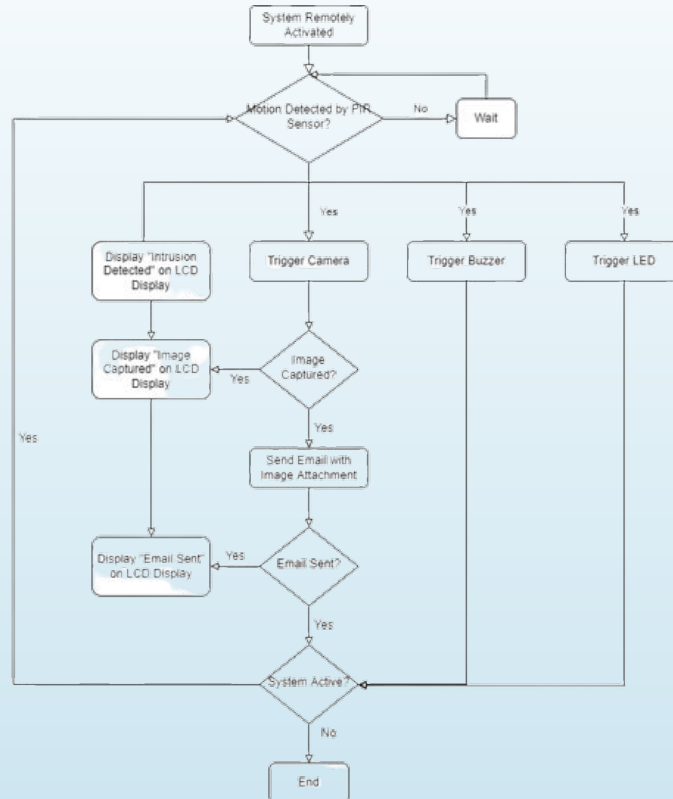
One can plug in Ethernet cable or connect the raspberry pi to internet through WiFi and use the Pi as your media server.

Circuit Diagram



Here black wires are used for positive terminals (Vcc) and white wires are used for the negative terminals (GND).

Working Principle



Code Analysis

```
import RPi.GPIO as gpio
import time
from cv2 import *

# make sure to have the drivers folder on the same
# parent folder as this python file
# import drivers
from .i2c_dev import Lcd, CustomCharacters

import smtplib
from email.mime.multipart import MIMEMultipart
from email.mime.text import MIMEText
from email.mime.base import MIMEBase
from email import encoders
from email.mime.image import MIMEImage
```

```
# Set the GPIO pins ids
led=17
buzzer=18
pir=4
HIGH=1
LOW=0
gpio.setwarnings(False)
gpio.setmode(gpio.BCM)
# Output GPIO pins
gpio.setup(led, gpio.OUT)
gpio.setup(buzzer, gpio.OUT)
# Input GPIO pins
gpio.setup(pir, gpio.IN)
data=""
# Setup LED and buzzer
gpio.output(led, LOW)
gpio.output(buzzer, LOW)
# Configure the to and from email address
from_email = "raspberrycream47@gmail.com"
from_email_pwd = "2-step verification password."

to_email = " "
mail = MIMEMultipart()
mail['From'] = from_email
mail['To'] = to_email
mail['Subject'] = "Someone is at Your Doorstep! "
body = "Hey Srivardhan,\nSomeone tried to open your door."
# Setup LCD display from the driver package
display = drivers.Lcd()
```

Code Analysis

```
# Run a forever loop
while 1:
    # PIR sensor detects any motion
    if gpio.input(pir)==1:
        # Trigger the led and buzzer
        gpio.output(led, HIGH)
        gpio.output(buzzer, HIGH)

        # Display that intrusion has been detected in the LCD and console
        print('Intrusion Detected')
        display.lcd_clear()
        display.lcd_display_string("Intrusion", 1)
        display.lcd_display_string("Detected", 2)

        (function) capture_image: () -> None
        capture_image()

    # Wait for the PIR sensor to not detect any motion
    while(gpio.input(pir)==1):
        time.sleep(1)

# PIR sensor doesn't detect any motion
else:
    # Turn off LED and buzzer and clear the LCD display
    gpio.output(led, LOW)
    gpio.output(buzzer, LOW)
    display.lcd_clear()
    time.sleep(0.01)
```

```
# Function to send the mail to the owner with images attached

def sendMail(data):

    # Create mail object with image attachment and text
    #mail.attach(MIMEText(body, 'plain'))
    print('hy')
    dat='hy.jpg'%data
    attachment = open(dat, 'rb')
    image=MIMEImage(attachment.read())
    attachment.close()
    mail.attach(image)

    # Establish connection and send the mail
    server = smtplib.SMTP('smtp.gmail.com', 587)
    server.starttls()
    server.login(from_email, from_email_pwd)
    text = mail.as_string()
    server.sendmail(from_email, to_email, text)

    # Notify that mail has been sent in LCD and console
    print('Mail Sent')
    display.lcd_clear()
    display.lcd_display_string("Mail Sent", 1)

    server.quit()
```

```
def capture_image():

    # importing OpenCV library

    # initialize the camera
    # If you have multiple camera connected with
    # current device, assign a value in cam_port
    # variable according to that
    cam_port = 0
    cam = VideoCapture(cam_port)

    # reading the input using the camera
    result, image = cam.read()

    # If image will detected without any error,
    # show result
    if result:
        imshow("hy", image)
        imwrite("hy.jpg", image)
        waitKey(0)
        destroyWindow("hy")
    else:
        print("No image detected. Please! try again")

    # Send the mail
    sendMail(image)
```

Future Scope

The scope of the project could be extended to include face recognition. Right now, the intrusion is triggered if any motion occurs to near the doorstep or any disturbance is caused to the door. However, it is helpful if it is only triggered and sends a mail if a person is in the door step. Further, it is unnecessary for it to alert the owner or the people they have whitelisted if it identifies their entry. To tackle this, facial recognition could help in selectively identifying the intruder. To extend it even further, microphone could be added to record the sound/voice of the intruder. To provide more context, instead of a picture, a video with the audio could be recorded and sent to the owner. An all-in-one system of this sort would typically cost thousands of rupees in the market but it could be easily added with a few additions to the code and hardware.

Conclusion

This project provides an all-in-one system to alert about an intrusion, help in catching the intruder and possibly deter the intrusion from taking place. Since the project is built using raspberry pi, it could be extended further to add more functionalities mentioned previously.

Thank You