SURVEILLANCE ROBOT USING IOT

A project report submitted in partial fulfilment

of requirements for the award of degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRICAL AND ELECTRONICS ENGINEERING

BY

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DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

PRASAD V. POTLURI SIDDHARTHA INSTITUTE OF TECHNOLOGY

Autonomous & Permanent Affiliation to JNTUK, Kakinada.

AICTE Approved, NBA & NAAC accredited and ISO 9001-2015 Certified Institution

KANURU, VIJAYAWADA - 520007

JULY – 2021

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CERTIFICATE

This is to certify that the project report entitled **"SURVEILLANCE ROBOT USING IOT"** is submitted by **KARNATI MANOJ KUMAR (17501A0253), DEVARAPALLI KAVYA (17501A0227), GUDDATI SASI KUMAR (17501A0240), ANNABATHUNI LAKSHMAN TEJA (17501A0210)** in partial fulfilment of the requirements for the award of **BACHELOR OF TECHNOLOGY** in **ELECTRICAL AND ELECTRONICS ENGINEERING,** from **PRASAD V. POTLURI SIDDHARTHA INSTITUTE OF TECHNOLOGY,** Vijayawada, to the Jawaharlal Nehru Technological University (JNTUK), Kakinada, is a record of bonafied work carried out by them under my guidance and supervision. The results embodied in this report have not been submitted to any other University or Institute for the award of any degree or diploma.

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Abstract

Video surveillance is the process of monitoring a situation, an area or a person. This generally occurs in a military scenario where surveillance of borderlines and enemy territory is essential to a country's safety. Human surveillance is achieved by deploying personnel near sensitive areas in order to constantly monitor for changes. But humans do have their limitations, and deployment in inaccessible places is not always possible. In this project a robot is developed which can be used for video surveillance & monitoring which can be controlled through a GUI. The control mechanism is provided with a video transmission facility. The video transmission is practically achieved through high-speed image transmission using open cv. The Video live feed, mobility of the robot is achieved by data transmission between system and Raspberry Pi. This transmission of data between the system and the Raspberry Pi is done by using SSH (Secure Shell Host) protocol. This also gives a secure and private communication between the system and Raspberry Pi. Initially, the robot will be equipped with a camera which will capture the scenes and transfer the images to the system on which the user will be controlling and watching the live feed.

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CHAPTER 1

INTRODUCTION

Surveillance is major thing when we are going to secure any thing as it is tedious job people are getting bored because of that it will might risky to observing all this things we are going to make a robot which is continuously monitoring. This robot continuously watch and sends a live streaming of it to a authorized person[1]. Because of that monitoring the work will be somewhat easy and it will be make accurate because of technology.

The implementation of this project to resolve the problem of replacing human to surveillance robot, because of this we reduce harm of human resource. Robot are usually miniature in size so they are enough capable to enter in tunnels, mines and small holes in building and also have capability to survive in harsh and difficult climatic conditions for life long time without causing any harm.

Raspberry Pi is a card sized computer. It functions almost same as computer. There are different types of surveillance systems available such as camera, CCTV etc., In these types of surveillance systems, the person who is stationary and is located in that particular area can only able to view what is happening in that place. Whereas here, even if the user is moving from one place to another, he/she can keep track of what is happening in that place at exact time. Also, another advantage is that it offers privacy on both sides since it is being viewed by only one person. The other big advantage of Raspberry pi[2] is that, it is an easy and simplecircuit for understanding and designing. The operating system used here is Raspbian OS. Raspbian OS has to be installed so that image can be transmitted to the laptop over wifi[4]. Closedcircuit television monitoring system has now become an indispensable device in today's world. Robots have found a drastically increasing demand for different range of work in our life. Their use in army[6] and other security sector increases day by day. Our paper includes one such instance of how a robot can be of use to human race in general.

According to the survey ,majority of the people of security force are using IP based installation rather than the analog. This is because IP based system provides better picture quality, and it also beneficial in term of mobility, scalability and flexibility. Due to the costing people are less interested to take the advantages of

IP based system. So, it is very much clear that IP based system overcome some of the limitation over the analog but still the camera, complex operation and expensive sensors are stilla drawback of these system. This paper contains the information for controlling the robotic system through internet web browser or android apps. This is only possible when the raspberry pi connects with internet connection.

1.1 CONCEPT OF IOT

About Internet of Things

The Internet of Things, or IoT, refers to the billions of physical devices around the world that are now connected to the internet, all collecting and sharing data. Thanks to the arrival of super-cheap computer chips and the ubiquity of wireless networks, it's possible to turn anything, from something as small as a pill to something as big as an aeroplane, into a part of the IoT. Connecting up all these different objects and adding sensors to them adds a level of digital intelligence to devices that would be otherwise dumb, enabling them to communicate real-time data without involving a human being. The Internet of Things is making the fabric of the world around us more smarter and more responsive, merging the digital and physical universes.

History behind Internet of Things

The idea of adding sensors and intelligence to basic objects was discussed throughout the 1980s and 1990s (and there are arguably some much earlier ancestors), but apart from some early projects -- including an internet-connected vending machine -- progress was slow simply because the technology wasn't ready. Chips were too big and bulky and there was no way for objects to communicate effectively.

Processors that were cheap and power-frugal enough to be all but disposable were needed before it finally became cost-effective to connect up billions of devices. The adoption of RFID tags -- low-power chips that can communicate wirelessly -- solved some of this issue, along with the increasing availability of broadband internet and cellular and wireless networking. The adoption of IPv6 -- which, among other things, should provide enough IP addresses for every device the world (or indeed this galaxy) is ever likely to need -- was also a necessary step for the IoT to scale.

Kevin ashton coined the phrase 'Internet of Things' in 1999, although it took at leastanother decade for the technology to catch up with the vision.

Security using Internet of Things

Security is one the biggest issues with the IoT. These sensors are collecting in many cases extremely sensitive data -- what you say and do in your own home, for example. Keeping that secure is vital to consumer trust, but so far the IoT's security track record hasbeen extremely poor. Too many IoT devices give little thought to the basics of security, like encrypting data in transit and at rest.

Flaws in software -- even old and well-used code -- are discovered on a regular basis, but many IoT devices lack the capability to be patched, which means they are permanentlyat risk. Hackers are now actively targeting IoT devices such as routers and webcams because their inherent lack of security makes them easy to compromise and roll up into giant botnets.

Flaws have left smart home devices like refrigerators, ovens, and dishwashers open to hackers. Researchers found 100,000 webcams that could be hacked with ease, while internet-connected smartwatches for children have been found to contain security vulnerabilities that allow hackers to track the wearer's location, eavesdrop on conversations, or even communicate with the user.

Governments are growing worried about the risks here. The UK government has published its own guidelines around the security of consumer IoT devices. It expects devices to have unique passwords, that companies will provide a public point of contact soanyone can report a vulnerability (and that these will be acted on), and that manufacturerswill explicitly state how long devices will get security updates. It's a modest list, but a start.

When the cost of making smart objects becomes negligible, these problems will only become more widespread and intractable.

All of this applies in business as well, but the stakes are even higher. Connecting industrial machinery to IoT networks increases the potential risk of hackers discovering and attacking these devices. Industrial espionage or a destructive attack on critical infrastructure are both potential risks. That means businesses will need to make sure that these networks are isolated and protected, with data encryption with security of sensors, gateways and other components a necessity. The current state of IoT technology makes that harder to ensure, however, as does a lack of consistent IoT security planning across organisations. That's very worrying considering the documented willingness of hackers totamper with industrial systems that have been connected to the internet but left unprotected.

The IoT bridges the gap between the digital world and the physical world, which meansthat hacking into devices can have dangerous real-world consequences. Hacking into the sensors controlling the temperature in a power station could trick the operators into makinga catastrophic decision; taking control of a driverless car could also end in disaster.

1.2 THE EVOLUTION OF ROBOTICS

The trends of robotics research are changed very rapidly in the last decades due to significant changes in information technology. The evolution of new applications of robots and robotic devices are always influenced by the current need of the society. It was around 1960 when industrial robots were first introduced in the production process, and until the 1990s industrial robots dominated robotics research. From this time the development in robotics sector has been increased very rapidly. Cyprian M. Wronka et al., 2006 developed a concept of Internet remote control interface for a multipurpose robotic arm. In their work authors proposed a tele operated model for controlling a robotic arm. Akiyuki Minamide et al., 2007 proposed a distant control robot model where game robots are controlled from long distance through internet. They practically implemented the concept and arranged robot gaming competition between the children of a Japanese school and of a Singapore school. C. Pacchierotti et al., 2015; B. Fang et al., 2015 and S. Chatel et al., 2016 made different researches on teleoperation system for robotics and found great success on respective fields and also describing an available public implementation of an Internet robot controller. A. Hiyama et al., 2017 implemented a robotic system for telecommunication by using remote wireless system. L. J. Williams took a patent on a method and system for determining position and/or pose of an object and showed that signal can be transmitted with quite low distortion by applying RF on a moving robotic system. O. Javed et al., 2003; O. Javed and M. Shah, 2008; A. A. Altahir et al., 2018 and G. Verma et al., 2018 published detailed and well experimented researches on applying and controlling surveillance-based robots which are capable of capturing and sending real-time image to a operator MCU with lowest delay time along with high performance output.

1.3 ABOUT SURVILLANCE ROBOT

Robotics has been a staple of advanced manufacturing for over half a century. As robotsand their peripheral equipment become more sophisticated, reliable, and miniaturized, these systems are increasingly being utilized for entertainment, military, and surveillance purposes. A remote controlled surveillance robot is defined as any robot that is remotely controlled to capture images/video for specific purposes. Mobile robots that are controlledremotely have important rules in area of rescue and military.

A rescue robot is a kind of surveillance robot that has been designed for the purpose ofrescuing people. Common situations that employ rescue robots are mining accidents, urban disasters, hostage situations, and explosions. Military robots are autonomous robots or remote-controlled devices designed for military applications. Such systems are currently being researched by a number of militaries.

There are many microcontrollers in the market consisting of various types of capabilityfrom basic input output to high end microcontroller. These various types of microcontrollerare purpose-made for general application. In this research, we propose architecture for Raspberry pi based robot that can be controlled by neural network with the capabilities to surveilling the surroundings.

Technology has brought a dynamic and tremendous change in robotics and automation field which ranges in all kinds of areas. Surveillance is the process of close systematic observation or supervision maintained over a person, group, etc. especially one in custody or under suspicion. Thus surveillance is mainly required in the areas such as border areas, public places, offices and in industries. It is mainly used for monitoring activities. The act of surveillance can be performed both indoor as well as in outdoor areas by humans or with the help of embedded systems such as robots and other automation devices. A robot is nothing but an automatic electronic machine that is capable of performing programmed activities thus replacing human work, providing highly accurate results and easily overcoming the limitations of human beings. Thus replacing humans in the surveillance fields is one of the great advancement in robotics.

CHAPTER 2

HARDWARE REQUIREMENTS

This surveillance robot requires a lot of essential hardware components for proper functioning. Due to advancement in technology, these surveillance robots are used in remote as well as domestic areas. The main components used in our project is shown in figure 2.1.

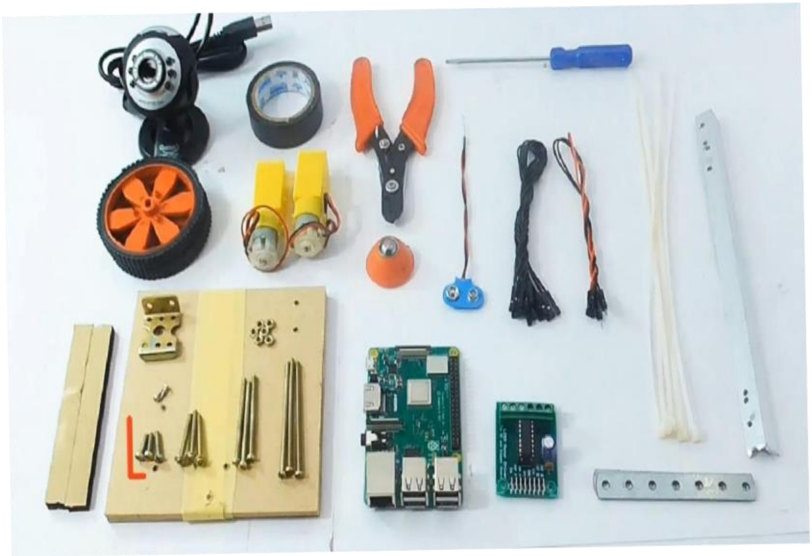


Figure 2.1 Components Required

- RASPBERRYPI 3MODELB+
- USB connector cable
- 60RPM Motors
- L239DMotorDriver
- Webcam
- DS18B20 Temperature Sensor
- Cable &Connectors
- Wooden Chassis
- Wire Strippers &Screwdrivers
- Other miscellaneous items

2.1 RASPBERRY PI 3 MODELB+

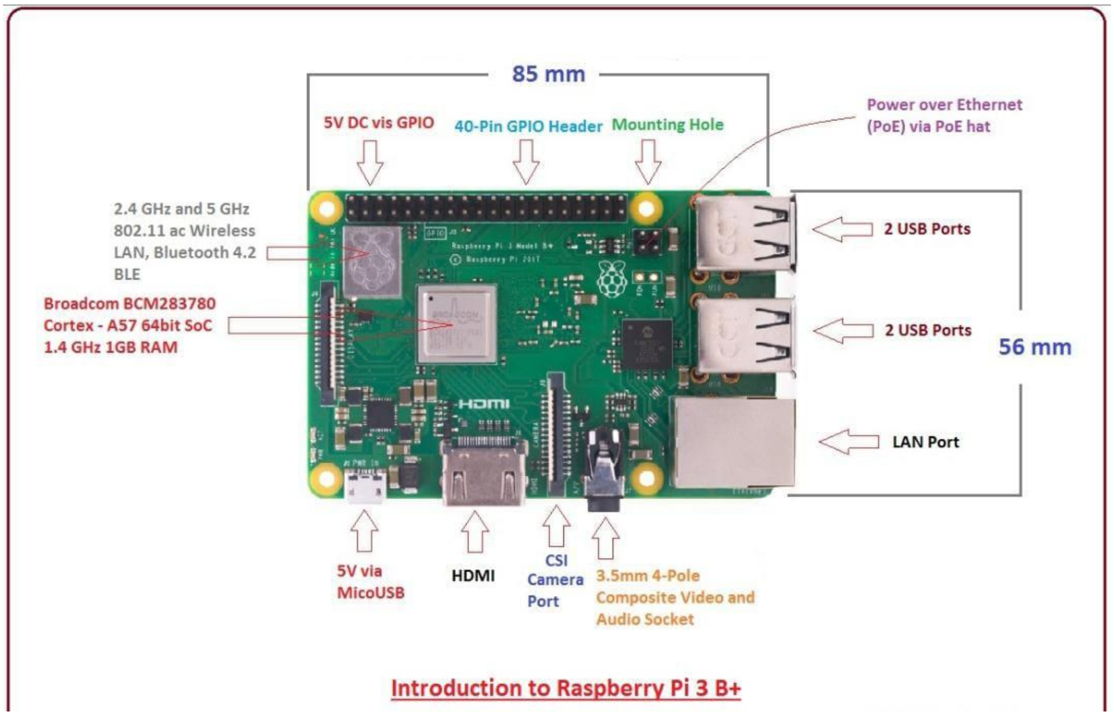


Figure 2.2 Raspberry PI

As shown in figure 2.2 Raspberry Pi was created with the goal of education in mind. This ultra-tiny computer was designed to be small and cheap so that schools could easily afford them in order to teach students about computers in the classroom. This is great for two reasons, the first is that it provides extremely cheap access to a computer, and second it is a great tool for learning more about computers.

In Raspberry Pi model B, has an HDMI out, The board itself has half a gigabyte of RAM and an onboard ARM processor. The model A has all of the same features of the model B minus one of the USB plugs, the Ethernet port, and half of the RAM. No matter how you look at it though, it gives you quite a bit of equipment to work with for not being much bigger than a credit card!

Here's how it works: An SD card inserted into the slot on the board acts as the hard drive for the Raspberry Pi. It is powered by USB and the video output can be hooked up to a traditional RCA TV set, a more modern monitor, or even a TV using the HDMI port. This gives you all of the basic abilities of a normal computer. It also has an extremely low power consumption of about 3 watts. To put this power consumption in perspective, you could run over 30 Raspberry Pi's in place of a standard light bulb.

The Raspberry Pi is a credit card-sized computer. The RaspberryPi3ModelB+is an improved version of the Raspberry Pi 3 Model B. It is based on the BCM2837B0 system-on-chip (SoC), which includes a 1.4 GHz quad-core ARMv8 64bit processor and a powerful Video Core IV GPU. The Raspberry Pi can run a full range of ARM GNU/Linuxdistributions, including Snappy Ubuntu Core, Raspbian, Fedora, and Arch Linux, as wellas Microsoft Windows 10 IoT Core.

Raspberry Pi 3 Model B+ has many performance improvements over the ModelB including a faster CPU clock speed (1.4 GHz vs 1.2 GHz), increased Ethernet throughput, and dual-band WiFi. It also supports Power over Ethernet with a Power over Ethernet HAT (not included)

The dual-band wireless LAN comes with modular compliance certification, allowing the board to be designed into end products with significantly reduced wireless LAN compliance testing, improving both cost and time to market.

The Raspberry Pi was designed by the Raspberry Pi Foundation to provide an affordable platform for experimentation and education in computer programming. The Raspberry Pi can be used for many of the things that a normal desktop PC does, including word-processing, spreadsheets, high-definition video, games, and programming. USB devices such as keyboards and mice can be connected via the board's four USB ports. With its 0.1″-spaced GPIO header and small size, the Raspberry Pi also works as a programmable controller in a wide variety of robotics and electronics applications.

Features

- GHz quad-core BCM2837B0 ARMv8 64bit CPU
- 1 GB RAM
- Video Core IV 3D graphics core
- Ethernet port
- dual-band (2.4 GHz and 5 GHz) IEEE 802.11.b/g/n/ac wireless LAN (Wi-Fi)
- Bluetooth 4.2

- Full-size HDMI output
- Four-pole 3.5 mm jack with audio output and composite video output
- 40-pin GPIO header with 0.1″-spaced male pins that are compatible with our 2x20 stackable female headers and the female ends of our premium jumper wires
- Camera interface (CSI)
- Display interface (DSI)
- Micro SD card slot
- Bluetooth Low Energy (BLE)
- Four USB ports

Requirements to use Raspberry Pi

To use the Raspberry Pi, you will need a few additional things that are not included :

- A 5 V power source with a micro USB connector that can source at least 2.5 A.
- A microSD card with an operating system on it, which also serves as the main storage forthe device.
- Input and output devices, such as a keyboard and monitor.

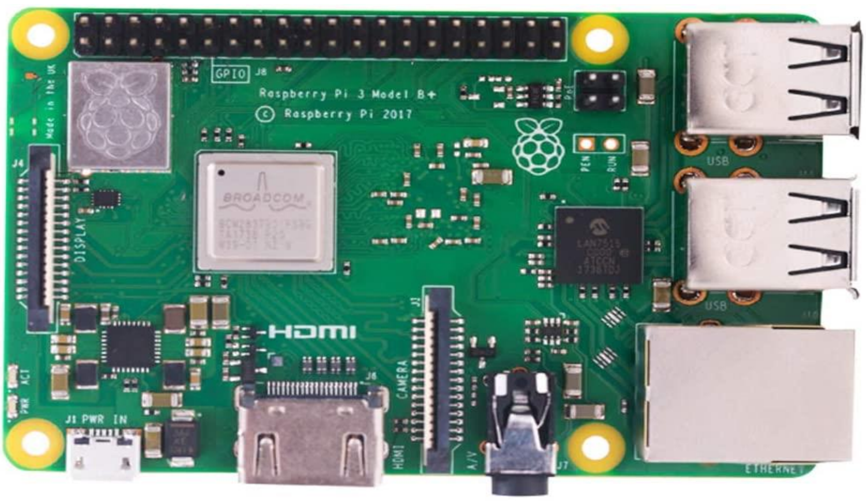


Figure 2.3Top view of Raspberry Pi 3 Model B+

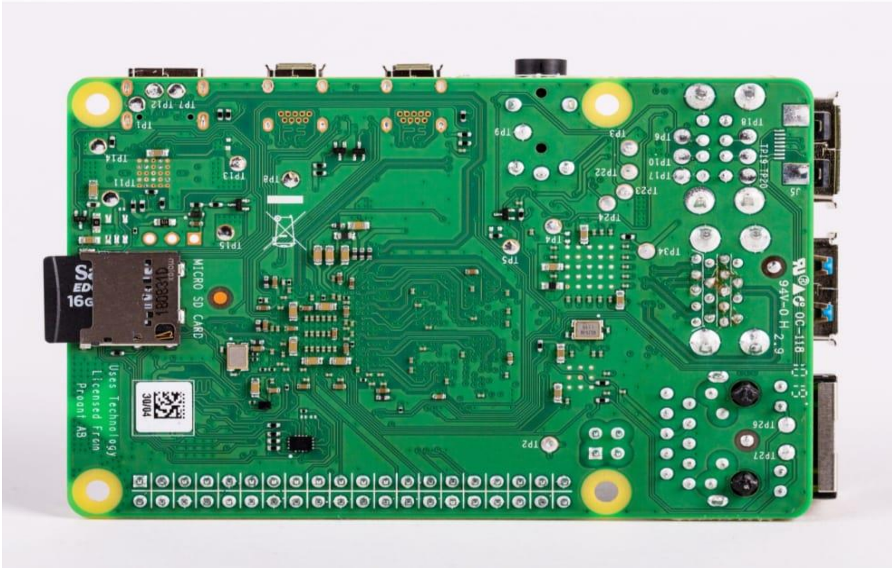


Figure 2.4 Bottom view of Raspberry Pi 3 model B+

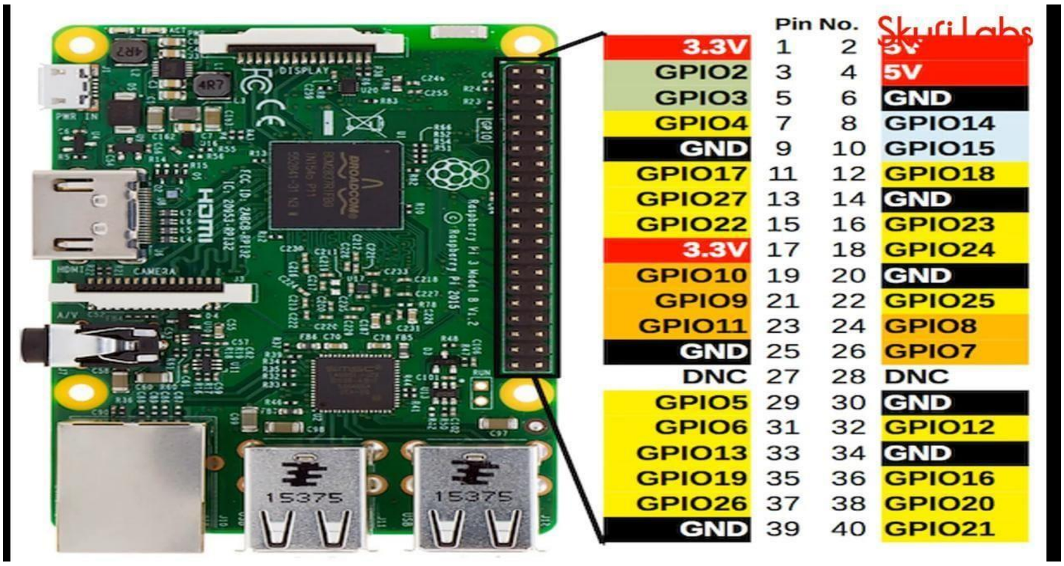


Figure 2.5 Raspberry Pi Pin diagram

Figure 2.3 shows top view of Raspberry Pi.It has four usb ports, one lan port, 3.5mm 4-pole composite video and audio socket, CSI camera port, HDMI port, 5v via Micro USB, Broadcom BCM283780 cortex – A57 64bit SoC 1.4 GHz 1GB RAM, 2.4 GHz and 5 GHz 802.11 ac Wireless LAN, Bluetooth 4.2 BLE, 5v DC via GPIO, 40 GPIO pins as shown in figure 2.2.

Figure 2.4 shows bottom view of Raspberry pi and it has sd card insert slot. Figure 2.5 shows Raspberry pi pin diagram and it has two 3.3v pins, two 5v pins, eight ground pins and 27 GPIO pins.

2.2 Types of DC Motors

Understanding the different types of DC motors will also help you understand how they're used for different applications, and which type may apply to your application.

There are 4 main types of DC motors

1.Permanent Magnet DC Motors

The permanent magnet motor uses a permanent magnet to create field flux. This type of DC motor provides great starting torque and has good speed regulation, but torque is limited so they are typically found on low horsepower applications.

2.Series DC Motors

In a series DC motor, the field is wound with a few turns of a large wire carrying the full armature current. Typically, series DC motors create a large amount of starting torque, but cannot regulate speed and can even be damaged by running with no load. These limitations mean that they are not a good option for variable speed drive applications.

3.Shunt DC Motors

In shunt DC motors the field is connected in parallel (shunt) with the armature windings. These motors offer great speed regulation due to the fact that the shunt field can be excited separately from the armature windings, which also offers simplified reversing controls.

4.Compound DC Motors

Compound DC motors, like shunt DC motors, have a separately excited shunt field. Compound DC motors have good starting torque but may experience control problems in variable speed drive applications.

Between the 4 types of DC motors, the potential applications are numerous. Each type of DC motor has its strengths and weaknesses. Understanding these can help you understand which types may be good for your application.

The basic operation of all these designs is similar. A current-carrying conductor is placed in a magnetic field, and applying power through these conductors causes motor rotation. The difference among the designs is how the electromagnetic fields are generated and where – in either the rotor or stator.

In a permanent-magnet motor, the stator is stationary and mounted to the motor frame (see Image 2). It holds permanent magnets mounted in proximity to the spinning current-carrying conductors in the rotor. Applying a voltage through brushes contacting the armature on the rotor induces the current needed to produce mechanical force, which is rotation. Connecting two wires to the motor and supplying the proper DC voltage will cause the motor to run.

Shunt, series, and compound-wound or stabilized-shunt motor designs have a rotor with electrical connections through a brush and commutator arrangement. The brush/commutator acts as a switch to apply voltage to different coil segments of the rotor as it spins.

DC motors are often selected instead of AC motors for many reasons such as

- Often the lower cost option
- Simple and efficient design
- Easy to service and maintenance
- Easy to vary the motor speed
- Full torque at zero speed
- Higher motor motor power density
- Less inertia
- Smaller converters and drivers

2.2.1 DC SERIES MOTOR

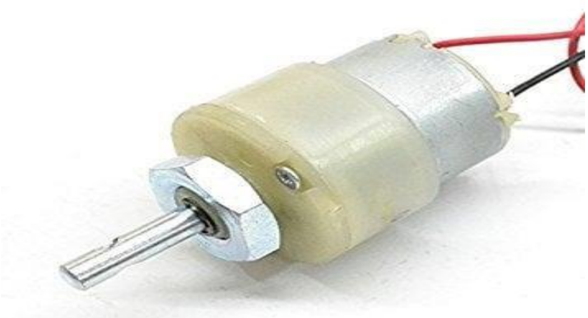


Figure 2.6 DC motor

Figure 2.6 shows 60 RPM, 9v Centre Shaft Economy Series DC Motor is high quality low cost DC geared motor. It has steel gears and pinions to ensure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to a mirror finish. The output shaft rotates in a plastic bushing. The whole assembly is covered with a plastic ring.Gearbox is sealed and lubricated with lithium grease and require no maintenance. The motor is screwed to the gear box from inside. Although motor gives 60 RPM at 12V but motor runs smoothly from 4V to 12V and giveswide range of RPM, and torque.

Specifications:

- DC supply: 4 to 12V
- RPM: 60 at 12V
- Total length: 46mm
- Motor diameter: 36mm
- Motor length: 25mm
- Brush type: Precious metal
- Gear head diameter: 37mm
- Gear head length: 21mm
- Output shaft: Centered
- Shaft diameter: 6mm
- Shaft length: 22mm
- Gear assembly: Spur
- Motor weight: 100gms

In addition to enabling the use of batteries to facilitate mobility, two key features that make DC motors great for robotics are speed variation and torque.

Speed Variation

A desirable feature of a DC motor is that it offers variable speed – a wide range both above and below the rated speed. There are three ways to control the speed of a DC motor. Because the motor speed is directly proportional to the supply voltage, you can vary the speed by varying the supply voltage. Additionally, since the speed of the motor is inversely proportional to the flux due to the field findings, by varying the flux and the current through field winding you can vary the speed. Lastly, with the speed of the motor inversely proportional to the armature voltage drop, you can vary speed by varying armature voltage and resistance.

Torque

Many say high torque is the biggest advantage of using DC motors in robotics. They are capable of a high starting-torque used for driving heavy loads in starting positions and for applications requiring acceleration. They are also capable of constant torque over a given speed, where shaft power varies with sed.

DC motors are free from reactive power - which is not really power at all but refers to volts and amperes that are out-of-phase with each other and take away from the active power in an electrical system – so there are no additional power requirements needed to supply the load. Also, in addition to quick starts and acceleration, DC motors are equally beneficial when quick reversing and stopping is needed.

Although they are a more expensive option, DC motors offer many capabilities that make them a desirable drive motor selection for robotics.

In today’s industrial sector, direct current (DC) motors are everywhere. From robotics to automobiles, small and medium sized motoring applications often feature DC motors for their wide range of functionality.

Because DC motors are deployed in such a wide variety of applications, there are different types of DC motors suited to different tasks across the industrial sector.

2.3 L-293 MOTOR DRIVER

A motor driver is an integrated circuit chip is shown in figure 2.7 which is usually used to control motors in autonomous robots. Motor driver act as an interface between Arduino and the motors. The most commonly used motor driver IC’s are from the L293 series such as L293D, L293NE, etc. These ICs are designed to control 2 DC motors simultaneously. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current ratedmotor. We will be referring the motor driver IC as L293D only. L293D has 16 pins.

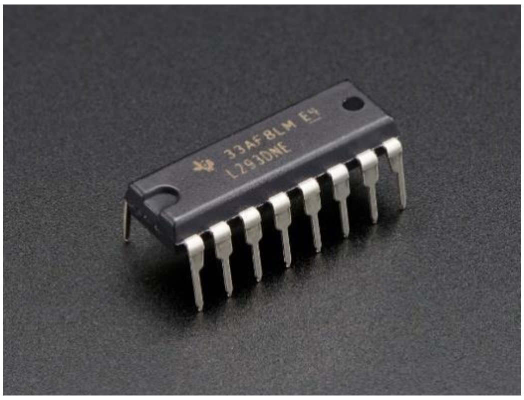


Figure 2.7 IC Of MOTOR DRIVER

Motor drivers acts as an interface between the motors and the control circuits. Motor require high amount of current whereas the controller circuit works on low current signals. So the function of motor drivers is to take a low-current control signal and then turn it into a higher-current signal that can drive a motor.L293D is used in various shields like Auton Shield, Xbee Shield, Starter Shield as it is best suitable for low current motors such as BO motors commonly used in small autonomous robots.

Usage of L293D IC

The L293D is a popular 16-Pin Motor Driver IC. As the name suggests it is mainly used to drive motors. A single L293D IC is capable of running two DC motors at the sametime; also the direction of these two motors can be controlled independently. So if you havemotors which has operating voltage less than 36V and operating current less than 600mA,which are to be controlled by digital circuits like Op-Amp, 555 timers, digital gates or evenMicron rollers like Arduino, PIC, ARM etc.. this IC will be the right choice for you.

Features

- Can be used to run Two DC motors with the same IC.
- Speed and Direction control is possible
- Motor voltage Vcc2 (Vs): 4.5V to 36V

- Maximum Peak motor current: 1.2A
- Maximum Continuous Motor Current: 600mA
- Supply Voltage to Vcc1(vss): 4.5V to 7V
- Transition time: 300ns (at 5Vand 24V)

2.4 WEBCAM

Figure 2.8 Webcam

A webcam is a video camera shown in figure 2.8 that feeds or streams an image or video in real time to orthrough a computer network, such as the Internet. Webcams are typically small cameras that sit on a desk, attach to a user's monitor, or are built into the hardware. Webcams can be used during a video chat session involving two or more people, with conversations thatinclude live audio and video.

Webcam software enables users to record a video or stream the video on the Internet. As video streaming over the Internet requires much bandwidth, such streams usually use compressed formats. The maximum resolution of a webcam is also lower than most handheld video cameras, as higher resolutions would be reduced during transmission. The lower resolution enables webcams to be relatively inexpensive compared to most video cameras, but the effect is adequate for video chat sessions.

In our surveillance robot we mount webcam at the top of the robot. It sends feed to thereceiver end by following the video that is received we can monitor the surroundings. There are many other applications for a webcam. Some programs can help you use it as video surveillance equipment. You could set it up to only survey your room, or set up multiple wireless webcams throughout a building as part of a security system. A webcam can also be used as a type of nanny cam. Many weather stations and nature parks use webcams and allow people to watch live feeds from the cameras. A webcam can also be used for home recording purposes -- for instance, when you need to send in a video clip for a competition or if you want to record a party or other event. Various lenses are available, the most common in consumer-grade webcams being a plastic lens that can be manually moved in and out to focus the camera. Fixed-focus lenses, which have no provision for adjustment, are also available. As a camera system's depth of field is greater for small image formats and is greater for lenses with a large f-number (small aperture), the systems used in webcams have a sufficiently large depth of field that the use of a fixed-focus lens does not impact image sharpness to a great extent. Digital video streams are represented by huge amounts of data, burdening its transmission (from the image sensor, where the data is continuously created) and storage alike. Webcams are known for their low manufacturing cost and their high flexibility, making them the lowest-cost form of video telephony.

2.5 DS18B20 Temperature Sensor

FEATURES

- Unique 1-Wire interface requires only one port pin for communication.
- Multidrop capability simplifies distributed temperature sensing applications
- Requires no external components
- Can be powered from data line. Power supplyrange is 3.0V to 5.5V
- Zero standby power required
- Measures temperatures from -55°C to +125°C. Fahrenheit equivalent is -67°F to +257°F.
- ±0.5°C accuracy from -10°C to +85°C
- Thermometer resolution is Programmable from 9 to 12 bits.
- Converts 12-bit temperature to digital word in 750ms (max).
- User-definable, nonvolatile temperature alarm settings.

- Alarm search command identifies and address devices whose temperature is outside of programmed limits (temperature alarm limits.
- Applications include thermostatic controls, industrial systems, consumer products, thermometers, or any thermally sensitive system.

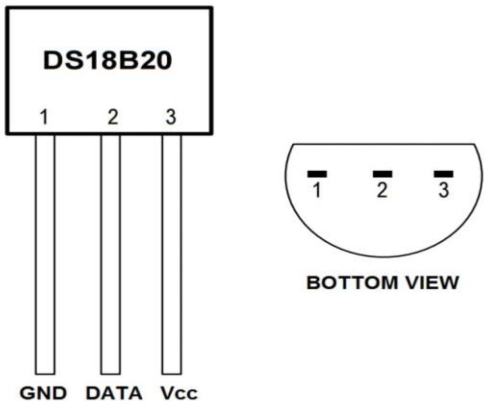


Figure 2.9 DS18B20 Temperature Sensor

DESCRIPTION

Figure 2.9 shows the DS18B20 Digital Thermometer provides 9 to 12-bit (configurable) temperature readings which indicate the temperature of the device. Information is sent to/from the DS18B20 over a 1-Wire interface, so that only one wire (and ground) needs to be connected from a central microprocessor to a DS18B20. Power for reading, writing, and performing temperature conversions can be derived from the data line itself with no need for an external power source. Because each DS18B20 contains a unique silicon serial number, multiple DS18B20s can exist on the same 1-Wire bus. This allows for placing temperature sensors in many different places. Applications where this feature is useful include HVAC environmental controls, sensing temperatures inside buildings,equipment or machinery, and process monitoring and control.

CHAPTER 3

INSTALLATION OF REQUIRED SOFTWARE PACKAGES AND ENABLING SECURE SHELL HOST (SSH)

This surveillance robot needs different softwares to control the mobility of the robot and also to transfer live video feed from webcam to the system, the softwares are open cv to transfer video feed and Raspbian OS for the mobility of robot.

3.1 Downloading the Raspbian OS

The following steps shows downloading, installation of Raspbian OS and enabling Secure Shell Host (SSH)

Step 1:

First, download the OS for the Raspberry Pi.

Open the browser, by following the link Raspbian OS will be downloaded https://www.raspberrypi.org/downloads/raspbian/

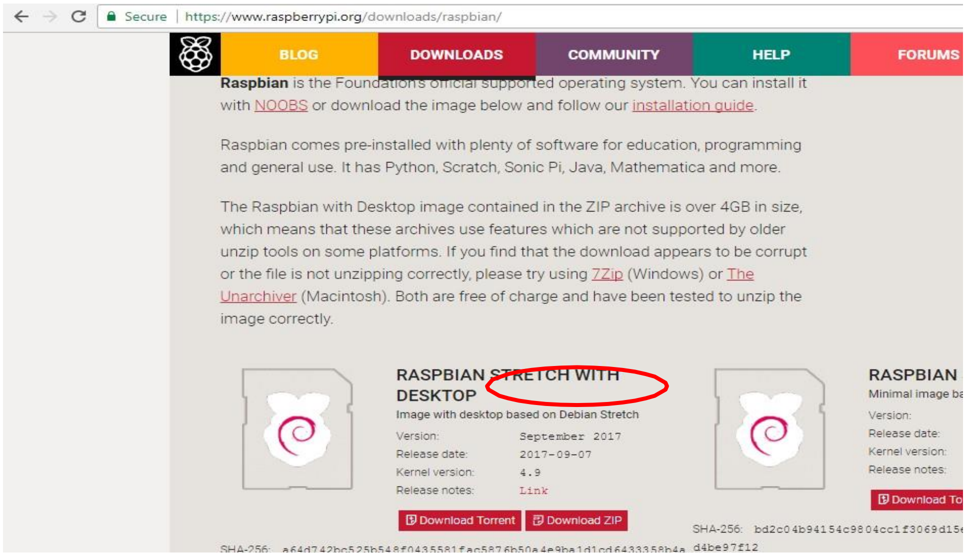


Figure 3.1 Package need to download

Figure 3.1 shows package need to be downloaded. As you scroll downwards, you'll get the option to download 'Raspbian Stretch with desktop'. Click on 'Download ZIP'.

Step 2:

The file will begin downloading. Please note that your file will be in a '.zip' format. Figure 3.2 shows downloading of Raspbian OS

Figure 3.2 Downloading file in '.zip' format

Step 3:

Once the file is downloaded, extract the file by right click and clicking the suitable option.

If the system don't have a ZIP extractor software like WinZIP, etc please download and install it as shown in the next step. Figure 3.3, shows extracting files of Raspbian OS in the same folder.

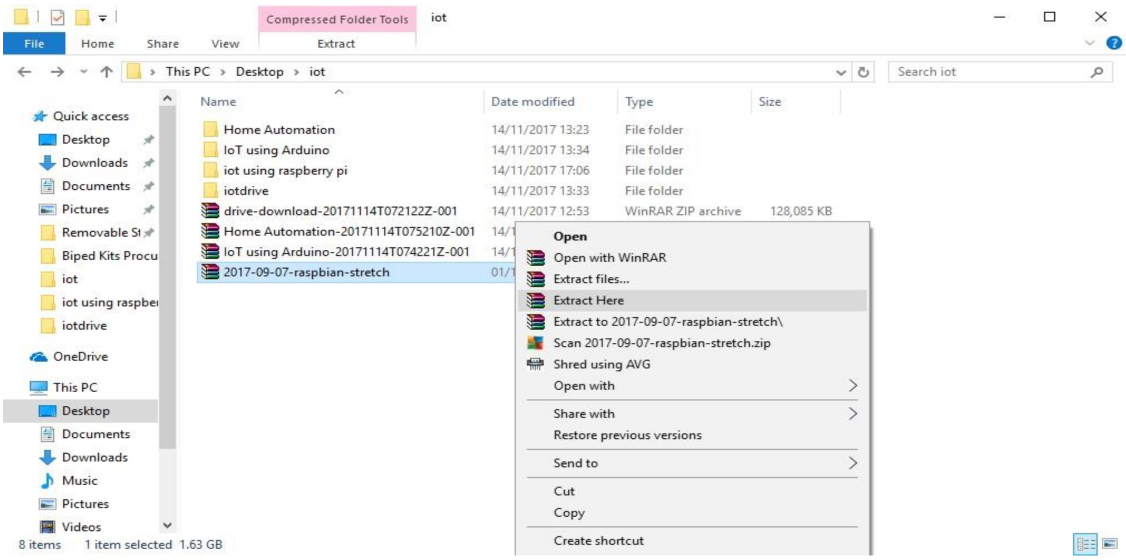


Figure 3.3 Extracting files from zip

Step 4:

For users not having ZIP extractor software, go to this link http://www.winzip.com/win/en/downwz.html and download the file and install it. Figure 3.4 shows downloading of WINZIP extractor.

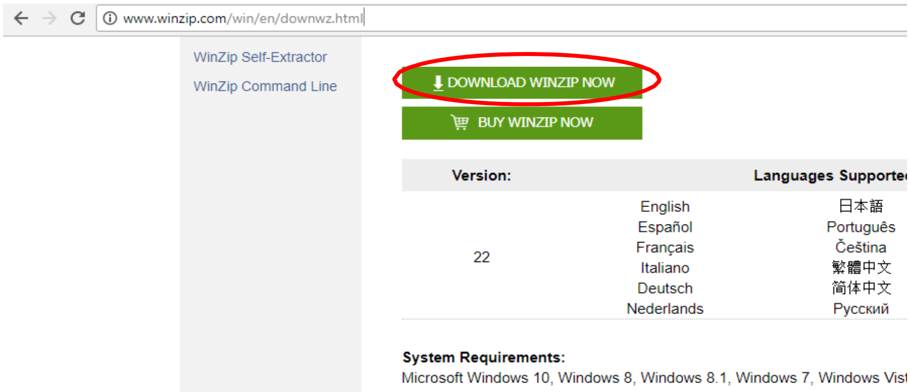


Figure 3.4 Downloading WINZIP

Step 5:

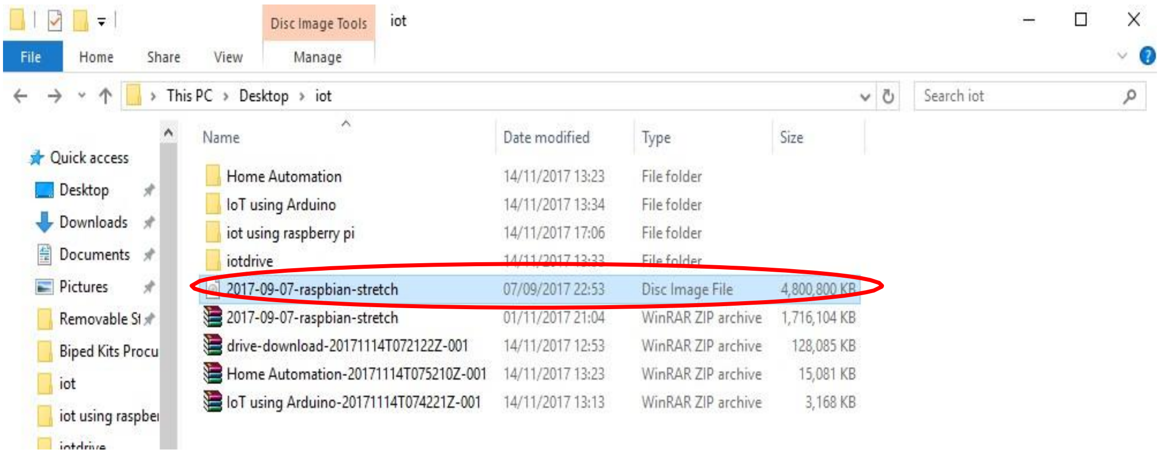


Figure 3.5 Disc image file

Please note that the extracted file of the Raspbian file is a Disc Image file as shown. Figure 3.5, shows Raspbian OS disc image that is downloaded.

3.2 Writing the Raspbian OS onto the Micro SD Card

Write the Raspbian OS into the Micro SD card, which we will be using in the Raspberry Pi to boot the OS.

Step 6:

Identify the Micro SD Card Adapter and the Micro SD card. Figure 3.6 shows Micro SD card adapter and SD card that are to be inserted in laptop.

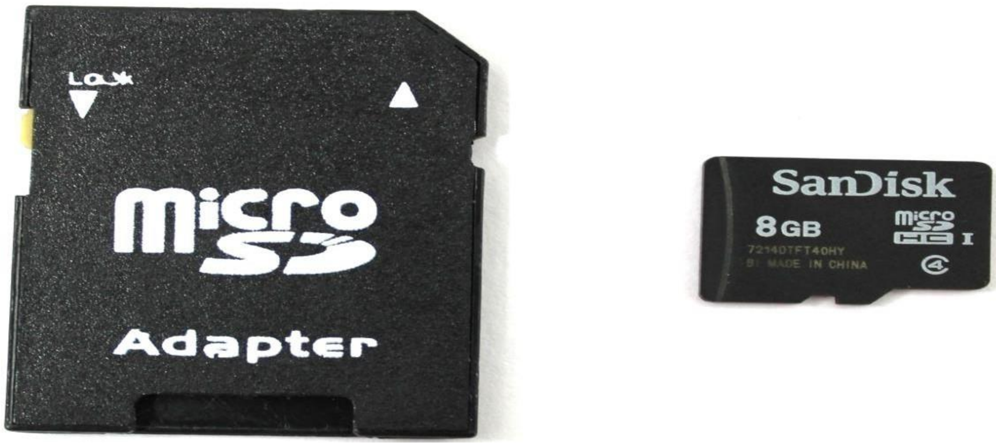


Figure 3.6 Micro SD Adapter and Micro SD Card

Step 7:

Insert the SD card into the adapter as shown. Make sure the orientation of the card is proper. Figure 3.7, shows inserting of SD card into SD card adapter to write the Raspbian OS onto the SD card.

Figure 3.7 Inserting SD card into Adapter

Step 8:

Make sure the Memory card switch is pulled up as shown, so that it is unlocked and data can be written and the card can also be formatted. Figure 3.8, shows that the SD card is correctly inserted

Figure 3.8 Checking SD card switch is pulled up

Step 9:

By Insert the adapter into the memory card slot in your laptop. Follow the direction as shown. Figure 3.9, shows insertimg of SD card adapter into laptop to write the Raspbian OS onto SD card.

Figure 3.9 Inserting SD Card Adapter into laptop

Step 10:

Installation of SD card formatter software will be downloaded by following link https://www.sdcard.org/downloads/formatter_4/

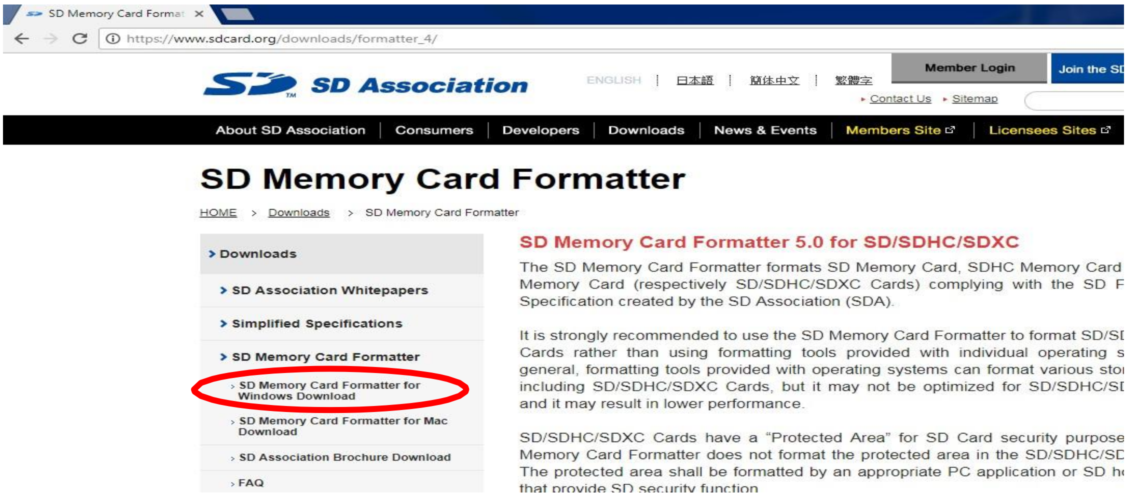


Figure 3.10 SD Card Formatter Download

Click on the link 'SD Memory Card Formatter for Windows Download' as shown in Figure 3.10.

Step 11:

New page will appear then scroll down to the bottom of the page till you get the options as shown. Click on 'Accept' as shown in figure 3.11.

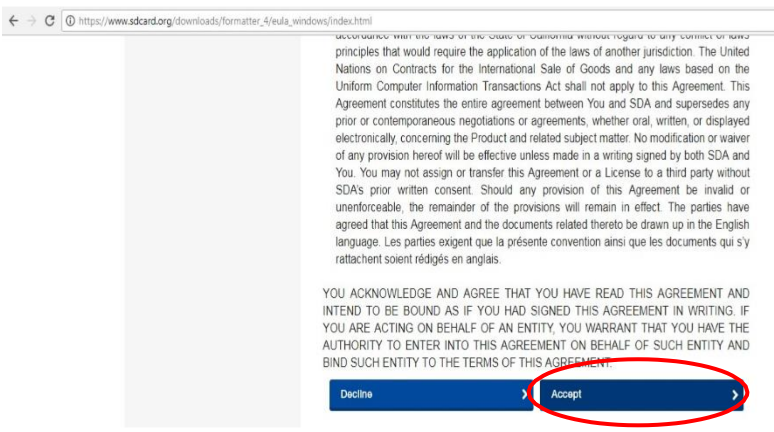


Figure 3.11 Click on Accept

The SD Card formatter software will be automatically downloaded now. Click on the downloaded file and the installation will start automatically. By agreeing license it will be installed.

Step 11:

Open the SD Card Formatter software that installed. Make sure the correct drive is selected.

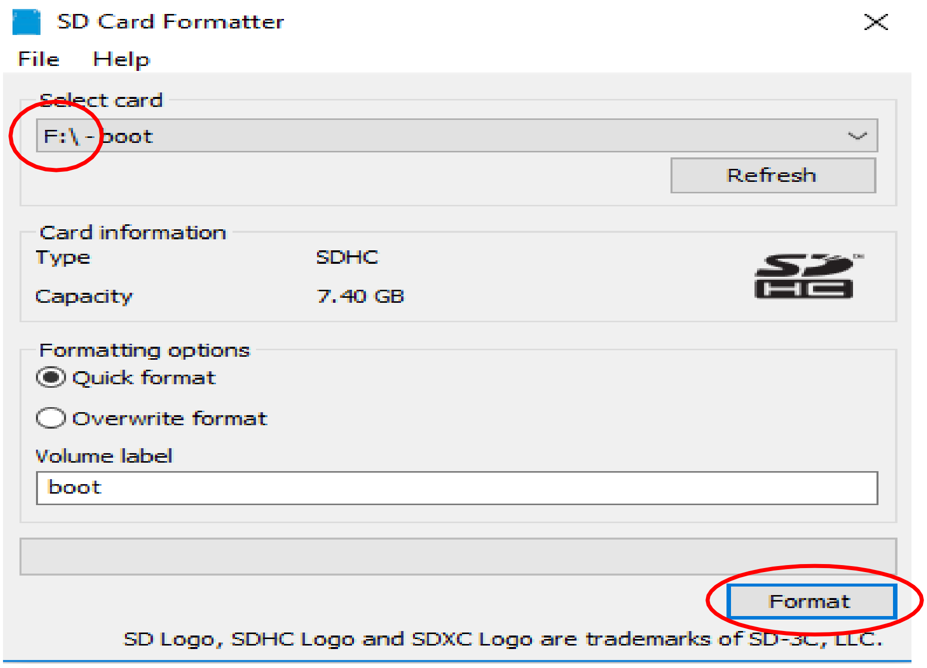


Figure 3.12 Formatting SD Card

Click on Format as shown in figure 3.12, then SD Card will be formatted.

3.3 Installation of win32 disk imager

Step 12:

This will need another software to open the Disc Image file we have extracted in Step 5.

By following link win32 disk imager will be downloaded ://sourceforge.net/projects/win32diskimager

Figure 3.13 Download of win32 Disk imager

Click on the 'Download' Option shown in figure 3.13 which will download the Win32 Disc Imager software.

The installation file will begin downloading. Open the file once the download is complete. By accepting license agreement it will be installed.

Step 13:

Click on the folder symbol as shown in figure 3.14 to locate the Raspbian Disk Image File that is extracted. Select the Disk Image file and click Open.

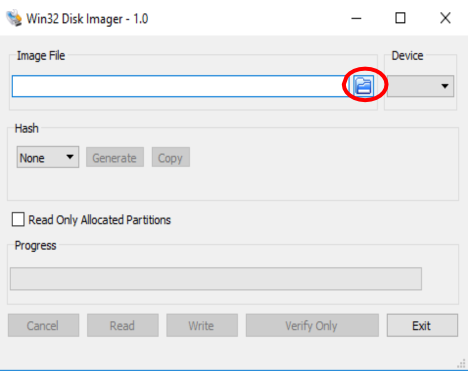


Figure 3.14 Folder selection

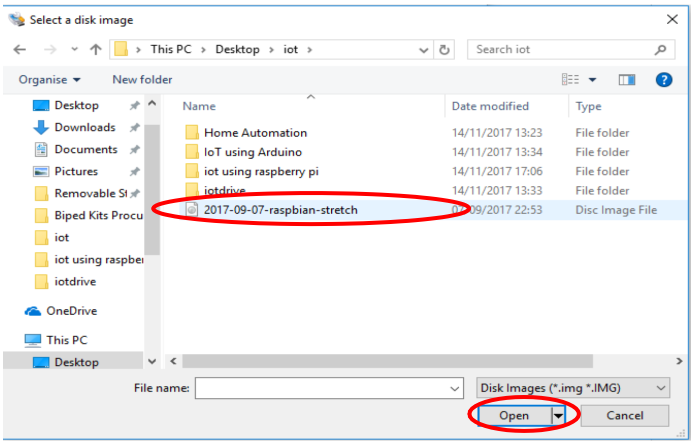


Figure 3.15 Selecting Raspbian OS Disk Image

Figure 3.15 shows selection of Raspbian OS disk image to write onto SD card.

Step 14:

Make sure the SD card adapter is inserted into your laptop & the correct file path and the drive of the SD Card are selected as shown in figure 3.16.

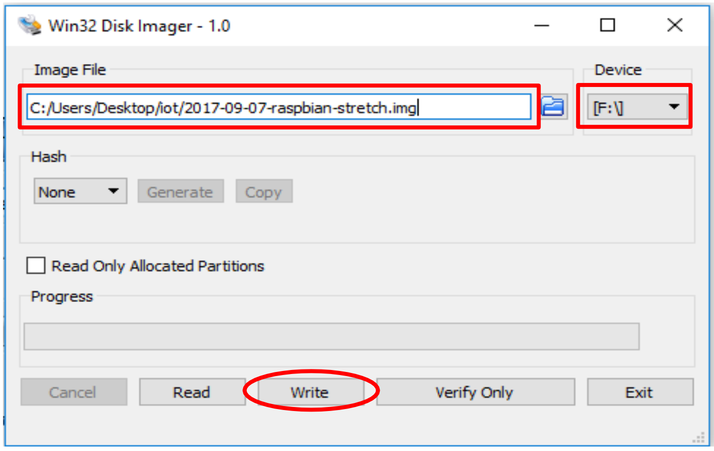


Figure 3.16 Writing Raspbian Disk image on to SD Card

Click on write.

Step 15:

This will make Raspbian OS is now installed on your SD card.

So it is ready to use this SD card in your Raspberry Pi to boot the Raspbian OS.

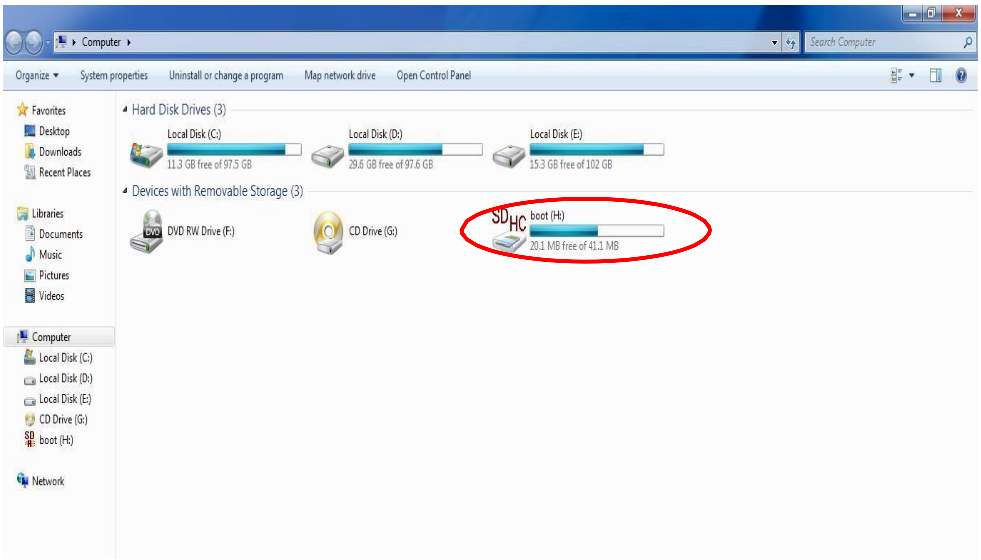


Figure 3.17 Raspberry Pi OS on SD Card

Figure 3.17 shows Raspbian OS is successfully written onto the SD card.

3.4 Enabling SSH Connection

By default, Raspbian has SSH (Secure Shell) disabled, which doesn't allow to remotely access the Raspberry Pi from the laptop. So,it is needed to enable Secure Shell which is described in this section.

Step 16:

Open Notepad by searching for it in the Windows search bar. Create an empty file and save this file as "SSH." to enable SSH connection in raspberry pi. Save this file with in SD card. Select the drive of the SD Card, in order to save the file into the SD card.

Type **"SSH."** and select 'All Files' in 'Save as type' Then Click on 'Save' as shown in figure 3.18.

Saving the "SSH." file in the boot directory enables the SSH and the Raspberry Pi can be accessed through Secure Shell upon booting.

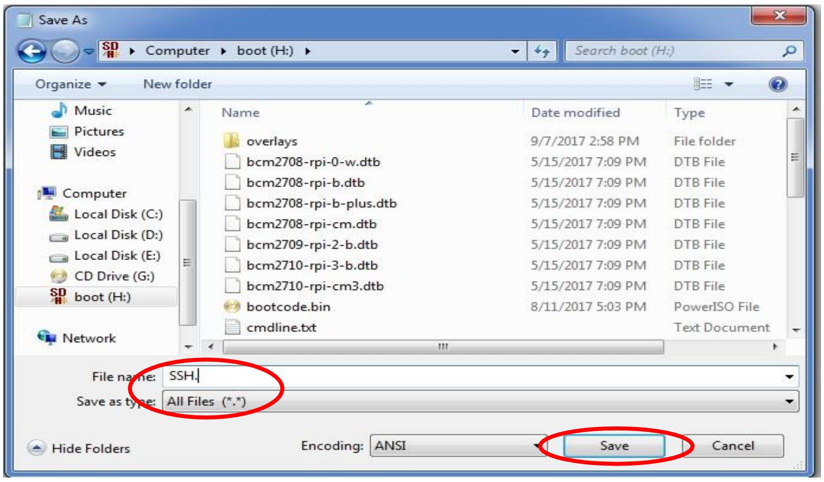


Figure 3.18 Enabling SSH

3.5 Installation of Advanced IP Scanner

On your browser, go to the link https://www.advanced-ip-scanner.com/

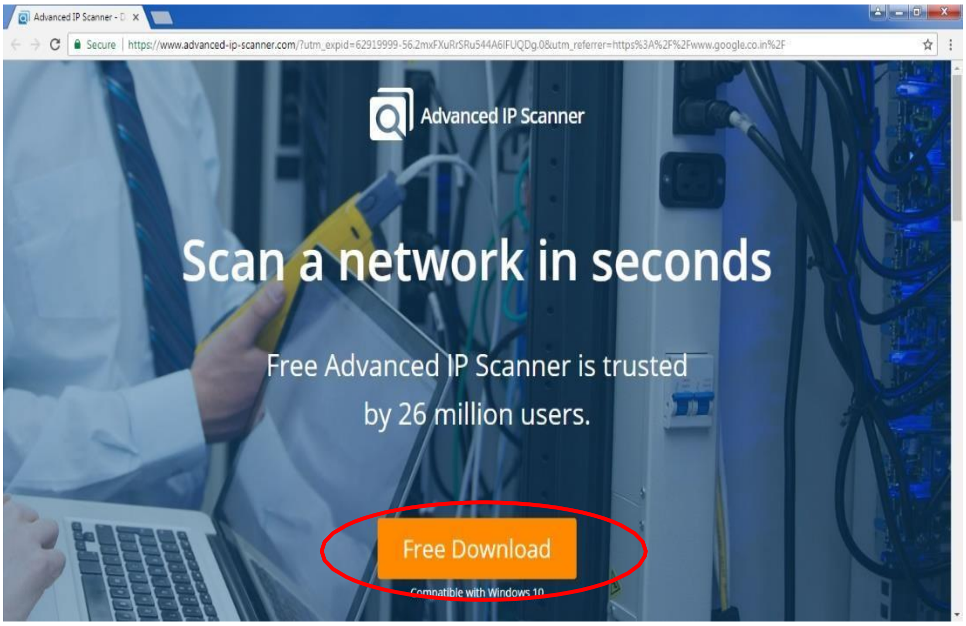


Figure 3.19 Download of Advanced IP Scanner

Click on free Download. Open the file once the download is completed. By accepting license agreement, click on install. Once installation is completed, open it by double tapping and locate IP address of Raspberry pi by connecting raspberry pi with laptop using micro USB.

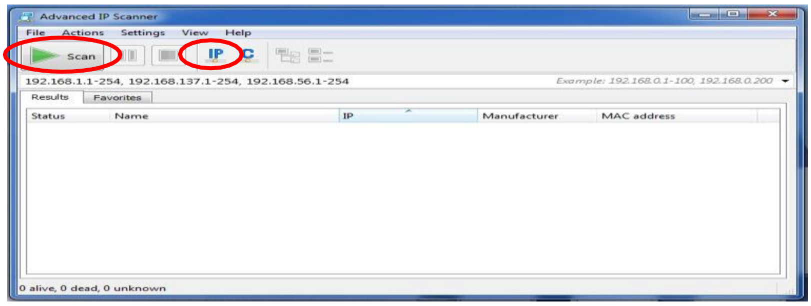


Figure 3.20 IP address scanning

Click on the IP option and then click on 'Scan' as shown in figure 3.20.

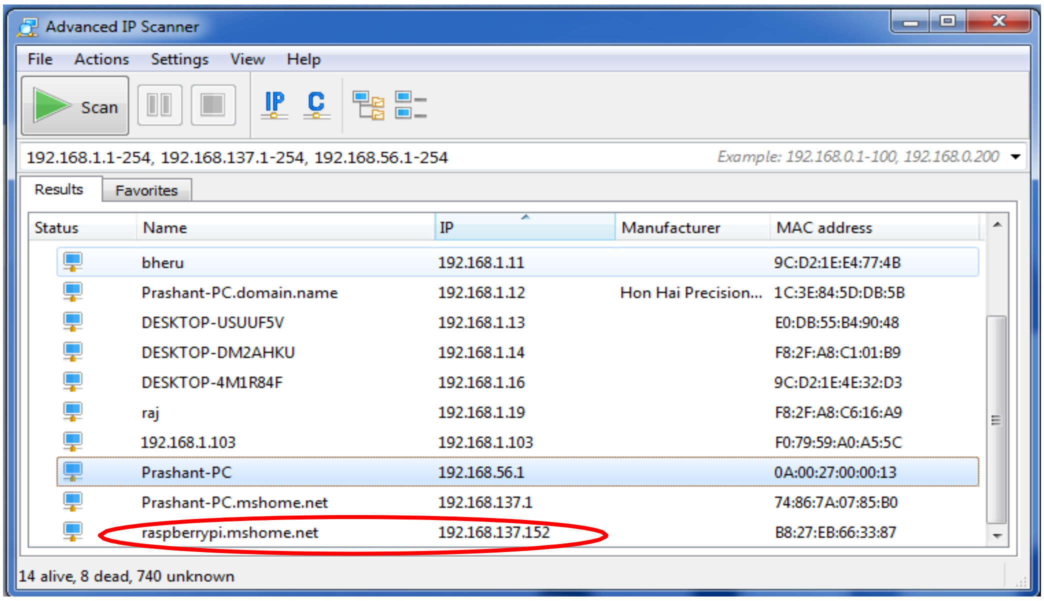


Figure 3.21 Locating IP Address of Raspberry pi

Locate the IP for the Raspberry Pi and note it as shown in figure 3.21. In you cannot locate IP address then change the IP range.

3.6 Installation of Putty

As IP address of the Raspberry Pi is identified, we will connect to it via SSH using the 'Putty' software. Go to the link www.putty.org on your browser. Click here to download Putty software. Click on Download here. Click on the correct option based on your laptop system configuration (32 bit or 64 bit) as shown in figure 3.22.

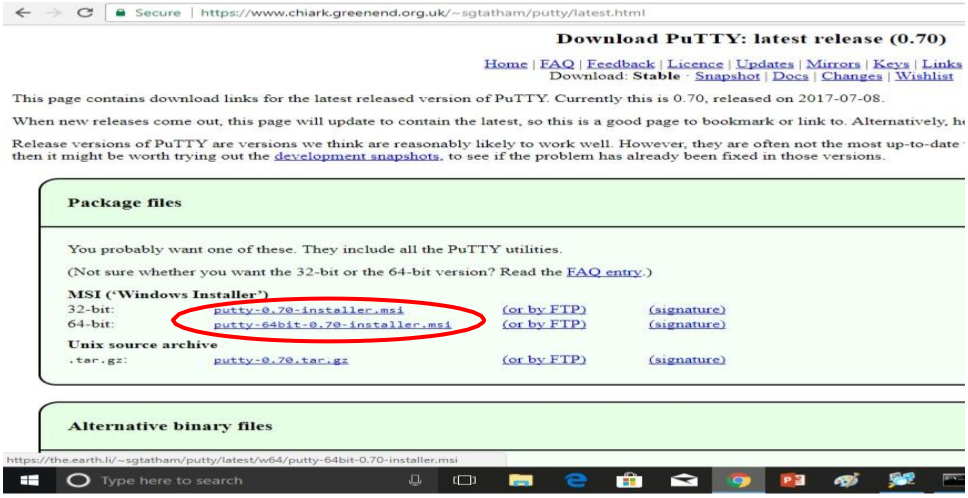


Figure 3.22 Downloading Putty Software

The Putty Software installation file will begin to download. Once it is downloaded open the file. Click on install by agreeing license.

Once the installation is complete, open it and then type the IP address and select the SSH option as shown in figure 3.23.

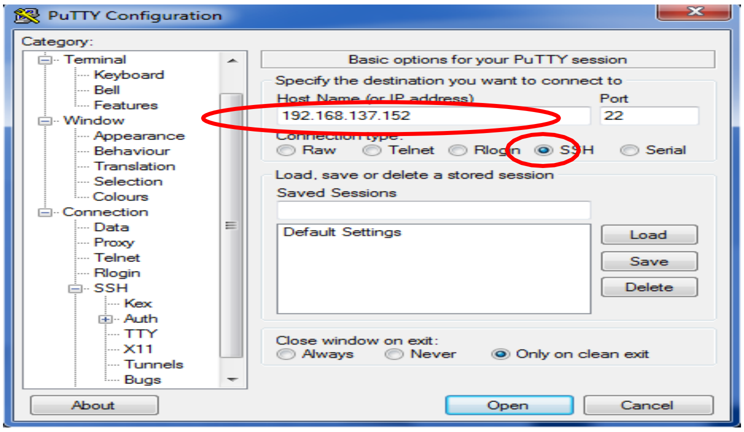


Figure 3.23 Connecting raspberry pi through putty

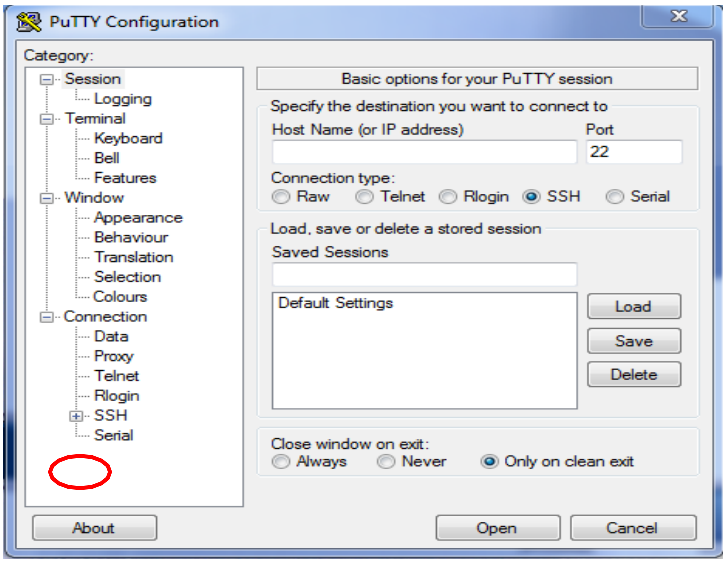


Figure 3.24 Enabling X11 Forwarding

Click on the '+' sign next to SSH option to expand it as shown in figure 3.24 and then select 'X11' Forwarding and click open. The putty application will show a security alert. Click on 'Yes'.

This will shown a login prompt, which means connection is successfully to the RPi via Putty.

The login credentials will be "pi" as username and "raspberry" as password. Type **pi** as shown in figure 3.25 the 'login as' option. Press enter after typing.

Type **raspberry** in the password option. Please note the password will not be shown as you type. Just press enter after typing.

Figure 3.25 Raspberry pi login

It will successfully logged into the Raspbian OS Command line of the Raspberry Pi.To update the Raspbian OS which will also install some additional packages into the Raspberry Pi.

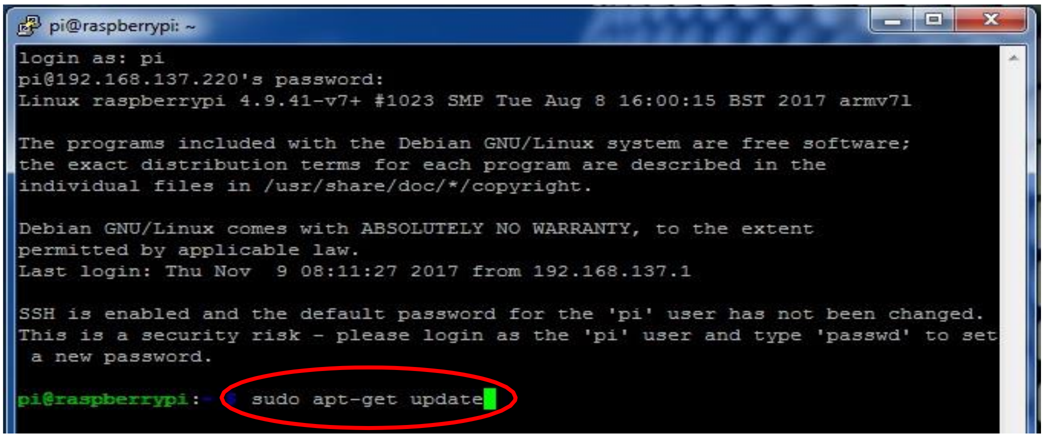


Figure 3.26 Updating packages

Type **sudo apt-get update** as shown and press enter as shown in figure 3.26.

3.7 Accessing Raspberry Pi using GUI of Raspbian

The Raspbian OS accessed through the command line of the OS. In order to access the GUI (Graphical User Interface) of the Raspbian, VNC (Virtual Network Computing) is used as shown in this section. VNC gives us the option of accessing the RPi as a remote computer from your computer. RPi will act as the server and your computer will act as the viewer.

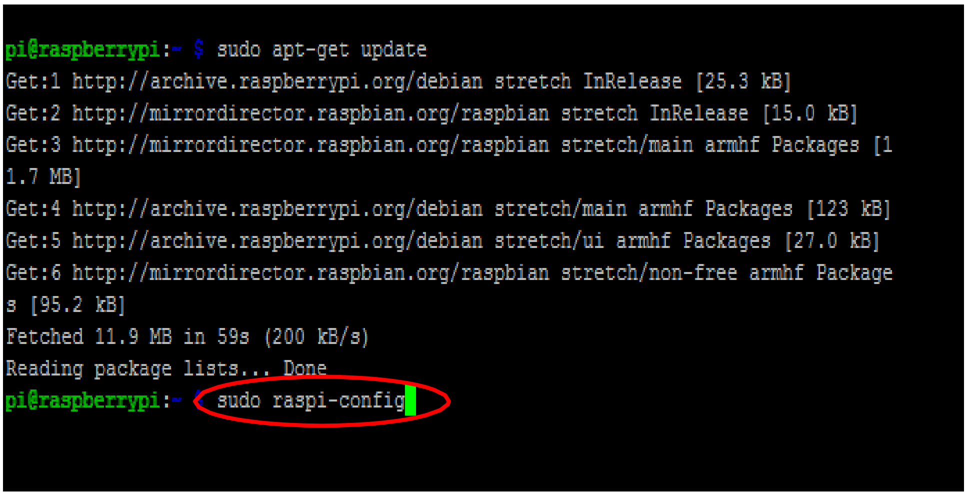


Figure 3.27 Raspberry Pi configurations

Type **sudo raspi-config** and press enter as show in figure 3.27 to view Raspbian configurations as shown in figure 3.28.

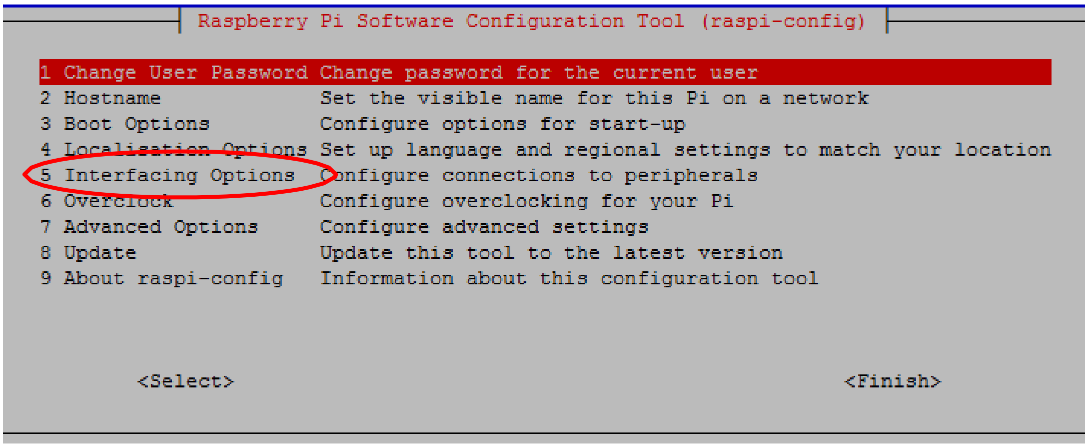


Figure 3.28 Interfacing Options

You'll get this window. Scroll down to the Interfacing Options (Number 5) using your down arrow key and press 'Enter

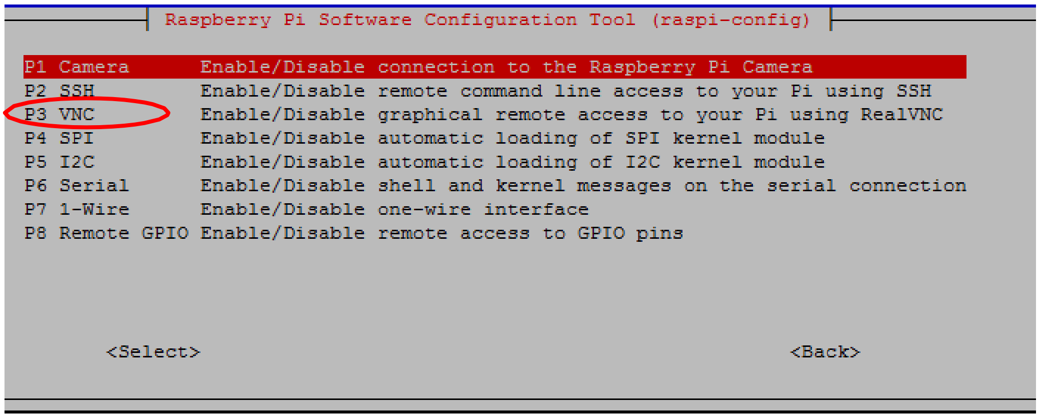


Figure 3.29 Enabling VNC viewer

Click on Yes to enable VNC as shown in figure 3.29.

Navigate to the 'Finish' option using arrow keys. Once 'Finish' is highlighted press Enter. It enables the RPi to be accessed over a Virtual Network.

3.8 Installation of VNC viewer

Type **sudo apt-get install realvnc-vnc-server realvnc-vnc-viewer** in the terminal of the RPi.Press Enter. This step will install the VNC Server on the RPi.

We will now install VNC Viewer software on your computer and use it to access the Raspbian GUI from your laptop OS.

By following link VNC viewer will be downloaded https://www.realvnc.com/en/connect/download/viewer and click on Download. Once it is downloaded open file and click on install by accepting license agreement and click on finish as shown in figure 3.3.

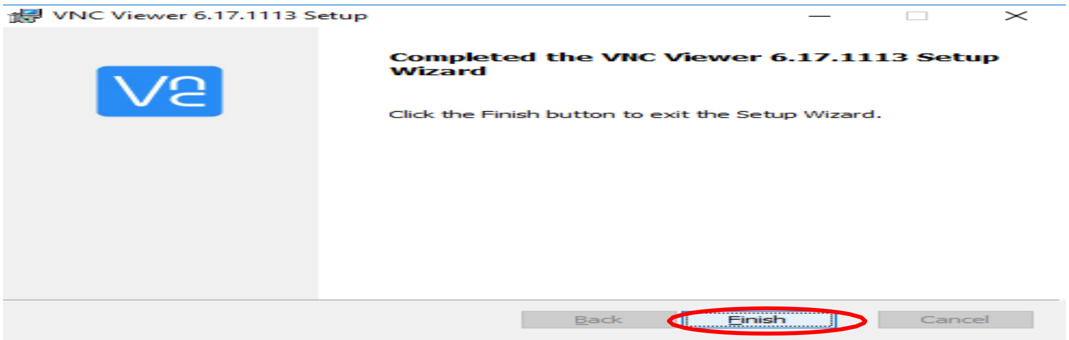


Figure 3.3 Finishing Installation

Open the VNC viewer and enter IP address of Raspberry Pi. Click on continue and enter Raspberry Pi login details and press enter.

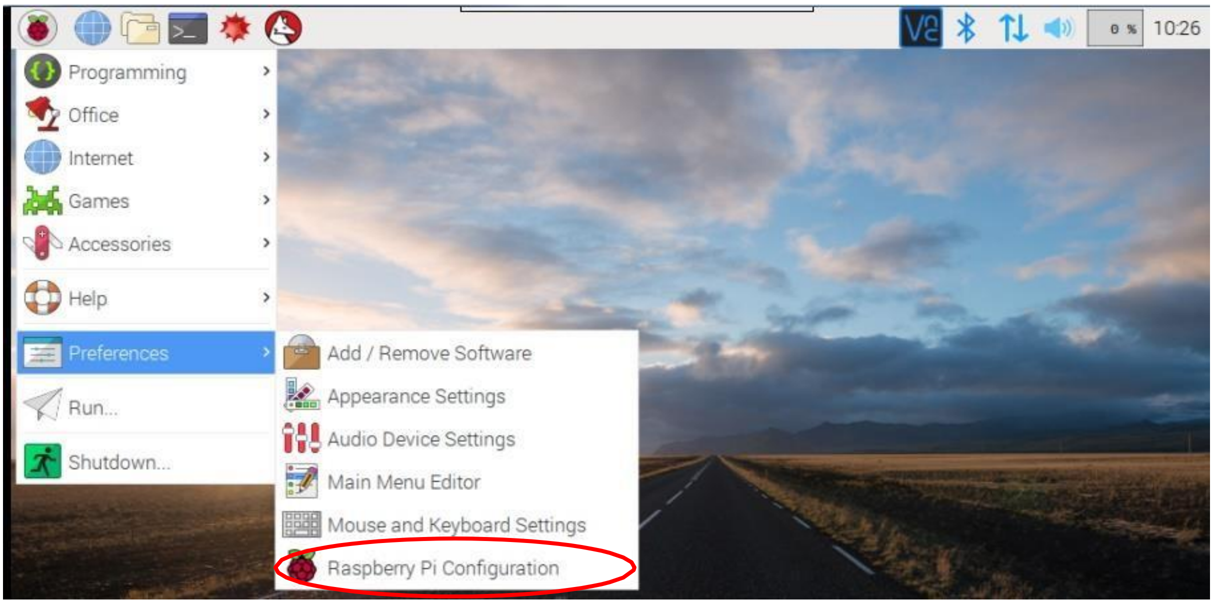


Figure 3.31 Changing resolution

Click on Raspberry Pi Configuration and set resolution as required and it asks for reboot. Press enter to reboot now.

CHAPTER 4

CONCEPTUAL IMPLEMENTATION

In this chapter it is discussed about network implementation. How the process is going. Initially Raspberry Pi is loaded with Raspbian OS and it is interfaced virtually using putty and VNC viewer. Then raspberry pi is enabled with wifi and motors are connected to raspberry pi through motor driver. A web cam is also connected to raspberry pi using usb port, its implementation is discussed below.

4.1 Network implementation

The basic concept of the project is to control the movement of the robot by giving commands in a remote system which is connected to the raspberry pi mounted on the robot and to achieve live streaming through a webcam mounted on the robot. The remote system and raspberry pi are connected over the internet.

The flow of process is continued as shown in figure 4.1.

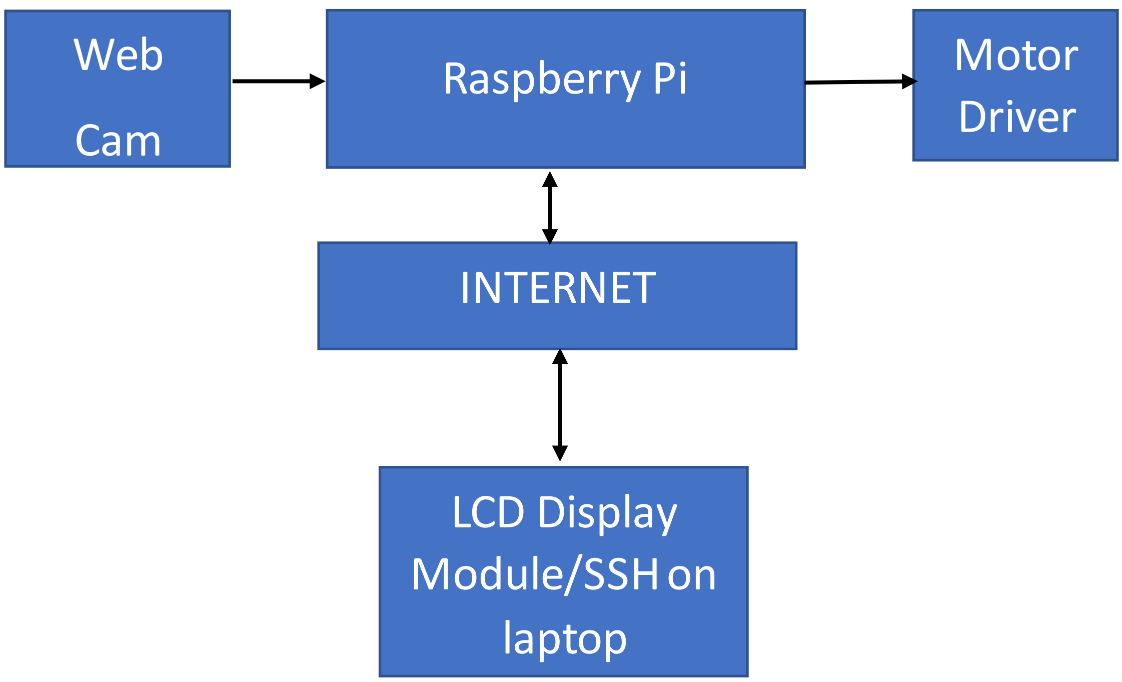


Figure 4.1 Block diagram

4.2 Modular description of the model

The whole project can basically divided into two modules

1. Robot control module
2. Video streaming module

Raspberry Pi plays a key role in both these modules. Our application provides a GUI to control the robot wirelessly. keys are used to control the robot in forward, backward, left or right direction. A camera is mounted on the robot, which fetches the live video streaming and display it. This video is achieved using open CV application.

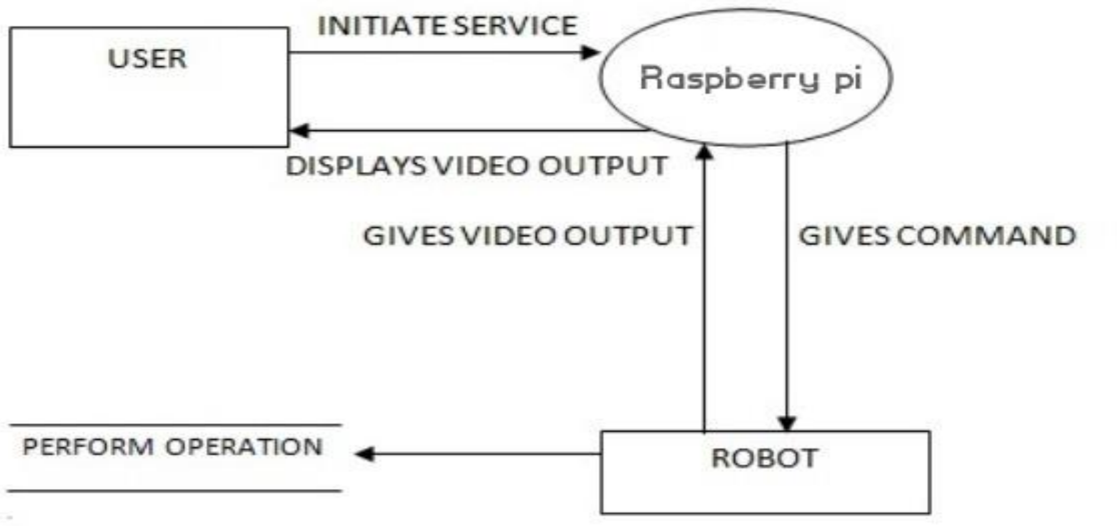


Figure 4.2.Flow Graph Of Working

As shown in figure 4.2 user can operate robot by givimg commands to raspberry pi over wifi and the video stream is viewed through laptop.

4.2.1. Robot control module

To control the movement of the robot first we need to install the Raspbian OS on the raspberry Pi and then access the Raspbian OS remotely through a system and run a prewritten python program in which specify the robot to move in specific directions when specific keys are pressed.

After installation of the necessary software, transfer the written python program to the Raspbian OS and run it in the VNC viewer. For the program to work perfectly the interface between the Raspberry Pi and motor driver should be done correctly and the GPIO pins should be imported to the program and perfect pin numbers should be assigned. The interface should be done as shown in the below table

Table 4.1.Connections between motor driver and Raspberry Pi:

Component 1	Terminals/Pins		Terminals/Pins	Component 2
Motor Driver	ENA	→	GPIO – 33	Raspberry Pi
	INP A1		GPIO – 35	
	INP A2		GPIO – 37	
	ENB		GPIO – 36	
	INP B1		GPIO – 38	
	INP B2		GPIO – 40	
	GND		GPIO – 39	

Table 4.2.Connections between motors and motor driver

Component 1	Terminals/Pins		Terminals/Pins	Component 2
Left Motor	Positive Terminal (+)	→	MB1	Motor Driver
	Negative Terminal (-)		MB2	
Right Motor	Positive Terminal (+)		MA2	
	Negative Terminal (-)		MA1	

Table 4.1,4.2 shows about how the motor is connected to motor driver and how the motor driver is connected to raspberry pi respectively. The program begins with importing the GPIO pins by using the command import in python. Then assign the GPIO pins for both motors using the command GPIO.setmode in this we assign each pin to a variable as shown the interface table. Then set the pins in output mode using GPIO.setup command. Then write a function consisting of if conditions specifying the direction of the robot by enabling certain pins as shown in the table.

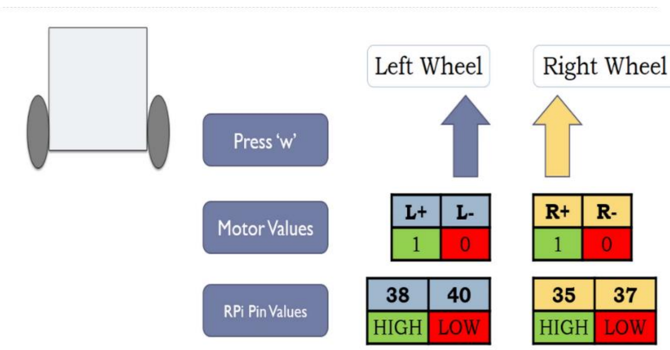


Figure 4.4 Pin conditions when w key is pressed

Figure 4.3. Key & directions

Figure 4.5 shows with which key the operation is carried out. By using 'w','a','s','d' keys in the laptop it can be moved forward,left turn, backward, right turn respectively. Tab key is used to stop the robot.

Figure 4.6,4.7,4.8,4.9,4.10 shows how the pin conditions are changed when ‘w’,’a’,’s’,’d’ keys are pressed.

As shown above when the key w is pressed both the motor pins are high so that both the motors rotate in clockwise direction and the robot moves forward. Similarly to move backwards the exact opposite conditions are enabled so that both the motors move anti clockwise so the robot moves backward. The conditions for robot to move right is shown below in which the right motor is made to rotate in anticlockwise while left motor in clockwise direction. To move left the exact opposite conditions are enabled.

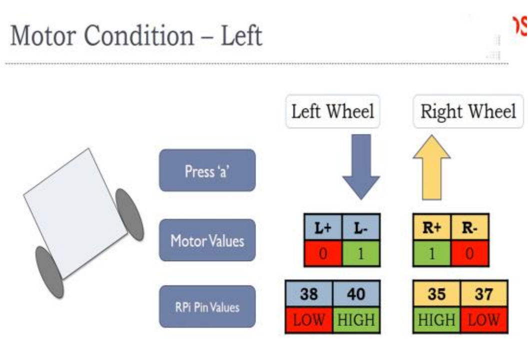


Figure 4.5 Pin conditions when a is pressed

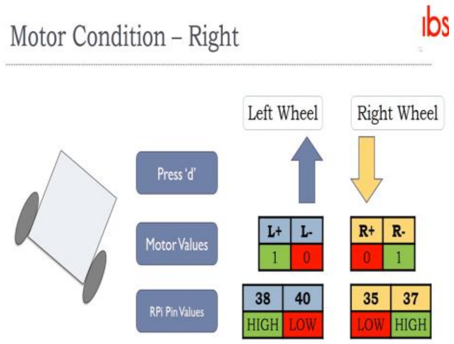


Fig4.6 Pin conditions when d is Pressed

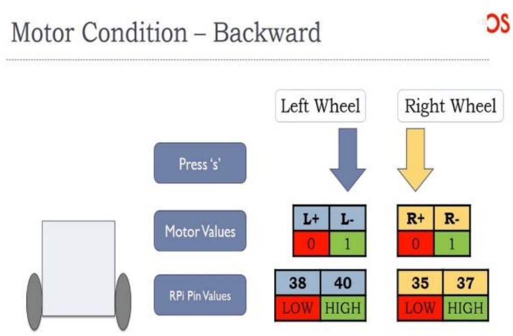


Figure 4.7Pin conditions when s is pressed

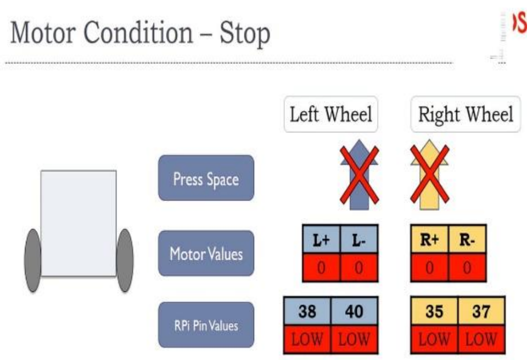


Fig 4.8Pin conditions when Tab is pressed

4.2.2. Video streaming module

For a successful live video streaming we need to be able to access the webcam mounted on the robot and start capturing the video and transmit the recorded video over the internet to the system. The webcam is connected to the Raspberry Pi camera slot, so the webcam can be accessed remotely by accessing the Raspberry Pi which is shown the Robot control module. Similar to the robot control module a python program is written and executed in the Raspbian OS for live video streaming. For video capturing and displaying we use open CV. Open CV stands for 'open source computer vision'. Computer vision is the automation of human visual system. It provides high level understanding to computer from digital images and videos. Open CV is a library of functions for real time computer vision, developed in c++ and supports python, java, matlab, octave. Computer vision has many applications like self-driving cars, detection of events, object identification and tracking. In this project we use some of the functions in open CV like video capture function, read function, im show functions for the purpose of video capturing and transmitting and displaying it on the screen.

Installing open CV on Raspberry Pi:

In the VNC viewer open terminal of the Raspberry Pi, use PIP packet manager to install open CV. It is a package management system which downloads and installs packages from the internet. In the terminal type pip3 install opencv-python and press enter, the dependencies for open CV will be downloaded and installed using the pip python packet manager. Some other softwares like libatlas, jasper software which can be used for coding and manipulation of images these softwares can be installed using the command sudo apt-get software name base-dev in the terminal of raspberry Pi and a GUI is also installed using the command sudo apt-get install libqtgui4 as shown in figure 4.9.

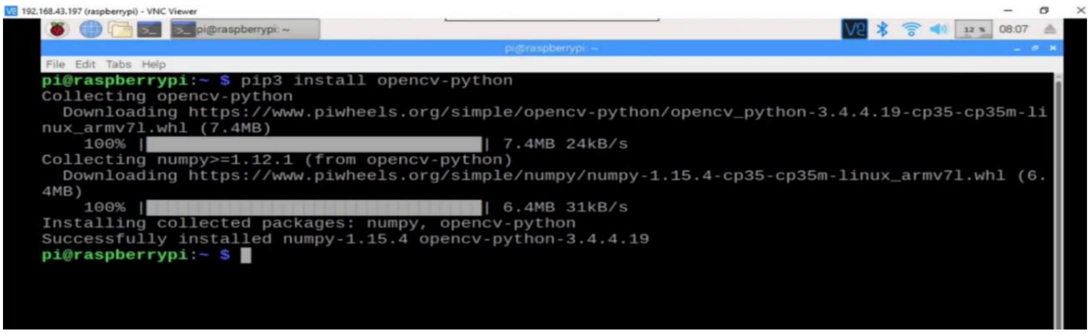


Figure 4.9 Installation of open CV on Raspbian OS

In the python program used to capture the video the first step is to import the open CV and other libraries like numpy using import function in python. The process of capturing and displaying a can be divided in to 3 simple steps.

Step1: Capturing the video:

To capture a video a video capture object is created and name the object. A video capture function is assigned to the object. The syntax of the video capture function is cv.videocapture(argument), argument is the device index which is a number to specify the camera a computer is interfaced with. Normally 0 is used since only one camera is used mostly. This function access the camera and starts capturing video.

Step2: Reading the captured video:

A video is a collection of multiple frames shown at high speed. Each frame is essentially an image. We use a infinite while loop to read and to display these images at high speed. Read function of the video capture object is used to read the images from the video being captured. The function gives two outputs. It returns a Boolean which is true when the frame is read correctly. It also gives out the image captured as an output, the captured image is stored in an variable. The syntax of the read function is object.read() object will have the captured video which is specified in step 1.

Step3: Displaying the read video:

To display the read video imshow function is used. The syntax is cv.imshow(string,variable), string is the name of the in which the video is displayed and the variable is the variable which is used to read the video.

Since the last two steps are written in an infinite while loop an condition to exit the infinite while loop is written such that when a specified key is pressed the loop breaks and the video streaming stops. The pressed key is detected using wait key function. The syntax of the wait key function is cv.waitkey(delay). It delays the program for a specified time and it returns the Unicode of the key pressed, if the pressed key is the same as the key mentioned in the if condition then the infinite while loop breaks. Then release the camera using release function and destroy all windows using destroy function. If wanted the FPS of the video can be increased using multithreading process. It is process of concurrently executing multiple threads, multithreading is a way of achieving multitasking. A thread is a sequence of instructions with in a program that can be executed independently of the other code.

4.3 Use case Report

Table 4.3.Use case report

Title:	Surveillance robot controlled using Raspberry Pi
Description:	In this project we can control the robot using an raspberry pi and can stream live video over the internet.
Primary Actor:	The one who uses the mobile
Pre conditions:	Installation of required software on our system.
Post conditions:	controlled a robot movement.
Main Success Scenario:	1. Fetching a live video streaming . 2. video is taken from a webcam which is mounted on a robot and then send to our system. 3. The Procedures starts by seeing a video then we can control the robot left, right, forward, backward easily.
Frequency of Use:	User can use many times

Figure 4.3 says about the description of the project and who can view the video streaming, pre conditions, post conditions, outputs and how many times we can use. Figure 4.7 shows the interface between user and the robot.

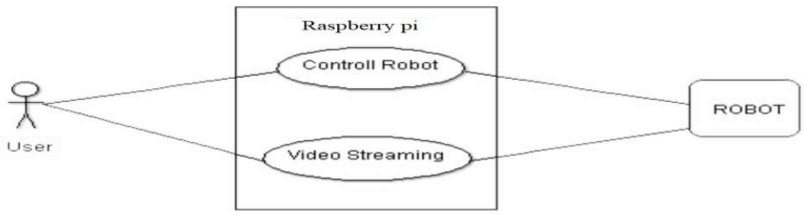


Figure 4.10.Use case diagram

4.4 Program for Implementation

```
import RPi.GPIO as GPIO
from time import sleep
from threading import Thread
import cv2 as cv
import numpy as np
import os
import glob
import time

os.system('modprobe w1-gpio')
os.system('modprobe w1-therm')

base_dir = '/sys/bus/w1/devices/'
device_folder = glob.glob(base_dir + '28*')[0]
device_file = device_folder + '/w1_slave'

def read_temp_raw():
    f = open(device_file, 'r')
    lines = f.readlines()
    f.close()
    return lines

def read_temp():
    lines = read_temp_raw()
    while lines[0].strip()[-3:] != 'YES':
        time.sleep(0.2)
        lines = read_temp_raw()
    equals_pos = lines[1].find('t=')
    if equals_pos != -1:
        temp_string = lines[1][equals_pos+2:]
        temp_c = float(temp_string) / 1000.0
        temp_f = temp_c * 9.0 / 5.0 + 32.0
        return temp_c, temp_f


class WebcamVideoStream:
    def __init__(self,src =0):
        self.stream = cv.VideoCapture(src)
        (self.grabbed, self.frame) = self.stream.read()

        self.stopped = False
```

```python
    def start(self):
        Thread(target = self.update, args =()).start()
        return self
    def update(self):
        while True:
            if self.stopped:
                return

            (self.grabbed, self.frame) = self.stream.read()

    def read(self):
        while True:
            if self.stopped:
                return

            (self.grabbed, self.frame) = self.stream.read()

    def read(self):
        return self.frame

    def stop(self):
        self.stopped = True


GPIO.setmode(GPIO.BOARD)

lm_ena=33
lm_pos=35
lm_neg=37

rm_ena=36
rm_pos=38
rm_neg=40

GPIO.setup(lm_ena,GPIO.OUT)
GPIO.setup(lm_pos,GPIO.OUT)
GPIO.setup(lm_neg,GPIO.OUT)

GPIO.setup(rm_ena,GPIO.OUT)
GPIO.setup(rm_pos,GPIO.OUT)
GPIO.setup(rm_neg,GPIO.OUT)
```

```python
def moveRobot(direction):
    if(direction=="f"):
        print("Forward")

        GPIO.output(lm_ena,GPIO.HIGH)
        GPIO.output(lm_pos,GPIO.HIGH)
        GPIO.output(lm_neg,GPIO.LOW)


        GPIO.output(rm_ena,GPIO.HIGH)
        GPIO.output(rm_pos,GPIO.HIGH)
        GPIO.output(rm_neg,GPIO.LOW)


    if(direction=="b"):
        print("Backward")

        GPIO.output(lm_ena,GPIO.HIGH)
        GPIO.output(lm_pos,GPIO.LOW)
        GPIO.output(lm_neg,GPIO.HIGH)


        GPIO.output(rm_ena,GPIO.HIGH)
        GPIO.output(rm_pos,GPIO.LOW)
        GPIO.output(rm_neg,GPIO.HIGH)


    if(direction=="r"):
        print("Rightward")

        GPIO.output(lm_ena,GPIO.HIGH)
        GPIO.output(lm_pos,GPIO.HIGH)
        GPIO.output(lm_neg,GPIO.LOW)


        GPIO.output(rm_ena,GPIO.HIGH)
        GPIO.output(rm_pos,GPIO.LOW)
        GPIO.output(rm_neg,GPIO.HIGH)


    if(direction=="l"):
        print("Leftward")
```

```
    if(direction=="l"):
        print("Leftward")

        GPIO.output(lm_ena,GPIO.HIGH)
        GPIO.output(lm_pos,GPIO.LOW)
        GPIO.output(lm_neg,GPIO.High)


        GPIO.output(rm_ena,GPIO.HIGH)
        GPIO.output(rm_pos,GPIO.HIGH)
        GPIO.output(rm_neg,GPIO.LOW)


    if(direction=="s"):
        print("Stop")

        GPIO.output(lm_ena,GPIO.HIGH)
        GPIO.output(lm_pos,GPIO.LOW)
        GPIO.output(lm_neg,GPIO.LOW)


        GPIO.output(rm_ena,GPIO.HIGH)
        GPIO.output(rm_pos,GPIO.LOW)
        GPIO.output(rm_neg,GPIO.LOW)


cam=WebcamVideoStream(src=0).start()

while(True):

    frame =cam.read()

    cv.imshow("frame",frame)

    key = cv.waitKey(10)

    if key == ord('w'):
        moveRobot('f')

    if key == ord('a'):
        moveRobot('l')
```

```
    if key == ord('s'):
        moveRobot('b')

    if key == ord('d'):
        moveRobot('r')

    if key == 32:
        moveRobot('s')

    if key == 27:
        break

    cv.imshow("frame",frame)
    print(read_temp())
    time.sleep(1)


cam.stop()
cv.destroyAllWindows()
GPIO.cleanup()
```

CHAPTER 5

RESULT

In this project working and operation of surveillance robot is achieved by Raspberry Pi through connecting things to the internet. The specifications of components to do surveillance robot are given in table 5.1

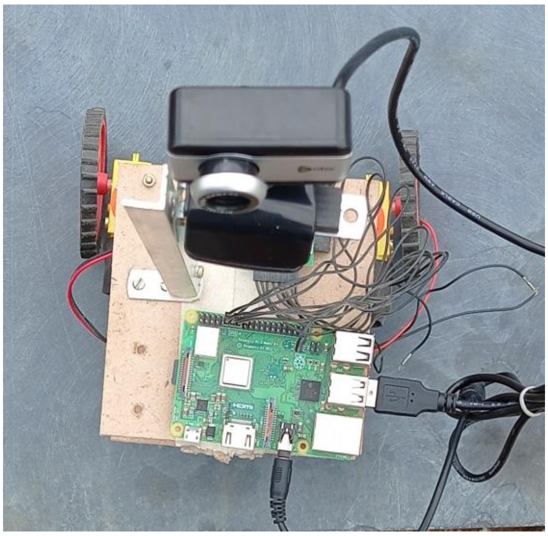
Table 5.1 Components specifications used in this model

Component Name	Specifications
Raspberry pi	1.1GB RAM 2.Quad core Broadcom BCM2837 64 bit CPU 3.Wireless lan and Bluetooth low energy on board 4.100 Base Ethernet 5.40-pin extended GPIO 6.4 USB 2 ports 7.4 pole stereo output and composite video port 8.Full size HDMI 9.Micro SD port for loading operating system and storing data 10.Upgraded switched Micro USB power source up to 2.5A
Dc Motor	1.DC supply – 4 to 12V 2.RPM – 60rpm 3.Operating Voltage – 9V DC 4.Torque – 2 kg-cm 5.No load current – 60 mA (max) 6.Load current – 300 mA (max)
L293 Motor Driver	1.Supply voltage – 4.5V to 36V 2.Output current 1A per channel 3.Peak output current 2A per channel
Camera	1.Pixels – 15MP 2.Focus is adjustable 3.It sends 60 Frames per second 4.It will cover upto 100ft. It is based on the wifi strength.
DS18B20 Temperature Sensor	1.Unique 1-wire interface require only one port pin for communication 2.Supply power – 3V to 5V 3.Temperature range - -55°C to +125°C (or) -67°F to +257°F 4. ±0.5°C accuracy from -10°C to +85°C

By using above component specifications surveillance robot covers wide area and it sends 60 frames per second and it also gives temperature of surroundings, but cctv cameras does not give temperature feed.

In this project there are two main results i.e. the hardware result and the software result.

1.The hardware result includes the movement of the robot which runs on DC motors in a specified direction. The input to the motors is provided by the L239D motor driver. The motor driver is interfaced with the Raspberry Pi which receives commands from a remote system. When the robot is tested by entering various keys on the keyboard of the system which is connected to the Raspberry Pi remotely over wifi, the robot moved in the specified direction without any interruptions. Python here acts as the main platform where most of the work is done. We can control the robot from the distance of 100ft as the same wifi must be connected to move the robot. We can also further increase the distance using RF modules (lora).



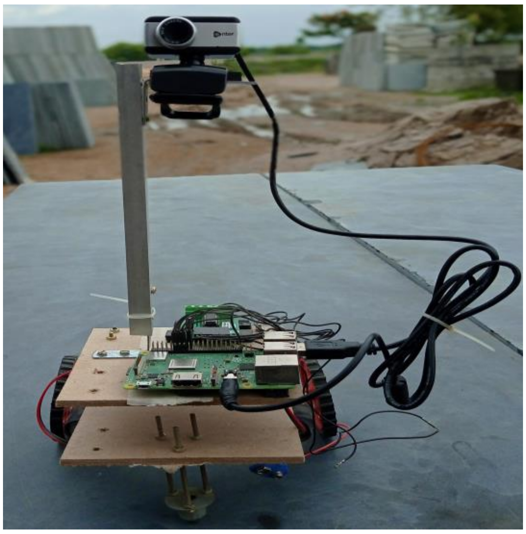


Figure 5.1.Top view of the robot **Figure 5.2.Front view of the robot**

Figure 5.1,5.2 shows front view of robot and top view of robot and the figure 5.3 shows the video footage that is taken by using the robot. Here the surveillance camera sends 60 frames per second which makes to see that as a video.

The above shown figures are the models of the robot where web cam is mounted top of the robot the video feed is transmitted directly to the system through the SSH Protocol. The Mobility of the robot is controlled through the system according to the commands given to the robot.

When W key is pressed then system gives command to the robot to move forward similarly when key A is pressed then to move left, when key D is pressed then it moves right, when key S is pressed it moves backward, when Space bar is pressed it stops if the robot is in motion, These keys are used to give commands to the robot these commands are first received by the raspberry pi which is responsible to execute the further steps as per received command the movement of robot is depended on dc motors where these are controlled by using L239D motor driver where it receives signals from raspberry pi as per the which command is executed.

2. The software result includes the live video streaming over the internet. The main purpose of the project here is to create a robot that can transmit live video over the internet to a remote system. For this purpose a webcam of 15mp is used which is connected to the Raspberry Pi camera slot. Open CV which is an open source computer vision software library that contains necessary functions to capture the video by accessing the webcam remotely and transmit the captured video over wifi to the system in which the python program is executed. It will cover wide area since it is mobile robot than the CCTV cameras. Installation of CCTV cameras at more places will be more cost. But this model will make the surveillance cost effective.

In addition to the mobility and live video feed transmission this robot also shows temperature around it which can be very use full when the robot is used in surveillance of surroundings at an unknown temperature areas this temperature is shown on the interface of the system which is used to control the particular robot this feature is achieved by using an temperature sensor in the robot.

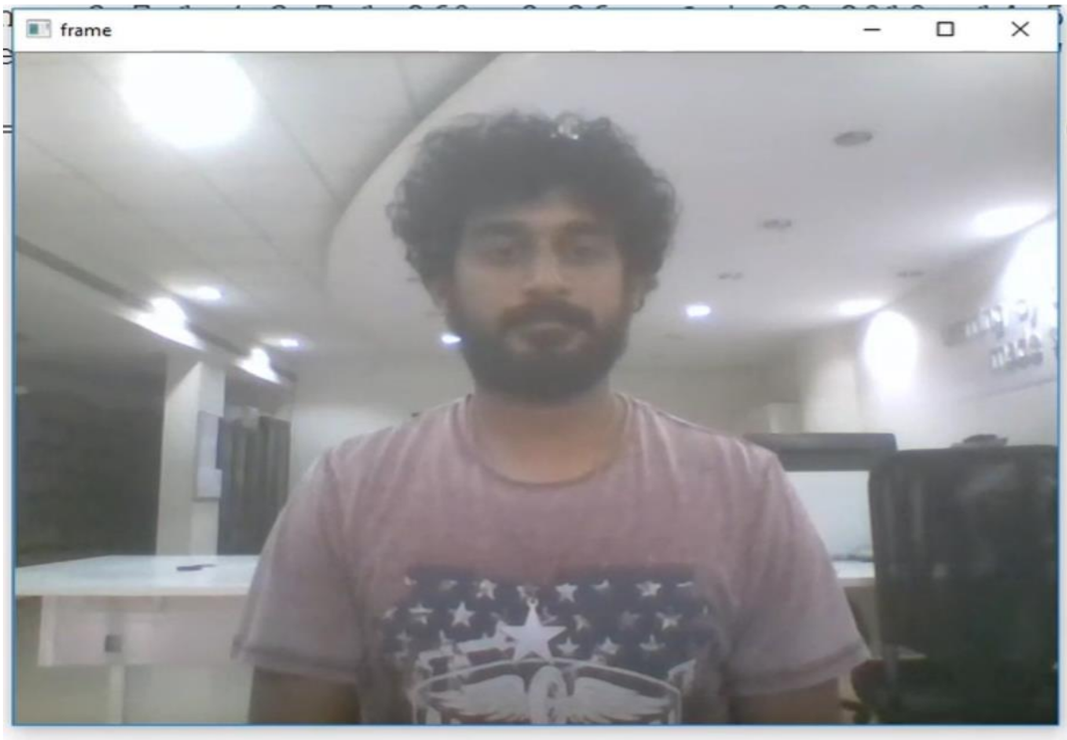


Figure 5.3.Live video streaming using Open CV

The above figure shows that how an live video feed that captured through the web cam of the robot is displayed in an user system interface this live video can only be displayed in one system because we use an SSH protocol for the transmission of the data where it prevents the problem of privacy by allowing only one id to access the robot.

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 Conclusion

That surveillance system using Raspberry pi is capable of capturing video/image and transmitting over the internet. It enables the user to surveillance at any time without any limitation. It is important to have privacy and security on both ends, which is achieved in this project by following SSH protocol. It is provided by authentication at the receiver side, hence it can by the concern person only. We can control the robot with the help of laptop manually. Wireless technology is one of the most integral technologies in the electronics Field. This technology is used to serve our project as a supreme part of surveillance act. This reduces human labor and replaces human work performing monitoring works in a well effective manner in unfavourable conditions like at the border surveillance, indoor surveillance etc., can be done.

6.2 Future Scope

Surveillance is needed in almost every field. It could be a greater solution to various problems or situations where Surveillance is needed. There are lots of improvements that can be made on the current design and technology and lots of additional feature scan be added. We can use different types of sensors so that we can use robot in different field i.e., Temperature Sensor, Pressure Sensor, Heat Sensor, Position Sensor, Proximity Sensor. A multipurpose robot can be made by wireless network, ranging from surveillance and home security to industrial applications where the user need not be present at the work place in person but can do it from his home itself.

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