INDIRA GANDHI DELHI TECHNICAL UNIVERSITY FOR WOMEN
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(*Formerly* **Indira Gandhi Institute of Technology**)

Mobile Architecture and Programming

Project Report

PORTABLE SURVEILLANCE DEVICE

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ABSTRACT

This project aims to develop a Python based portable surveillance robot that wirelessly streams footage to a laptop or PC. It can be controlled anywhere around the world using WiFi. The robot is developed on Raspberry Pi 3 using various other components. The robot has vast utilities and features, including video surveillance, portability, remote control, automatic path, video saving, remote video play, camera capture and compact design. The Raspbian development environment and Python programming languages are used to program and configure the device. The simplicity and compactness of the device enable it to be used for multiple applications in various fields and industry.

ACKNOWLEDGEMENTS

We would like to thank Dr. S.R.N. Reddy for motivating us to develop this project under the Mobile Architecture and Programming course and for his constant guidance and encouragement. We would also like to thank Ms. Jasleen and Ms. Zeenat for their help and cooperating during the design and development phase of the project.

INTRODUCTION

Surveillance, or constant vigilance, is important in today's day and age where security is a matter of great concern. The surveillance devices

that are commonly used are always fixed in one place, which results in blind spots and unwatched territories.

This portable surveillance device overcomes the drawbacks of fixed cameras by covering all possible nooks and crannies in a particular room. The two modes - default path and remote controlled - are a further extension to its functionalities. It continues to record the video even if the user is away and stores it for later viewing.

The compactness of the device makes it easier to use and does not impose any restrictions on the terrain and layout of furniture.

Wifi-enabled live streaming of the video being captured by the camera is one of the most essential features, specially if the device is being used for home security.

Using one portable device instead of multiple stationary ones not only improves visibility and field of view, but also optimises cost efficiency.

The device requires minimum physical effort, thereby making it suitable for people of all ages and abilities.

The portable video surveillance device can also be used for keeping a check on students in a classroom or ensuring security in different areas such as banks, offices and museums.

IMPLEMENTATION

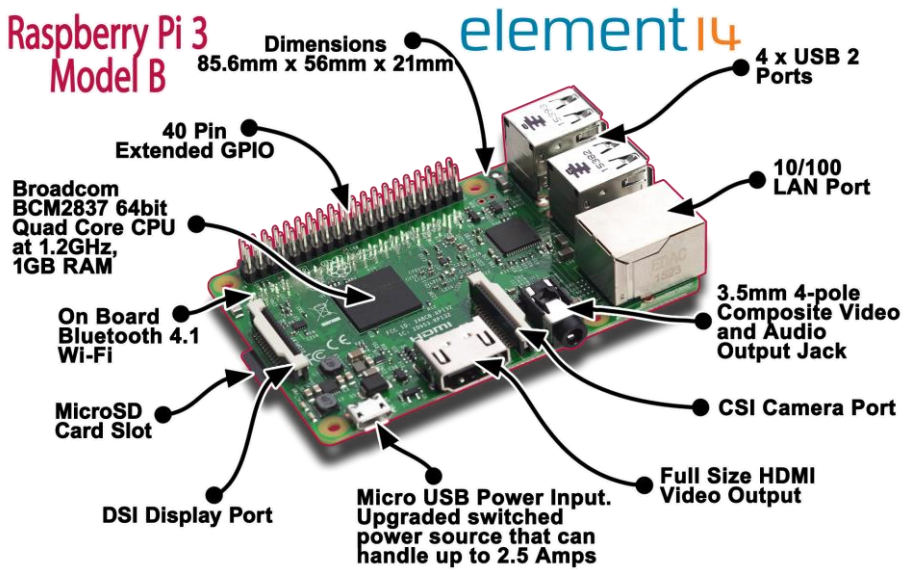
To implement the Python based portable surveillance robot following components have been used :

1. **RASPBERRY PI**

The Raspberry Pi is a credit-card-sized computer that plugs into your TV and a keyboard. It is a capable little computer which can be used in electronics projects,

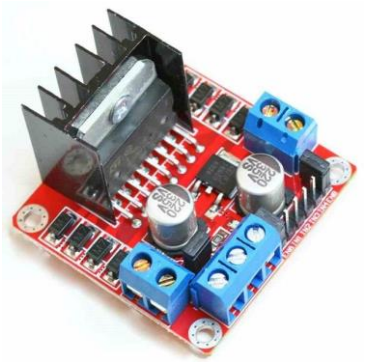
and for many of the things that your desktop PC does, like spreadsheets, word processing, browsing the internet, and playing games.
Various operating systems like Raspbian Fedora Ubuntu MATE Kali Linux Ubuntu Core Windows 10 IoT Core RISC OS Slackware Debian Arch Linux ARM Android Things etc can be run on Raspberry pi.
Several generations of Raspberry Pi have been released and in our project we have used **RASPBERRY PI3.**
Some of the Features of Pi 3 are:

- CPU: Quad-core 64-bit ARM Cortex A53 clocked at 1.2 GHz
- GPU: 400MHz VideoCore IV multimedia
- Memory: 1GB LPDDR2-900 SDRAM (i.e. 900MHz)
- USB ports: 4
- Video outputs: HDMI, composite video (PAL and NTSC) via 3.5 mm jack
- Network: 10/100Mbps Ethernet and 802.11n Wireless LAN
- Peripherals: 17 GPIO plus specific functions, and HAT ID bus
- Bluetooth: 4.1
- Power source: 5 V via MicroUSB or GPIO header
- Size: 85.60mm × 56.5mm
- Weight: 45g (1.6 oz)



2. L298N Motor Driver Board

The L298N H-bridge module can be used with motors that have a voltage of between 5 and 35V DC. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.



3. **2 DC MOTORS and DUMMY WHEELS**

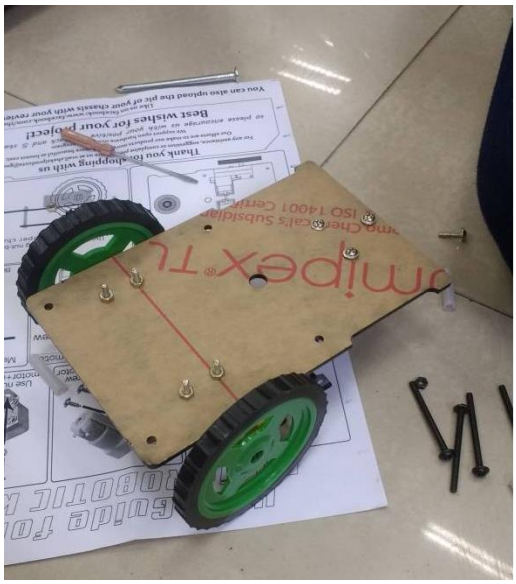
Most common electric motors used in robotics projects are the DC motors. The DC motors provide a high torque and has high efficiency. Apply torque in response to loading, the DC motors are characterized by the speed and torque curve. Common preferred voltages for DC motors are 3, 6, 12 and 24 Volts. If to a motor is applied a voltage lower than the voltage listen in the data sheet, the torque will not overcome the internal friction – mostly from the brushes. Also, if a higher voltage than that supported is applied to the motor, it may heat up and can be damaged.

4. **BATTERY and POWER BANK**

Battery to power the whole robot and power bank to power the raspberry pi.

5. **CHASSIS**

Frame on which the boards, motors and battery will be arranged.



6. **CONNECTING WIRES**

Connecting wires to connect raspberry pi, motor driving board, motors and batteries

7. **RASPBERRY PI CAMERA**

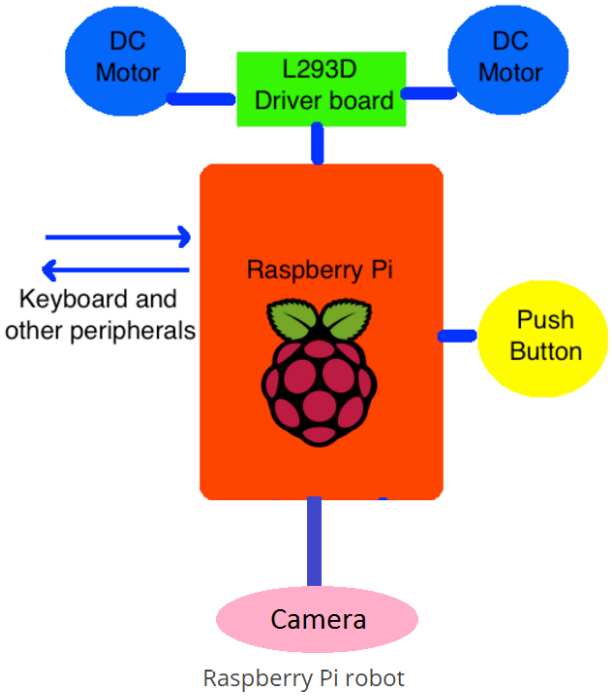
The Raspberry Pi camera module can be used to take high-definition video, as well as stills photographs.

LANGUAGE USED

Python is a wonderful and powerful programming language that's easy to use (easy to read and write) and with Raspberry Pi lets you connect your project to the real world. Python syntax is very clean, with an emphasis on readability and uses standard English keywords.

BUILDING THE BOT

Basic structure of our bot is as follows:

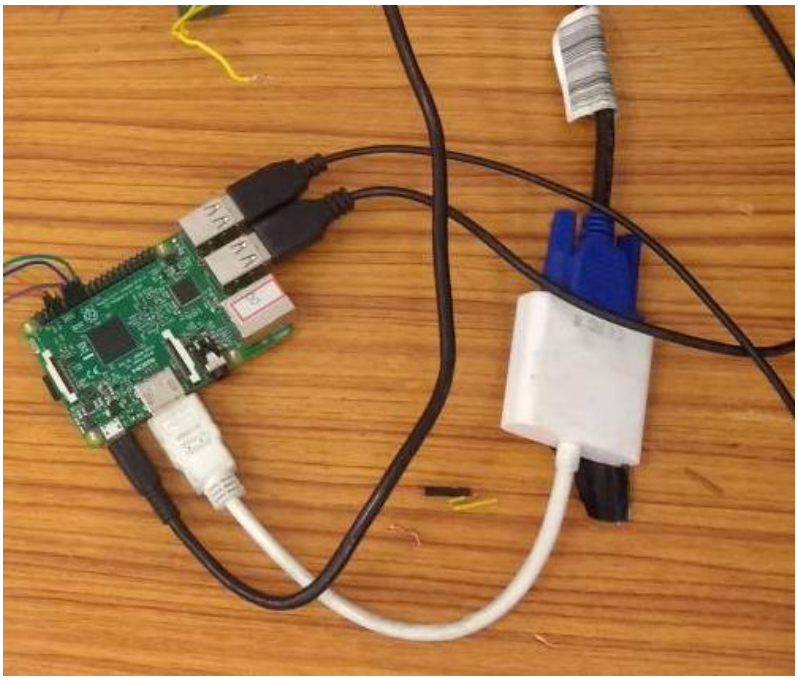


Raspberry Pi robot

- **Set up Chassis**
  Connect the motors and the wheels and fix them on the chassis using nuts and bolt.
- **OPERATING SYSTEM**
  Download the image for raspbian os and write it in the SD Card which will be inserted in the raspberry Pi

- **USING PI**

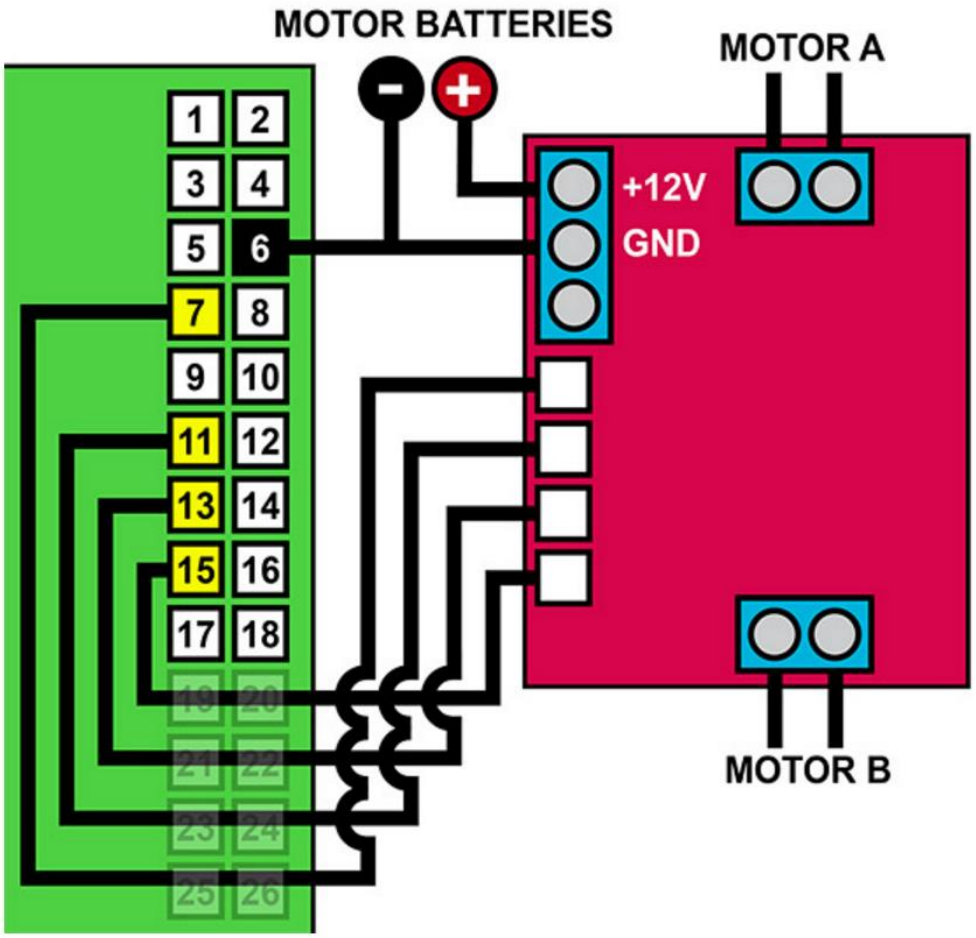
Power the raspberry pi using the charger and then connect it to a monitor using HDMI cable. Connect the keyboard and mouse. Run the pi terminal and install the GPIO library and other required libraries and check the pi using a LED.

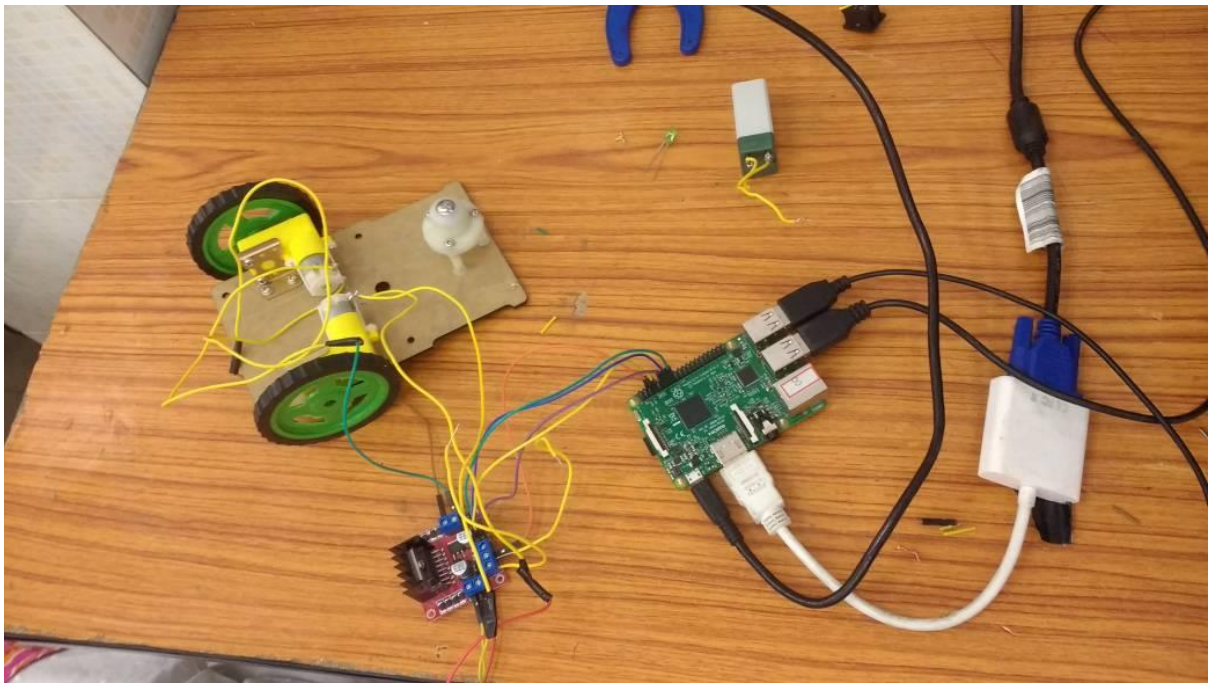


- **Network**
  In this project we have used wifi connection to control this robot. In raspberry pi we can use any OS that supports Python GPIO library. We have used raspbian OS.
  Once we have installed everything, we have to setup network connection. In Raspberry Pi 3 there is a inbuilt Broadcom Wifi Adapter. Connect the Pi to the Network. It is better to provide a static IP address for the Pi.

- **INTERFACE THE CAMERA**
  Connect the camera with pi in Camera Serial Interface Type 2 (CSI-2) port. Configure the camera using raspi-config and test the camera by capturing an image or video.

- **CONNECTIONS**
  Connect the raspberry pi, motor driving board and the motors.



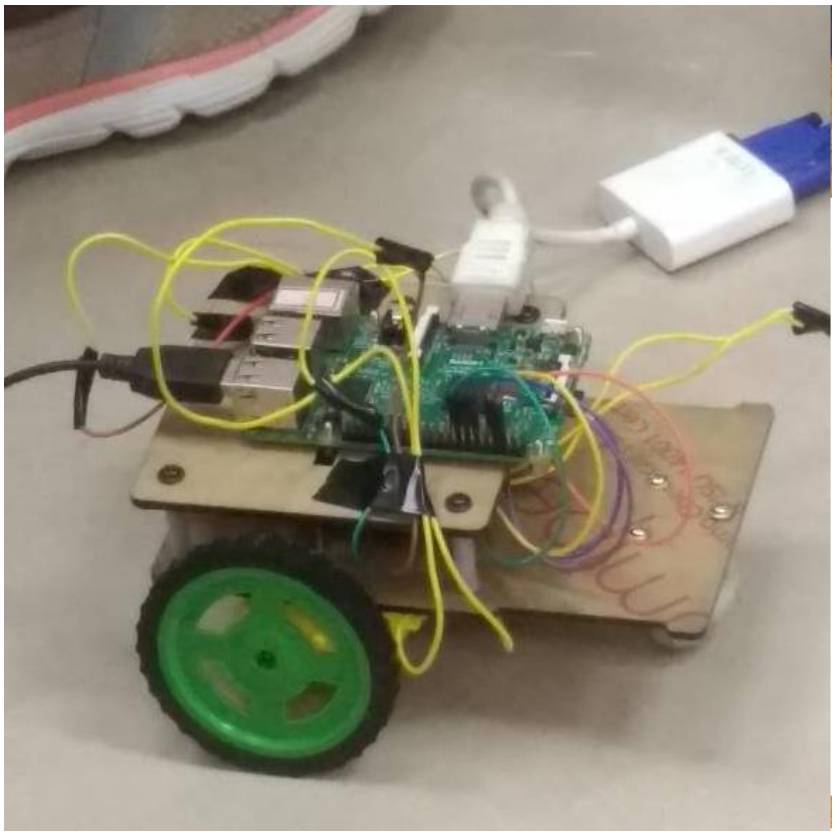


- **KEYBOARD CONTROL**
  Curses library is used to control the bot using the arrow keys. Write the code to define the action of bot when the arrow keys are pressed. The curses library supplies

a terminal-independent screen-painting and keyboard-handling facility for text-based terminals

- **CAMERA CAPTURING**
  Add the python code for capturing the video as long as the bot is switched on and store it in the memory card inserted in raspberry pi.

- **ASSEMBLY**
  Arrange the raspberry pi, charger, motor driver on the bot chassis. So that bot can move easily.

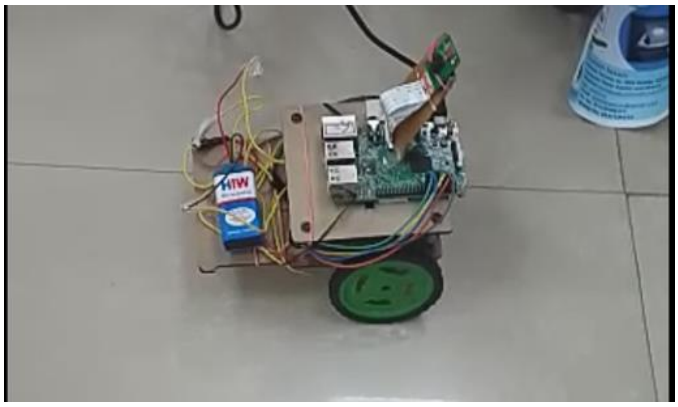


- **TESTING**
  Test the bot by running the code written.

MAKING THE BOT WIRELESS

- **USE SSH**
  Secure Shell (SSH) is a cryptographic network protocol for operating network services securely over an unsecured network.The best known example application is for remote login to computer systems by users.
  In windows to establish ssh connection a software named PUTTY is used. Run the software and to establish the connection add the IP address of raspbian network in putty. Using this software the terminal of our raspbian os can now be accessed through a remote computer.

So now we can control out bot with some other remote system and thus no need to connect the raspberry pi to the monitor using HDMI cable or to the mouse and keyboard.



LIVE VIDEO STREAMING

Live streaming of the camera has been achieved using SSH and VLC Media Player which allows the robot to send its camera footage over WiFi. This is then played using VLC Media Player after providing the appropriate network address of the Pi.

The camera can capture and save video for later use on the cloud via Amazon Simple Storage Service (Amazon S3). Amazon S3 is used to store and retrieve any amount of data from anywhere on the web. Videos are automatically saved on the cloud after it is saved locally on the Raspberry Pi.

SOURCE CODE

Program code used for motion control of robot and video capturing:

```
import RPi.GPIO as GPIO
```

```
import time
import curses
import picamera
GPIO.setmode(GPIO.BOARD)
GPIO.setup(7,GPIO.OUT)
GPIO.setup(11,GPIO.OUT)
GPIO.setup(13,GPIO.OUT)
GPIO.setup(15,GPIO.OUT)

camera = picamera.PiCamera()
screen = curses.initscr()
curses.noecho()
curses.cbreak()
screen.keypad(True)

GPIO.output(7, False)
GPIO.output(11, False)
GPIO.output(13, False)
GPIO.output(15, False)
camera.start_recording('robovid.h264')
try:
        while True:
            char = screen.getch()
            if char == ord('q'):
                camera.stop_recording()
                break
            elif char == curses.KEY_UP:
                GPIO.output(7,False)
                GPIO.output(11,True)
                GPIO.output(13,False)
                GPIO.output(15,True)
            elif char == curses.KEY_DOWN:
                GPIO.output(7,True)
                GPIO.output(11,False)
                GPIO.output(13,True)
                GPIO.output(15,False)
            elif char == curses.KEY_RIGHT:
                GPIO.output(7,True)
                GPIO.output(11,False)
                GPIO.output(13,False)
                GPIO.output(15,True)
            elif char == curses.KEY_LEFT:
                GPIO.output(7,False)
                GPIO.output(11,True)
```

```
            GPIO.output(13,True)
            GPIO.output(15,False)
        elif char == ord('d'):
            for i in range(0,4):
                GPIO.output(11,True)
                GPIO.output(15,True)
                time.sleep(2)
                GPIO.output(11,False)
                GPIO.output(15,False)
                time.sleep(0.5)
                GPIO.output(11,True)
                GPIO.output(13,True)
                time.sleep(0.97)
                GPIO.output(11,False)
                GPIO.output(13,False)
        elif char == ord('s'):
            GPIO.output(7,False)
            GPIO.output(11,False)
            GPIO.output(13,False)
            GPIO.output(15,False)

    finally:
        #Close down curses properly, inc turn echo back on!
        curses.nocbreak(); screen.keypad(0); curses.echo()
        curses.endwin()
        GPIO.cleanup()
```

RESULTS

The portable video surveillance robot comprises of the following features and benefits:

- **Compact Design**
  The compact and simple design allows the robot to move in small spaces and cover all areas of the intended space.

- **Portability**
  The robot is entirely wireless and free to move in any location.

- **Automatic Path Movement**
  The default mode of the robot allows the user to specify a predefined path for the device to move on, leaving the user free from monitoring and controlling.

- **Remote Control**
  The device can be wirelessly controlled from any laptop or PC over WiFi, making it very advantageous in today's world.

- **Live Streaming**
  Any surveillance device must be able to give live footage of the home to the user so he/she must be able to monitor at all times. This functionality allows users to keep their spaces secure and well monitored.

- **Video Capturing**
  The camera can capture and save video for later use in case live monitoring is not required.

CONCLUSION AND FUTURE SCOPE

Conclusion :
Thus with the help and able guidance of our teachers and their constant support, we were able to complete our project of building a 'portable surveillance robot' in time.

Future Scope :

We can improvise our portable video surveillance robot in the following ways to further expand our robot into a E-home security system such that it governs the activities that take place at your home in your absence.

- A temperature sensor can be added to the robot such that it keeps a record of the temperature and humidity values at all times to make sure there is no fire.
- A smoke sensor can be interfaced such that any gas leakage at homes can be detected timely.
- A GPS can be incorporated to keep a track of the position of the robot at all times in case of theft.
- IR sensor can be used to automatically change the direction of motion on detection of any obstacle keeping the device safe with minimal attention.
- An audio sensor can further help us to control the system by voicing our commands to it making it simpler and more efficient to use.

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