## HOME SECURITY AUTOMATION USING RASPBERRYPI

## B. Tech. Lab Project Report

**on**

**Electronic Workshop 3 (19EC2214)**

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**VADDESWARAM, GUNTUR**

## AUGUST, 2021

# KLEF for Android - APK Download

# CERTIFICATE

We hereby certify that the work which is being presented in the B.Tech. Project Report entitled **“ HOME SECURITY AUTOMATION USING RASPBERRYPI”,** in partial fulfillment of the requirements for the award of the **Bachelor of Technology in Electronics & Communication Engineering** and submitted to the Department of Electronics & Communication Engineering of KLEF, Vaddeswaram, Guntur This is an authentic record of our own work carried out during a period from December 2020 to Augusrt 2021 under the supervision of **Aswin Kumar sir,** **ECE Department**.

*Signature of Candidates*

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1. **Introduction**

In the world of Internet of Things (IoT) when we have all the technologies to revolutionize our life, it's a great idea to develop a system which can be controlled and monitored from anywhere. There are many types of good security systems and cameras out there for home security but they are much expensive so today we will build a low cost simple Raspberry Pi based Intruder Alert System, which not only alert you through an email but also sends the picture of Intruder when it detects any.

Home security has been a crucial and most common thing these days. This has been made simpler with iot and automation. In this project we are going to build an automated home security system using raspberry pi. This can be used for home or even for office as it is compact and easy to setup. Home automation security has been much active in the meantime as the usage of iot increased a lot.

The basic principle of the project is we will be using a raspberry pi with a pi camera module which is used to capture the images. The ultrasonic sensors, Lights, Alarm will be connected the pi. When any object moment has been detected the ultrasonic sensor then will trigger the pi to turn on the lights with activating the buzzer so the nearby neighbours be notified about the alert. As the lights on the camera module will capture the images of the scene and mail them to our designated mails and send us an alert message for our mobiles.

These iot automations makes our life easier with less efforts and more outcome. As these work perfectly fine and can be made at low cost we can make it a useful tool.

1. **List of Components**

|  |  |
| --- | --- |
| **Components** | **Requirement(pcs)** |
| **Raspberry pi** | **1** |
| **Pi Camera module** | **1** |
| **Buzzer** | **1** |
| **Ultra sonic sensor** | **1** |
| **Resistors** | **330 and 410 ohms 2 pcs** |
| **Relay** | **N/A** |
| **LEDS** | **1** |
| **BREAD BOARD** | **1** |

**3. Hardware Components Details**

**3.1. RASPBERRY PI**

The Raspberry Pi is a tiny and affordable computer that you can use to learn programming through fun, practical projects. 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, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games.



Figure 3.1.1

(Raspberry pi 4 image)

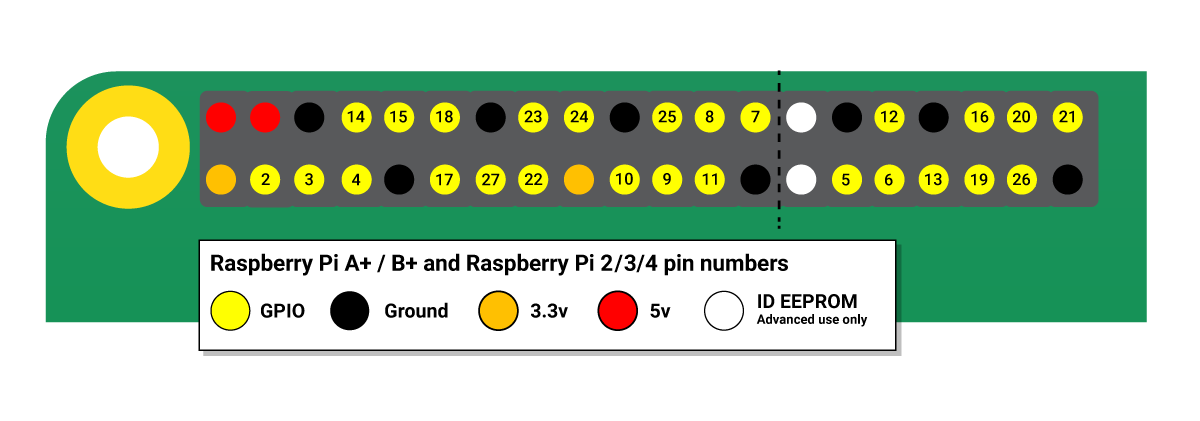
Any of the GPIO pins can be designated (in software) as an input or output pin and used for a wide range of purposes

Figure 3.1.2

(Pin Description of raspberry pi)

The numbering of the GPIO pins is not in numerical order; GPIO pins 0 and 1 are present on the board (physical pins 27 and 28) but are reserved for advanced use (see below**).**

*Voltages*

Two 5V pins and two 3.3v pins are present on the board, as well as a number of ground pins (0V), which are unconfigurable. The remaining pins are all general purpose 3.3v pins, meaning outputs are set to 3.3v and inputs are 3.3v-tolerant.

*Outputs*

A GPIO pin designated as an output pin can be set to high (3.3v) or low (0V).

*Inputs*

A GPIO pin designated as an input pin can be read as high (3.3v) or low (0V). This is made easier with the use of internal pull-up or pull-down resistors. Pins GPIO2 and GPIO3 have fixed pull-up resistors, but for other pins this can be configured in software.

*More*

As well as simple input and output devices, the GPIO pins can be used with a variety of alternative functions, some are available on all pins, others on specific pins.

* PWM (pulse-width modulation)
  + Software PWM available on all pins
  + Hardware PWM available on GPIO12, GPIO13, GPIO18, GPIO19
* SPI
  + SPI0: MOSI (GPIO10); MISO (GPIO9); SCLK (GPIO11); CE0 (GPIO8), CE1 (GPIO7)
  + SPI1: MOSI (GPIO20); MISO (GPIO19); SCLK (GPIO21); CE0 (GPIO18); CE1 (GPIO17); CE2 (GPIO16)
* I2C
  + Data: (GPIO2); Clock (GPIO3)
  + EEPROM Data: (GPIO0); EEPROM Clock (GPIO1)
* Serial
  + TX (GPIO14); RX (GPIO15)

**3.2. PI CAMERA MODULE**

Raspberry pi camera module is basically a camera piece which connects to raspberry pi with DSI cable. In this project the camera module plays the key role as it will capture the images of the area. Here we are using pi camera V1.3 which has 5mp resolution and capture up to 1080p videos with ease.

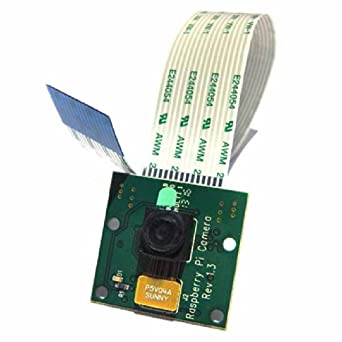


Figure 3.2.1

(Pi camera module)

**3.3. BUZZER**

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.



Figure 3.3

(beep sound buzzer)

**3.4. ULTRASONIC SENSOR:**

An ultrasonicsensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). In this project we will be using HC-SR04 module which emits a wave at 40Khz frequency.



Figure 3.4.1

(Ultrasonic sensor HC-SR04 with 4 pins and 5v input)

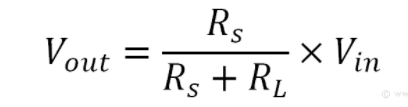
|  |  |  |
| --- | --- | --- |
| **Pin Number** | **Pin Name** | **Description** |
| 1 | Vcc | The Vcc pin powers the sensor, typically with +5V |
| 2 | Trigger | Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave. |
| 3 | Echo | Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor. |
| 4 | Ground | This pin is connected to the Ground of the system. |

Table 3.4.1(Pin Description of the ultrasonic sensor)

**Note:** The working voltage of sensor is 5v, the operational voltage of

raspberry pi is 3.3v.



****

So, here Rs is 1.5Kohm, Rl is 680ohm, Vin is form the echo pin which varies form 0-5v. When echo is 5v the Vout is (1500/2180)\*5 = 3.44V. Which can be round to around 3.3v(working voltage of PI).

**3.5. RESISTOR**

Resistor is an electrical component that reduces the electric current. The resistor's ability to reduce the current is called resistance and is measured in units of ohms (symbol: Ω).If we make an analogy to water flow through pipes, the resistor is a thin pipe that reduces the water flow.

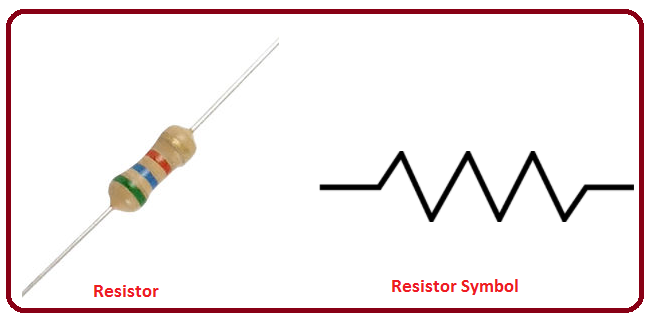


Figure 3.5.1(Image of Resistor and it’s symbol)

**3.6. LED (LIGHT EMITTING DIODE)**

A light-emitting diode (LED) is a two-lead semiconductor light source that resembles a basic pn- junction diode, except that an LED also emits light. When an LED's anode lead has a voltage that is more positive than its cathode lead by at least the LED's forward voltage drop, current flows. Electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the colour of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor**.**

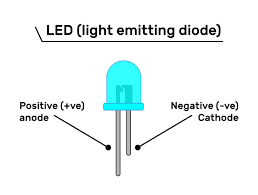


Figure 3.6.1(Basic Led)

**3.7. RELAY**

Relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. The traditional form of a relay uses an electromagnet to close or open the contacts, but other operating principles have been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called protective relays.

In this project we will not be using a relay as were making an prototype we will be using an led as light indication.

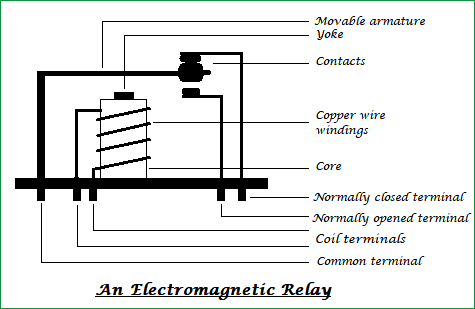


Figure 3.7.1(Basic functionality of relay)

**3.8. BREAD BOARD**

A breadboard, or proto board, is a construction base for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used when slicing bread.In the 1970s the solderless breadboard (a.k.a. plugboard, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these. Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also popular with students and in technological education



Figure 3.8.1(Generic Bread Board)

**4. Software Details and Code**

**4.1. BASIC INTRO ON PYTHON**

In this project we will be using python as the coding language because it is the most easy and convenient languages for iot.

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed. The language is quite easier for iot, machine learning, opencv and many real world applications and websites run on this.

**4.2. CODE**

Here we have divided the code into parts for our convenience. In code 1 we will be having the functions to get the input from the ultrasonic sensor and activate the lights and alarm and send us the alert message to specified number. Here we have kept a maximum distance of 60cm up to with the input will trigger if any object passes through it.

**4.2.1. CODE1**

NOTE: We will be using GPIO numbering for pin connection

import RPi.GPIO as GPIO

import time

import test

from twilio.rest import Client

GPIO.setmode(GPIO.BOARD)

def lightandalarm():

light=13

alarm=22

GPIO.setup(light,GPIO.OUT)

GPIO.setup(alarm,GPIO.OUT)

GPIO.output(light,True)

GPIO.output(alarm,True)

msgalert()

test.main()

time.sleep(2)

GPIO.output(light,False)

GPIO.output(alarm,False)

def msgalert():

account\_sid = "AC0924a58632fc926905fabda429cabeb9"

auth\_token = "da584c234a0db1c43ef8b15c989ea080"

client = Client(account\_sid, auth\_token)

message = client.messages .create(body = "intruder alert!!", #Message you send

from\_ = "\*\*\*\*\*\*\*\*\*\*\*",#Provided phone number given by twilio

to = "\*\*\*\*\*\*\*\*\*\*\*\*\*")#Your phone number

message.sid

GPIO.cleanup()

if \_\_name\_\_ == "\_\_main\_\_":

trig=16

echo=18

i=0

GPIO.setup(trig,GPIO.OUT)

GPIO.setup(echo,GPIO.IN)

GPIO.output(trig, False)

print("starting")

time.sleep(1)

try:

while True:

GPIO.output(trig,True)

time.sleep(0.00002)

GPIO.output(trig,False)

while GPIO.input(echo)==0:

start=time.time()

while GPIO.input(echo)==1:

end=time.time()

duration=end-start

distance=duration\*17150

distance=round(distance+1.15,2)

if(distance >=10 and distance<60):

print("distance is :",distance)

lightandalarm()

GPIO.cleanup()

except KeyboardInterrupt:

print("stopping")

time.sleep(2)

GPIO.cleanup()

**4.2.2. CODE 2**

In 2nd code we will be having functions to capture the images from the picamera module and send those photos to designated mail id with the time and date stamp on the images.

We will be sending mail using Simple Mail Text Protocol which makes us to send mails automatically even with attachments in it.

import glob

import picamera

from time import sleep

import datetime

import os

import smtplib

from email.message import EmailMessage

global path

def startshoot():

time=datetime.datetime.now().strftime("%c")

folder\_name=str(time)

parentpath="/home/pi/Desktop/EW3 project/cameraoutput"

path=os.path.join(parentpath,folder\_name)

os.mkdir(path)

camera=picamera.PiCamera()

sleep(3)

for i in range(2):

name=datetime.datetime.now().strftime("%X")

image\_store\_path=path+'/'+name+'.jpg'

sleep(1)

camera.capture(image\_store\_path)

camera.close

print(path)

makelist\_and\_mail(path)

def makelist\_and\_mail(location):

msg=EmailMessage()

msg['Subject']="There's something wrong here. The alarm has triggered Please check the images from pi"

msg['From']='Home Security'

msg['To']='reciever mail id'

msg.set\_content("This is alert message.There is something wrong at the house")

images\_path=location+'/'

fileslist=glob.glob(images\_path+"\*.jpg")

print(fileslist)

for file in fileslist:

with open(file,"rb") as data:

file=data.read()

#print(file) to show the binary values for understanding as we kept RB as read format

fname=data.name[-12:]

msg.add\_attachment(file,maintype="Image",subtype="jpg",filename=fname)

print(fname+" attached to the mail")

server=smtplib.SMTP\_SSL('smtp.gmail.com',465)

server.login("The sender email","password")

server.send\_message(msg)

server.quit()

print("mail sent")

def main():

startshoot()

**4.3. Working Principle**

So the principle will be explained in detailed and simple manner. Let understand this in 4 steps.

1) The ultrasonic sensor will be actively run in the loop when the program starts and if anything passes through the detectable area then the sensor will be triggered.

2) The triggered input will be passed to the pi as Echo pin is in input mode and the distance will be displayed in the console and it activates the lights and alarm function. This function will on the lights and alarm and starts mobile message alert function.

3) While the alarm is on the message will be sent and image capturing function activates followed with mailing function.

4) The image will be captured and will be saved in pre detonated folder and the path is passed to the mail function. In the mail function from the path given the code takes the images and attach to the mail to the default syntax provided.For mailing we are using SMTP Library which is available.

**5. RESULTS AND ANALYSIS**

**5.1. Real time and output figures**



Figure 5.1.1 Figure 5.1.2

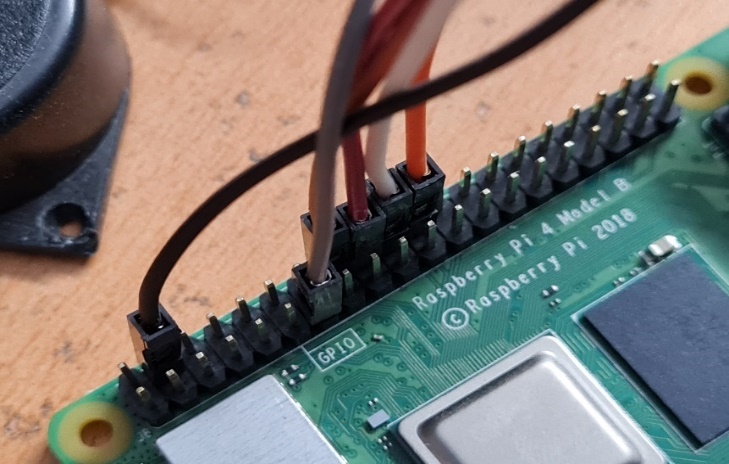
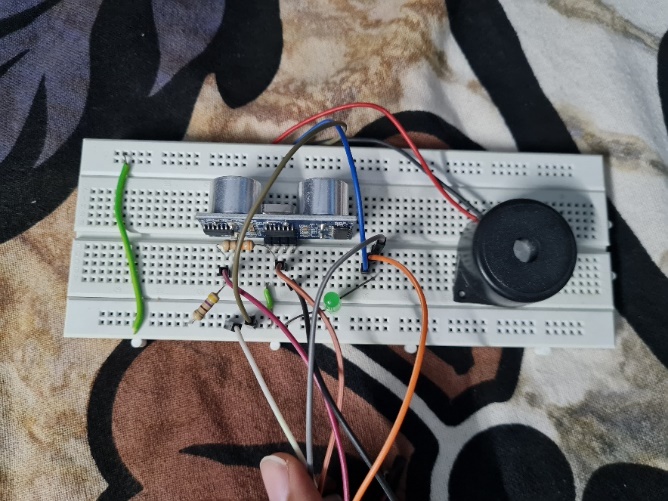
 (Pi Camera Module) (Pi connected with the camera module)

Figure 5.1.3 Figure 5.1.4

(Pin Configuration) (Complete Demo Circuit)

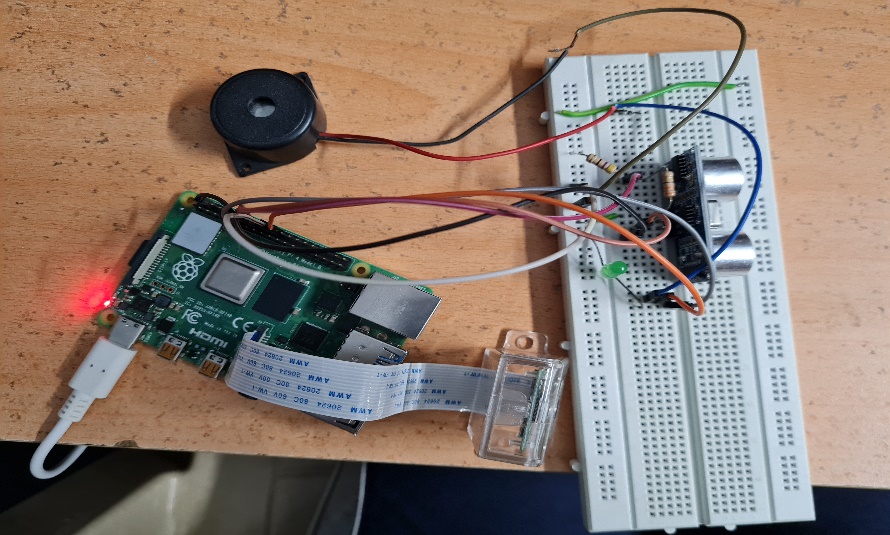


Figure 5.1.5

(Completed connected Circuit)

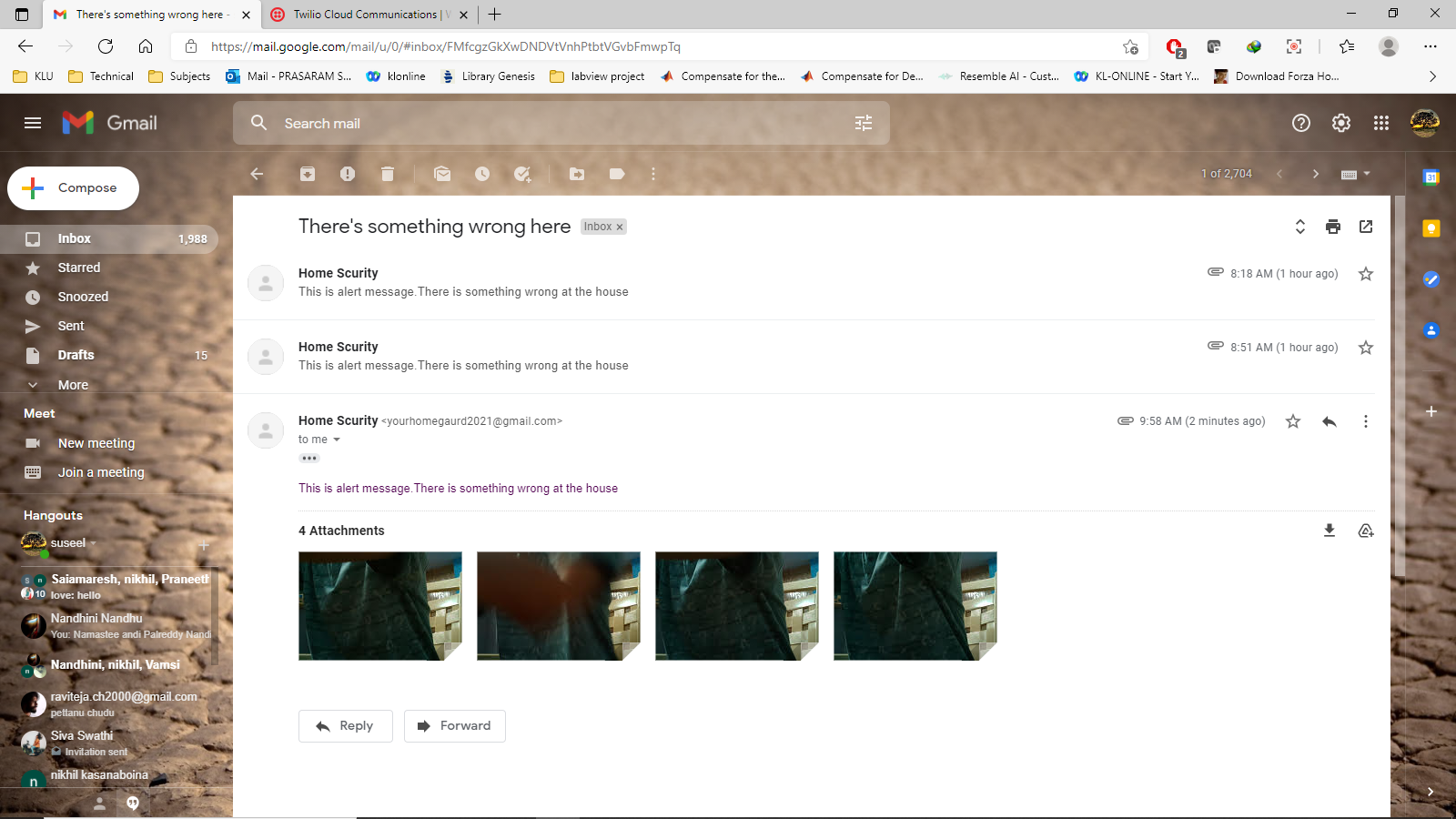


Figure 5.1.6

(The images sent by the device as alert message)

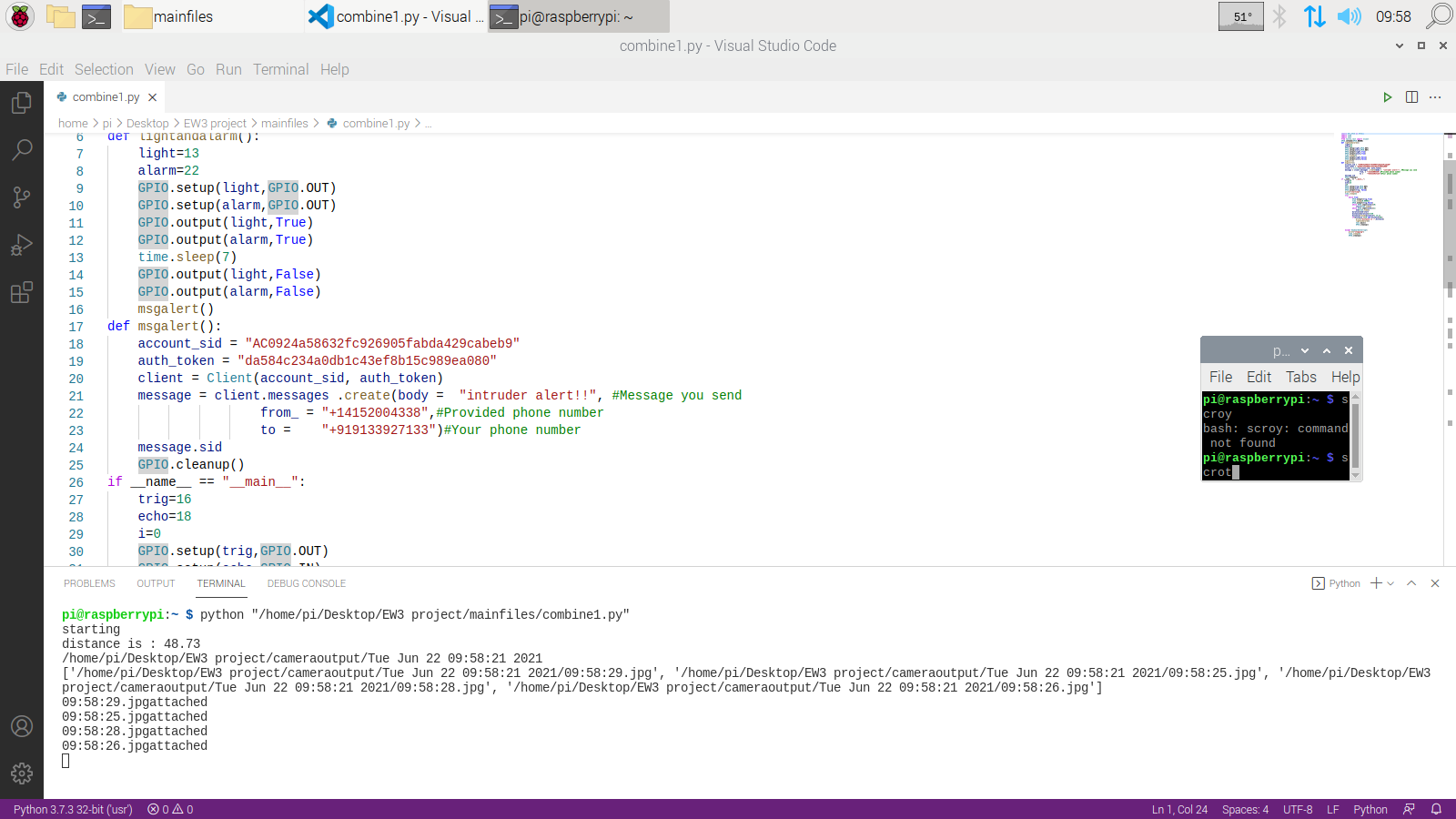


Figure 5.1.7(The Output at the console in Visual Studio Code IDE)

**5.2. Advantages and Disadvantage**

**5.2.1. Advantages**

1. The main advantage of this system is that it can be controlled anywhere with a wider range application**.**
2. It's easy and allows communication with set up without wired connection.
3. It is easy to use and comes in affordable price,

**5.2.2. Disadvantages**

1. As these were electronic circuits, circuit failures may happen .We need to have network connected all time.
2. It can be manipulated by using any object nearer to the device or false alarm may happen easily.
3. Power source is mandatory so we do need external backup power for both device and lights, alarm.

**5.3. Reference Link**

PLEASE GO THROUGH THE LINK FOR VIDEO REFERENCE

[(10) home security automation using raspberry pi - YouTube](https://www.youtube.com/watch?v=3iarGBbiIs4)