

# **NIGHT VISION PATROLLING ROBOT FOR SECURITY PATROLLING USING COMPUTING AND RASPBERRY PI**

Submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in **ELECTRONICS AND COMMUNICATION ENGINEERING**

By

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**SATHYHABAMA**

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

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**MAY - 2022**



# **SATHYABAMA**

**INSTITUTE OF SCIENCE AND TECHNOLOGY**

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## **DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

### **BONAFIDE CERTIFICATE**

This is to certify that this project is the bonafide work of **AKHIL GALI (38130064) & KONA SIVA KESAVA VENKATA SATYA SAI (38130110)** carried out the project entitled "**NIGHT VISION PATROLLING ROBOT FOR SECURITY PATROLLING USING COMPUTING AND RASPBERRY PI**" under our supervision from **09/12/2021** to **01/03/2022**

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# **DECLARATION**

We **AKHIL GALI & KONA SIVA KESAVA VENKATA SATYA SAI** hereby declare that the project report entitled “**NIGHT VISION PATROLLING ROBOT FOR SECURITY PATROLLING USING COMPUTING AND RASPBERRY PI**” done by me under the guidance of **DR. EMALDA ROSLIN** and **DR. P. KAVI PRIYA** at **SATHYABAMA UNIVERSITY** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering in **ELECTRONICS AND COMMUNICATION ENGINEERING**

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THE CANDIDATES

## **ACKNOWLEDGEMENT**

I am pleased to acknowledge my sincere thanks to Board of Management of SATHYABAMA for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my thanks to **DR. N. M. NANDHITHA**, Dean, School of Electrical Engineering and **DR. T. RAVI**, Head of the Department, Department of **ELECTRONICS AND COMMUNICATION ENGINEERING** for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **DR. P. KAVI PRIYA** for his valuable guidance, suggestions and constant encouragement paved way for the successful completion of my project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the Department of **E.C.E** who were helpful in many ways for the completion of the project.

## **AIM**

The aim of the project is to construct a device to patrol during the night autonomously in corridors, balconies and confined spaces using various sensors and pi-cam to take pictures of the intruders and send to the registered email-Id

## **ABSTRACT**

In this project we design, development of night patrol that robot is used to find the sound waves in the surroundings, and security patrolling services. When the sound is sensed by sound sensor the robot starts to be capturing the image where the sound is appeared. Then it sends the particular image to the given mail id.

The robot can perform security patrols during the night while functioning as a guide during the day. We designed and implemented a robust, easy to assemble, anthropomorphic security robot aiming to patrol large indoor areas, welcome, provide information and guide clients to their destination, as well as function as a telepresence platform for the human security guards. Our project suggest that Robot is user friendly and pleasing to the people, it can perform security for human being.

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# CHAPTER 1

## INTRODUCTION

Robots are being used in variety of industrial applications for various activities like pick and place, painting, assembling of subsystems and in hazardous places for material handling etc. Nowadays robots in the use of surveillance is emerging because of their miniature size allowing them 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 any defect and causing no harm. This project's main functionality is to deal with tough situations where human beings cannot handle situations like darkness, entering narrow and small places and detecting hidden bombs etc. Such hostile situation is occurring day by day in different parts of the world through terrorist attack or in natural catastrophes. This designed system is connected to a remote computer wirelessly through which the whole controlling of the system response is done. The project is also designed to search invisible metal stuffs from where people are not capable to reach and it is so designed to work in environment where visible light will not be available. The proposed system consists of two units mainly a robotic unit and a remotely control unit. The robotic unit is consisting of the webcam, sensors and the heart of the project, raspberry pi along with the PCB containing motor driven IC and voltage regulator circuitry.

### **1.1 EMBEDDED SYSTEM:**

An embedded system is a combination of computer hardware and software, either fixed in capability or programmable, designed for a specific function or functions within a larger system. Industrial machines, agricultural and process industry devices, automobiles, medical equipment, cameras,

household appliances, airplanes, vending machines and toys, as well as mobile devices, are possible locations for an embedded system.

Embedded systems are computing systems, but they can range from having no user interface (UI) -- for example, on devices in which the system is designed to perform a single task -- to complex graphical user interfaces (GUIs), such as in mobile devices. User interfaces can include buttons, LEDs, touchscreen sensing and more. Some systems use remote user interfaces as well.

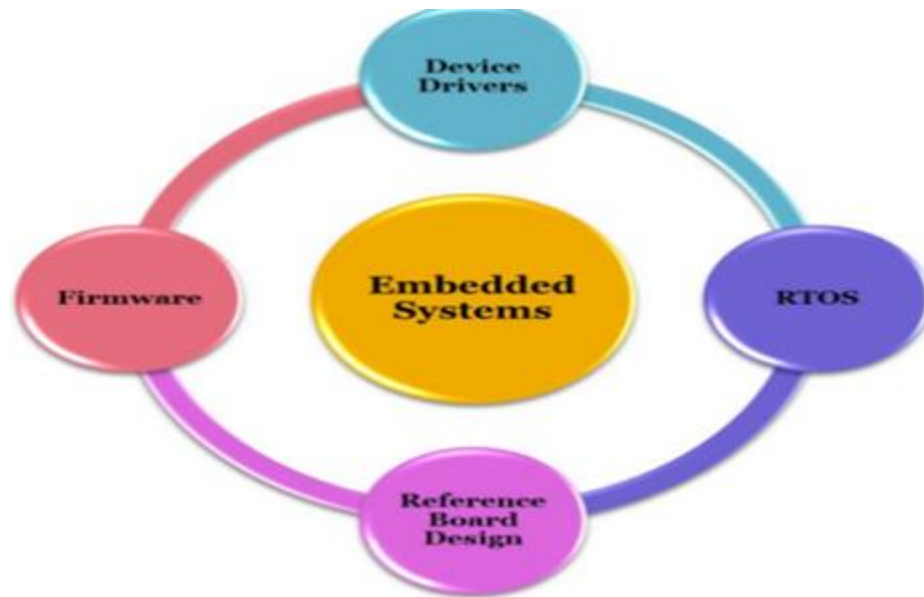
#### **1.1.1 EMBEDDED SYSTEM BASED ON MICRO-PROCESSOR AND MICRO-CONTROLLER**

Embedded system hardware can be microprocessor- or microcontroller-based. In either case, an integrated circuit is at the heart of the product that is generally designed to carry out computation for real-time operations.

Microprocessors are visually indistinguishable from microcontrollers, but while the microprocessor only implements a central processing unit (CPU) and, thus, requires the addition of other components such as memory chips, microcontrollers are designed as self-contained systems.

Microcontrollers include not only a CPU, but also memory and peripherals such as flash memory, RAM or serial communication ports. Because microcontrollers tend to implement full (if relatively low computer power) systems, they are frequently put to use on more complex tasks. For example, microcontrollers are used in the operations of vehicles, robots, medical devices and home appliances, among others. At the higher end of

microcontroller capability, the term system on a chip (SoC) is often used, although there's no exact delineation in terms of RAM, clock speed and so on.



The embedded market was estimated to be in excess of \$140 billion in 2013, with many analysts projecting a market larger than \$20 billion by 2020. Manufacturers of chips for embedded systems include many mainstays of the computer world, such as Apple, IBM, Intel and Texas Instruments, as well as numerous other companies less familiar to those outside the field. Arm has been a highly influential vendor in this space. The company began as an outgrowth of Acorn, a U.K. maker of early PCs. Arm chips, produced under license by other companies, are based on the reduced instruction set computer (RISC) architecture and are often used in mobile phones; they remain the most widely deployed SoC in the embedded world, with billions of units fielded.

### **1.1.2 EMBEDDED SYSTEM SOFTWARE**

A typical industrial microcontroller is unsophisticated compared to the typical

enterprise desktop computer and generally depends on a simpler, less-memory-intensive program environment. The simplest devices run on bare metal and are programmed directly using the chip CPU's machine code language. Often, embedded systems use operating systems or language platforms tailored to embedded use, particularly where real-time operating environments must be served.

At higher levels of chip capability, such as those found in SoCs, designers have increasingly decided the systems are generally fast enough and the tasks tolerant of slight variations in reaction time that near-real-time approaches are suitable. In these instances, stripped-down versions of the Linux operating system are commonly deployed, although other operating systems have been pared down to run on embedded systems, including Embedded Java and Windows IoT (formerly Windows Embedded). Generally, storage of programs and operating systems on embedded devices make use of either flash or rewritable flash memory.



### 1.1.3 Embedded firmware:

The firmware on embedded systems, referred to as embedded firmware, is specific software written into the memory of a device that serves the purpose of ROM, but can be updated more easily. Firmware can be stored in non-volatile memory devices including ROM, programmable ROM, erasable PROM or flash memory. Embedded firmware is used to control various device and system functions, for example, telling the device how to communicate with other devices, perform specific functions and provide input and output functionality.

The delineation between the terms embedded firmware and embedded software are blurring, but embedded software often refers to the only code running on a piece of hardware, while firmware can also refer to the chip that houses a device's basic input/output system (BIOS) or Unified Extensible

Firmware Interface (UEFI), which connect software and a system's operating system.

#### **1.1.4 Embedded systems vs. VLSI:**

Very-large-scale integration, or VLSI, is a term that describes the complexity of an integrated circuit. VLSI is the process of embedding hundreds of thousands of transistors into a chip, whereas LSI (large-scale integration) microchips contain thousands of transistors, MSI (medium-scale integration) contain hundreds of transistors, and SSI (small-scale integration) contain tens of transistors. ULSI, or ultra-large-scale integration, refers to placing millions of transistors on a chip.

VLSI circuits are common features of embedded systems. Many ICs in embedded systems are VLSI, and the use of the VLSI acronym has largely fallen out of favor.

#### **1.1.5 Debugging embedded systems:**

One area where embedded systems part ways with the operating systems and development environments of other, larger-scale computers is in the area of debugging. While programmers working with desktop computer environments have systems that can run both the code being developed and separate debugger applications that monitor the actions of the development code as it is executed, embedded system programmers generally cannot.

Some programming languages run on microcontrollers with enough efficiency that rudimentary interactive debugging is available directly on the chip.

Additionally, processors often have CPU debuggers that can be controlled -- and, thus, control program execution -- via a JTAG or similar debugging port.

In many instances, however, programmers of embedded systems need tools that attach a separate debugging system to the target system via a serial or other port. In this scenario, the programmer can see the source code on the screen of a conventional personal computer just as would be the case in the debugging of software on a desktop computer. A separate, frequently used approach is to run software on a PC that emulates the physical chip in software, thus making it possible to debug the performance of the software as if it were running on an actual, physical chip.

Broadly speaking, embedded systems have received more attention to testing and debugging because a great number of devices using embedded controls are designed for use in situations where safety and reliability are top priorities.

#### **1.1.6 The Internet of Things builds on an embedded systems base:**

While some embedded systems can be relatively simple, a growing number either supplant human decision-making or offer capabilities beyond what a human could provide. For instance, some aviation systems, including those used in drones, are able to integrate sensor data and act upon that information faster than a human could, permitting new kinds of operating features.

## CHAPTER 2

### LITERATURE SURVEY

- **Ghanem Osman Elhaj Abdalla, T. Veeramanikandasamy. Implementation of spy robot for a surveillance system using Internet protocol of Raspberry Pi, 2017 2nd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT)**

At present the surveillance of International border areas is a difficult task. The border guarding forces are patrolling the border seriously, but it is not possible to watch the border at each and every moment. An essential requirement of this situation is a robot which automatically detects trespasser in the border and report nearby board security control unit. Many of the military departments now utilize the robots to carry out risky jobs that cannot be done by the soldiers. In this present work, a Raspbian operating system-based spy robot platform with remote monitoring and control algorithm through Internet of Things (IoT) has been developed which will save human live, reduces manual error and protect the country from enemies. The spy robot system comprises the Raspberry Pi (small single-board computer), night vision pi camera and sensors. The information regarding the detection of living objects by PIR sensor is sent to the users through the web server and pi camera capture the moving object which is posted inside the webpage simultaneously. The user in control room able to access the robot with wheel drive control buttons on the webpage. The movement of a robot is also controlled automatically through obstacle detecting sensors to avoiding the

collision. This surveillance system using spy robot can be customized for various fields like industries, banks and shopping malls.

- **Alexander Lopez; Renato Paredes; Diego Quiroz; Gabriele Trovita; Francisco Cuellar. Robot man: A security robot for human-robot interaction. 2017 18th International Conference on Advanced Robotics (ICAR)**

In this paper we present the design, development and preliminary tests of Robot man, a robot that combines qualities for interaction with humans, and security patrolling services. The robot is inspired by the information obtained from a security company in which their personnel not only perform security patrolling services, but have to interact with people, providing additional information about the area they safeguard. The robot is able to perform security patrols during the night while functioning as a guide during the day. We designed and implemented a robust, easy to assemble, anthropomorphic security robot aiming to patrol large indoor areas, interact with humans, welcome, provide information and guide clients to their destination, as well as function as a telepresence platform for the human security guards. Our results suggest that Robot man is user friendly and pleasing to the people, it can perform security tasks.

- **Dr. Shaik.mahaboob basha, sk.abdul khayyum, b. Amarendra, s.k.sajid. Design of security robot in night vision using wireless video camera and ultrasonic sensor, IJARIE-ISSN(O)-2395-4396. Vol-2 Issue-5 2017.**

A robot is a mechanical or virtual artificial agent, usually an electro-mechanical machine that is guided by a computer program or electronic circuitry. It is a unique spy robot circuit which can be controlled using a RF remote controller. It can act as a live telecast of audio and video information's from the surroundings and can be sent to a remote station through RF. Moment of camera is also. The maximum range is 100 meters. Another feature included it measure the distance of object at front of robot and also automatically stop robot if its detect distance of object is inside 10cm & data of distance can be also access at remote section unit by send RF signal. RF 2.4GHz ASK transmitter and receiver are used for the remote control which provide serially communication under specific range. The camera has a receiver, which is placed in the remote station. Its output signals are in the form of audio and video. The objective of the paper is to design a unique spy robot circuit which can be controlled by using a remote controller to detect any object or unwanted incident like fire in the night. Thus, our paper can be used as a societal application to identify culprits in the selected area. Further, the advancement of our paper can be established in security systems in defense.

- **Dr m senthamil selvi, m.faesa fathima, s.dhivyuaa, s.mouriya. Surveillance robot using raspberry pi for defense. International journal of current engineering and scientific research (ijcesr)**

The main objective behind this paper is to develop a cost effective easy to control surveillance vehicle through remote desktop for the implementation of military purpose. Since the risk factor in military border is too high causing threats to the lives of soldiers at time patrol by both climatic conditions and enemy nation which needs a replacement, that is done effectively by the

surveillance vehicle that comprises the Raspberry Pi (small single-board computer), pi camera and sensors. The information regarding the detection of living objects by PIR sensor and image capture of moving objects by pi camera capture is posted inside the webpage simultaneously. The movement of a robot is also controlled automatically through obstacle detecting sensors to avoiding the collision, and the system causes an alert at the time of metal detection through metal detecting sensor. Since the system does multitask this can be used in surveillance purpose.

- **Sonu kumar, Suraj kumar, Shruti shankar, Sakshi saxena. Smart Wireless Surveillance BOT with video monitoring and object avoiding facility. International Research Journal of Engineering and Technology (IRJET)**

Robots nowadays plays a major role not only in the daily industrial operations but are extensively used in the areas of defense, industries, medical and home applications. They can carry out different risky jobs that cannot be done by a human. This paper presents Surveillance robot that has its importance in defense and military purpose. It proposes one of the ways in which robots can be used in future to perform difficult tasks by the use of various sensors like LDR sensor for night vision, fire detection sensor with pump motor to extinguish the fire, IR sensors for pathfinding and obstacle avoidance, moisture sensor. This paper, however, presents only the use of object avoidance facility and a camera mounted on the top of it to provide continuous visual monitoring. In the similar ways, various other facilities can also be incorporated into it by interfacing the corresponding sensors

- **Wilson Feipeng Abaya, Jimmy Basa, Michael Sy, Alexander C. Abad and Elmer P. Dadios. Low-Cost Smart Security Camera with Night Vision Capability Using Raspberry Pi and OpenCV. 7th IEEE International Conference Humanoid, Nanotechnology, Information Technology**

In order to further maintain peace and provide security to people now a day, Closed-circuit television (CCTV) surveillance system is being utilized. This study focused on the design and implementation of a low-cost smart security camera with night vision capability using Raspberry Pi (RPI) and OpenCV. The system was designed to be used inside a warehouse facility. It has human detection and smoke detection capability that can provide precaution to potential crimes and potential fire. The credit card size Raspberry Pi (RPI) with Open-Source Computer Vision (OpenCV) software handles the image processing, control algorithms for the alarms and sends captured pictures to user's email via Wi-Fi. As part of its alarm system, it will play the recorded sounds: "intruder" or "smoke detected" when there is a detection. The system uses ordinary webcam but its IR filter was removed in order to have night vision capability.

- **K.M. Al-Aubidy, M.M. Ali, A.M. Derbas and A.W. Al-Mutairi. "GPRSbased remote sensing and teleoperation of a mobile robot". 10th International Multi-Conference on Systems, Signals & Devices, SSD 2013. March 2013; on page(s) 1 to 7.**

The main objective of this research was to design and implement a remote sensing and monitoring system running on mobile robot with obstacle avoidance capability in unreachable area. A simple mobile robot prototype

with onboard sensors has been designed and implemented to scan and monitor several variables in the surrounding environment. Teleoperation of such a mobile robot is a challenging task that requires an efficient interface and a reliable real-time robot control to avoid obstacles. The proposed system enables the user (base station) to send commands to the remote station (mobile robot), and receive scanned data and images from the environment through the internet and mobile DTMF signal. The proposed system hardware and software was implemented using PROTUS development software to obtain the suitable design parameters. Then, real experiments have been achieved to demonstrate the system performance including both the ultrasonic teleoperation of mobile robot navigation to avoid obstacles, and real-time sensing and monitoring in unreachable area.

- **Ebrahimzadeh, Amin, Martin Maier, and Roch H. Glitho. "Trace-Driven Haptic Traffic Characterization for Tactile Internet Performance Evaluation." In 2021 International Conference on Engineering and Emerging Technologies (ICEET), pp. 1-6. IEEE, 2021.**

The Tactile Internet is expected to be the central part of next-generation mobile networks. The future Tactile Internet will not only allow for the transmission of traditional triple-play traffic (i.e., audio, video, and data), but it will also enable the transmission of sense of touch. Substantially improved human-to-machine/robot interaction will enable humans to touch and physically interact with remote objects in real-time. Despite the growing interest in the Tactile Internet, the characteristics of real haptic traffic are still unknown, especially at the packet level. In this paper, we model Tactile Internet traffic by means of haptic traces, taking different teleoperator robots into account, and determine the best fitting packet interarrival time

distributions while exploiting the inherent human-in-the-loop nature of haptic interaction to reduce the packet rate via perceptual coding.

## CHAPTER 3

### PROJECT DESCRIPTIONS

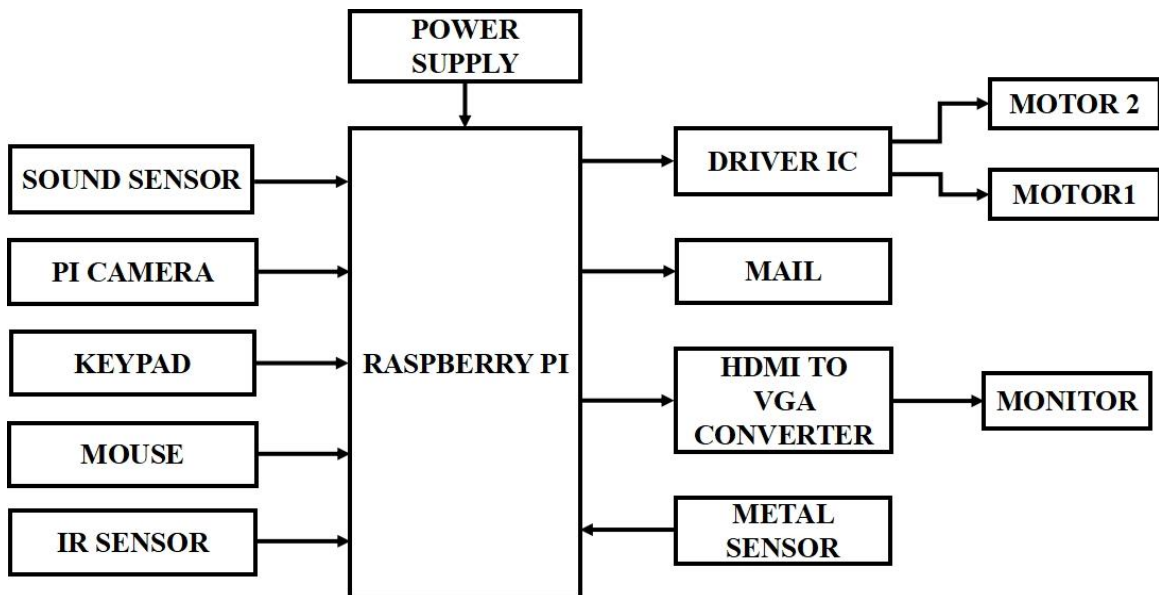
#### 3.1 EXISTING SYSTEM:

- In existing system, we can't monitor the sound.
- There is no facility of IOT.
- In existing camera is not available.

#### 3.2 PROPOSED SYSTEM:

- The proposed system can be used for protecting human.
- Sound sensor detect the sound, then it will activate the camera to capture the image by using Raspberry Pi camera.
- Then captured images are send to the respective email id through IOT.

#### 3.3 BLOCK DIAGRAM:



### **3.4 HARDWARE REQUIREMENTS:**

- Raspberry Pi
- Sound Sensor.
- Motor.
- Driver IC.
- Pi Camera.
- SD Card.
- HDMI to VGA Converter.
- Monitor.
- Keypad.
- Mouse.
- Metal Sensor
- IR Sensor

### **3.5 SOFTWARE REQUIREMENTS:**

- Raspbian OS.
- Python.

## CHAPTER-4

### HARDWARE AND SOFTWARE DESCRIPTIONS & ALGORITHMS

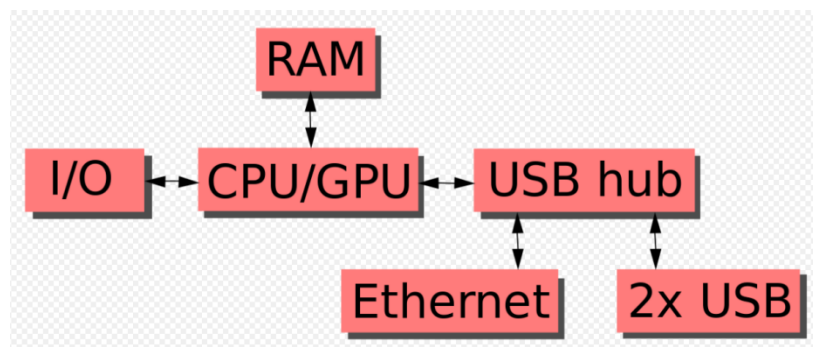
#### 4.1 RASPBERRY PI:

The **Raspberry Pi** is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries.<sup>[5][6][7]</sup> The original model became far more popular than anticipated,<sup>[8]</sup> selling outside its target market for uses such as robotics. It does not include peripherals (such as keyboards and mice) and cases. However, some accessories have been included in several official and unofficial bundles.<sup>[8]</sup>

The organization behind the Raspberry Pi consists of two arms. The first two models were developed by the Raspberry Pi Foundation. After the Pi Model B was released, the Foundation set up Raspberry Pi Trading, with Eben Upton as CEO, to develop the third model, the B+. Raspberry Pi Trading is responsible for developing the technology while the Foundation is an educational charity to promote the teaching of basic computer science in schools and in developing countries.

#### HARDWARE:

The Raspberry Pi hardware has evolved through several versions that feature variations in memory capacity and peripheral-device support.



This block diagram describes Model B and B+; Model A, A+, and the Pi Zero are similar, but lack the Ethernet and USB hub components. The Ethernet adapter is internally connected to an additional USB port. In Model A, A+, and the Pi Zero, the USB port is connected directly to the system on a chip (SoC). On the Pi 1 Model B+ and later models the USB/Ethernet chip contains a five-port USB hub, of which four ports are available, while the Pi 1 Model B only provides two. On the Pi Zero, the USB port is also connected directly to the SoC, but it uses a micro USB (OTG) port.

#### Processor:

- The Broadcom BCM2835 SoC used in the first generation Raspberry Pi includes a 700 MHz ARM11 76JZF-S processor, VideoCore IV graphics processing unit (GPU),<sup>[21]</sup> and RAM. It has a level 1 (L1) cache of 16 KB and a level 2 (L2) cache of 128 KB.
- The level 2 cache is used primarily by the GPU. The SoC is stacked underneath the RAM chip, so only its edge is visible. The 1176JZ(F)-S is the same CPU used in the original iPhone,<sup>[22]</sup> although at a higher clock rate, and mated with a much faster GPU.



- The earlier V1.1 model of the Raspberry Pi 2 used a Broadcom BCM2836 SoC with a 900 MHz 32-bit, quad-core ARM Cortex-A7 processor, with 256 KB shared L2 cache.<sup>[23]</sup> The Raspberry Pi 2 V1.2 was upgraded to a Broadcom BCM2837 SoC with a 1.2 GHz 64-bit quad-core ARM Cortex-A53 processor,<sup>[24]</sup> the same SoC which is used on the Raspberry Pi 3, but underclocked (by default) to the same 900 MHz CPU clock speed as the V1.1. The BCM2836 SoC is no longer in production as of late 2016.
- The Raspberry Pi 3+ uses a Broadcom BCM2837B0 SoC with a 1.4 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB shared L2 cache.<sup>[1]</sup>

#### Performance:

- While operating at 700 MHz by default, the first generation Raspberry Pi provided a real-world performance roughly equivalent to 0.041

GFLOPS.<sup>[25][26]</sup> On the CPU level the performance is similar to a 300 MHz Pentium II of 1997–99. The GPU provides 1 Gpixel/s or 1.5 Texel/s of graphics processing or 24 GFLOPS of general purpose computing performance. The graphical capabilities of the Raspberry Pi are roughly equivalent to the performance of the Xbox of 2001.

- Raspberry Pi 2 V1.1 included a quad-core Cortex-A7 CPU running at 900 MHz and 1 GB RAM. It was described as 4–6 times more powerful than its predecessor. The GPU was identical to the original. In parallelized benchmarks, the Raspberry Pi 2 V1.1 could be up to 14 times faster than a Raspberry Pi 1 Model B+.<sup>[27]</sup>
- The Raspberry Pi 3, with a quad-core ARM Cortex-A53 processor, is described as having ten times the performance of a Raspberry Pi 1.<sup>[28]</sup> This was suggested to be highly dependent upon task threading and instruction set use. Benchmarks showed the Raspberry Pi 3 to be approximately 80% faster than the Raspberry Pi 2 in parallelized tasks.

#### Overclocking:

- Most Raspberry Pi systems-on-chip could be overclocked to 800 MHz, and some to 1000 MHz. There are reports the Raspberry Pi 2 can be similarly overclocked, in extreme cases, even to 1500 MHz (discarding all safety features and over-voltage limitations). In the Raspbian Linux distro the overclocking options on boot can be done by a software command running "sudo raspi-config" without voiding the warranty.<sup>[30]</sup> In those cases the Pi automatically shuts the overclocking down if the chip temperature reaches 85 °C (185 °F), but it is possible to override automatic over-voltage and overclocking settings (voiding the

warranty); an appropriately sized heat sink is needed to protect the chip from serious overheating.

- Newer versions of the firmware contain the option to choose between five overclock ("turbo") presets that when used, attempt to maximise the performance of the SoC without impairing the lifetime of the board. This is done by monitoring the core temperature of the chip and the CPU load, and dynamically adjusting clock speeds and the core voltage. When the demand is low on the CPU or it is running too hot the performance is throttled, but if the CPU has much to do and the chip's temperature is acceptable, performance is temporarily increased with clock speeds of up to 1 GHz, depending on the individual board and on which of the turbo settings is used.

#### **4.2 DC MOTOR:**

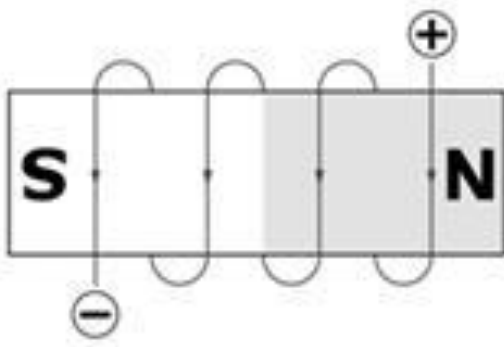
A **DC motor** is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

DC motors were the first type widely used, since they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable

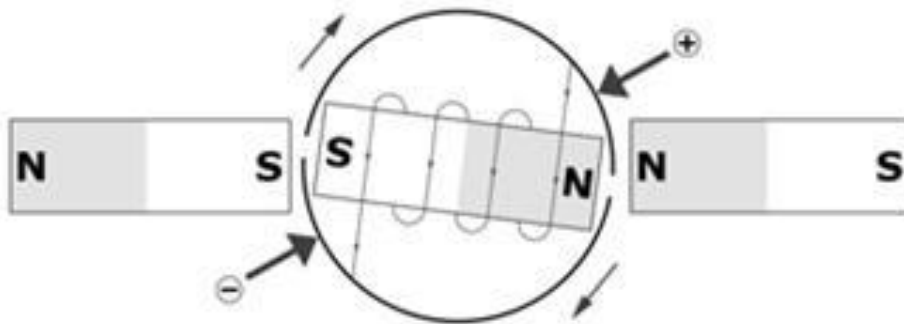
power tools and appliances. Larger DC motors are used in propulsion of electric vehicles, elevator and hoists, or in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

WORKING:

The DC motor is a machine that transforms electric energy into mechanical energy in form of rotation. Its movement is produced by the physical behavior of electromagnetism. DC motors have inductors inside, which produce the magnetic field used to generate movement. But how does this magnetic field changes if DC current is being used

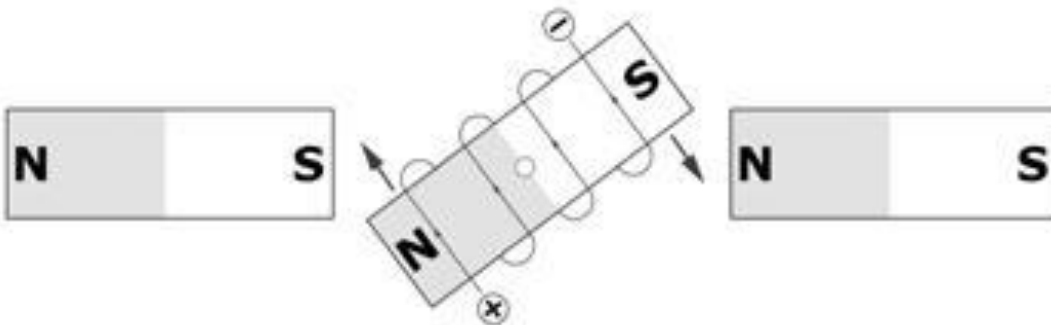


An electromagnet, which is a piece of iron wrapped with a wire coil that has voltage applied in its terminals. If two fixed magnets are added in both sides of this electromagnet, the repulsive and attractive forces will produce a torque.

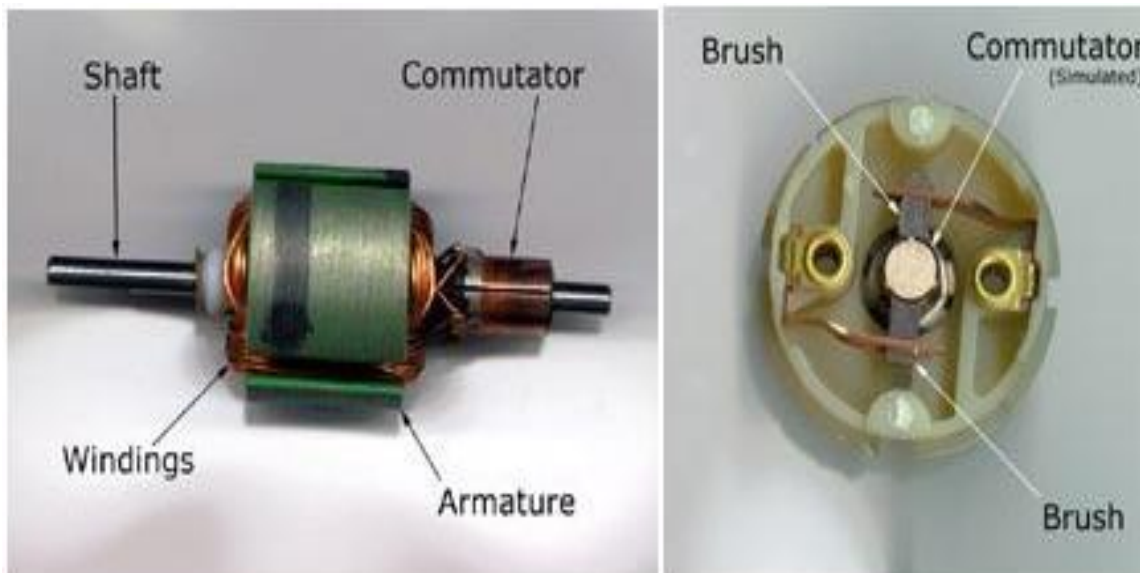


Then, there are two problems to solve: feeding the current to the rotating electromagnet without the wires getting twisted, and changing the direction of

the current at the appropriate time. Both of these problems are solved using two devices: a split-ring commutator, and a pair of brushes.



As it can be seen, the commutator has two segments which are connected to each terminal of the electromagnet, besides the two arrows are the brushes which apply electric current to the rotary electromagnet. In real DC motors it can be found three slots instead of two and two brushes.



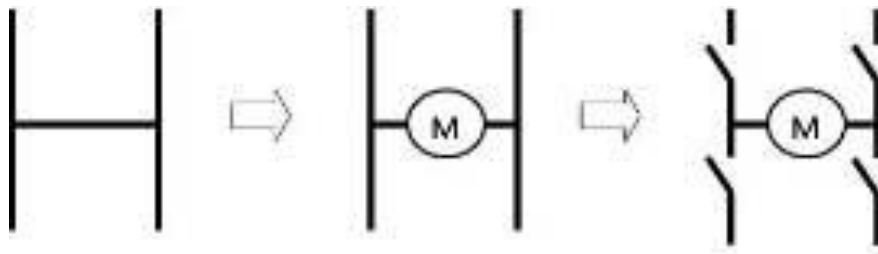
This way, as the electromagnet is moving its polarity is changing and the shaft may keep rotating. Even if it is simple and sounds that it will work great there are some issues which make these motors energy inefficient and mechanically unstable, the principal problem is due to the timing between each polarity inversion.

Since polarity in the electromagnet is changed mechanically, at some velocities polarity is changing too soon, which result in reverse impulses and sometimes in changing too late, generating instantaneous “stops” in rotation. Whatever the case, these issues produce current peaks and mechanical instability.

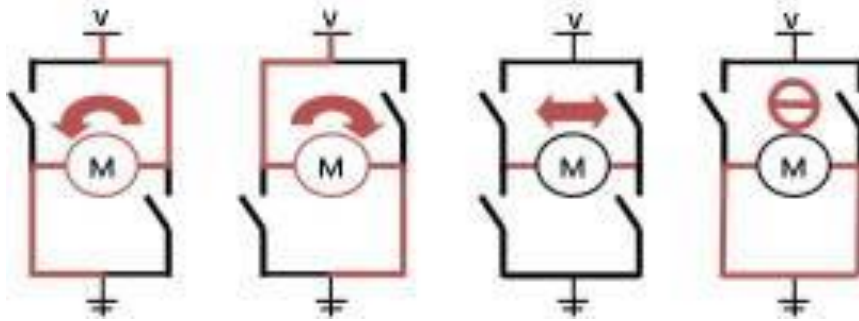
### CONTROL OF DC MOTOR:

DC motors have only two terminals. If you apply a voltage to these terminals the motor will run, if you invert the terminals position the motor will change its direction. If the motor is running and you suddenly disconnect both terminals the motor will keep rotating but slowing down until stopping. Finally if the motor is running and you suddenly short-circuit both terminals the motor will stop.

So there is not a third wire to control a DC motor, but knowing the previous behaviors it can be designed a way to control it, and the solution is an H-bridge.



Look at the last evolution of the DC Motor above, you can observe that there are four gates and a motor connected between them. This is the simplest H-bridge, where the four gates represent for transistors. By manipulating these gates and connecting the upper and lower terminals to a voltage supply, you can control the motor in all the behaviors as below.



### **Main 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.

## **4.3 SOUND SENSOR:**

The sound sensor is one type of module used to notice the sound. Generally, this module is used to detect the intensity of sound. The applications of this module mainly include switch, security, as well as monitoring. The accuracy of this sensor can be changed for the ease of usage.

This sensor employs a microphone to provide input to buffer, peak detector and an amplifier. This sensor notices a sound & processes an o/p voltage signal to a microcontroller. After that, it executes required processing.

This sensor is capable to determine noise levels within DB's or decibels at 3 kHz 6 kHz frequencies approximately wherever the human ear is sensitive. In smartphones, there is an android application namely decibel meter used to measure the sound level.

### **Working Principle:**

The working principle of this sensor is related to human ears. Because human eye includes a diaphragm and the main function of this diaphragm is, it uses the vibrations and changes into signals. Whereas in this sensor, it uses a microphone and the main function of this is, it uses the vibrations and changes into current otherwise voltage.

Generally, it includes a diaphragm which is designed with magnets that are twisted with metal wire. When sound signals hit the diaphragm, then magnets within the sensor vibrates & simultaneously current can be stimulated from the coils.

### **Features:**

The features of the sound sensor include the following

- These sensors are very simple to use
- It gives analog o/p signal
- Simply incorporates using logic modules on the input area

### **Specifications**

The specifications of the sound sensor include the following

- The range of operating voltage is  $3\frac{3}{5}$  V

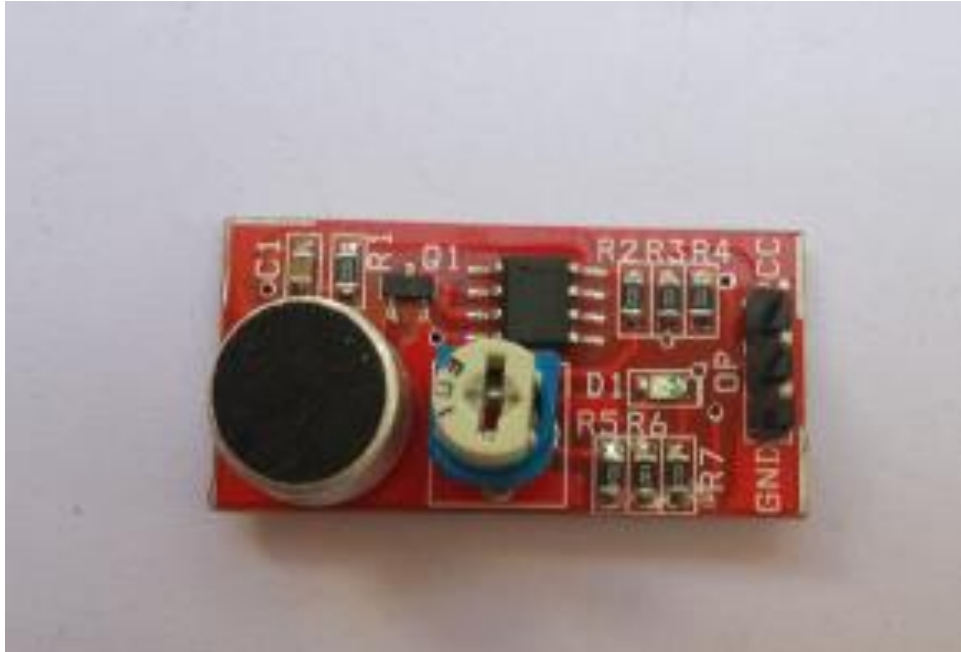
- The operating current is 4~5 mA
- The voltage gain 26 dB ( $V=6V$ ,  $f=1kHz$ )
- The sensitivity of the microphone (1kHz) is 52 to 48 dB
- The impedance of the microphone is 2.2k Ohm
- The frequency of m microphone is 16 to 20 kHz
- The signal to noise ratio is 54 dB

### **Applications:**

The applications of the sound sensor include the following.

This sensor can be used to build various electronic projects with the help of an Arduino board. For instance, this project uses a grove sensor, which fundamentally gives your Arduino's ears. In this project, a microphone can be attached to an analog pin of the board. This can be used to notice the noise level within the nearby surroundings.

The grove sensors support platforms like Arduino, Raspberry Pi, BeagleBone Wio, and LinkIt ONE. This sensor plays an essential role while activating the light in your office or house by detecting a precise whistle or clap sound.



#### **4.4 L293D MOTOR DRIVER:**

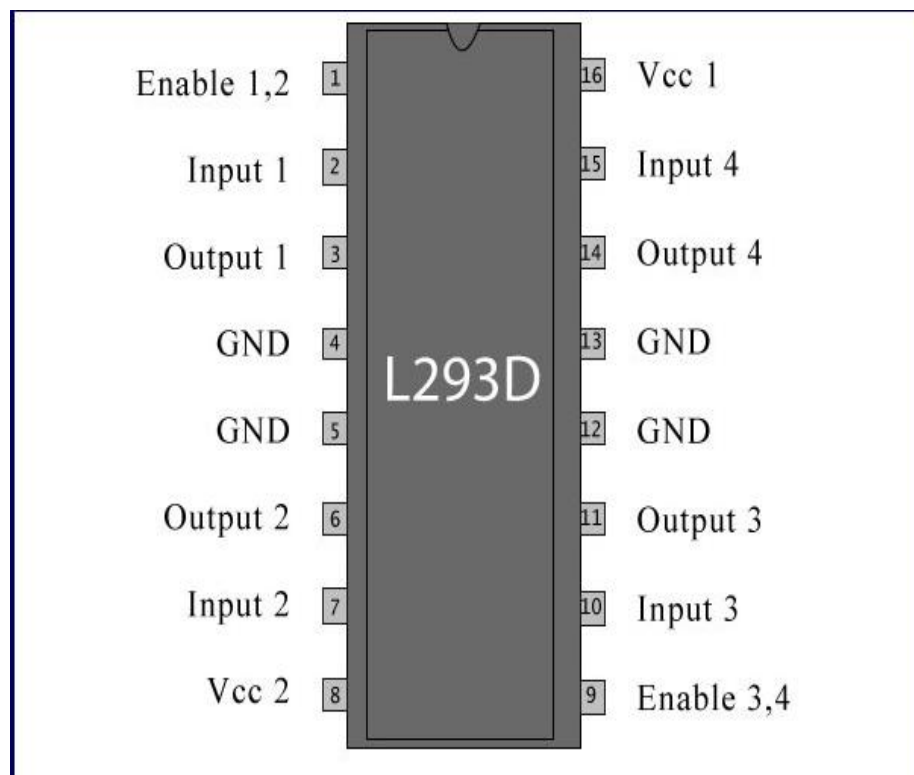
L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver

gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

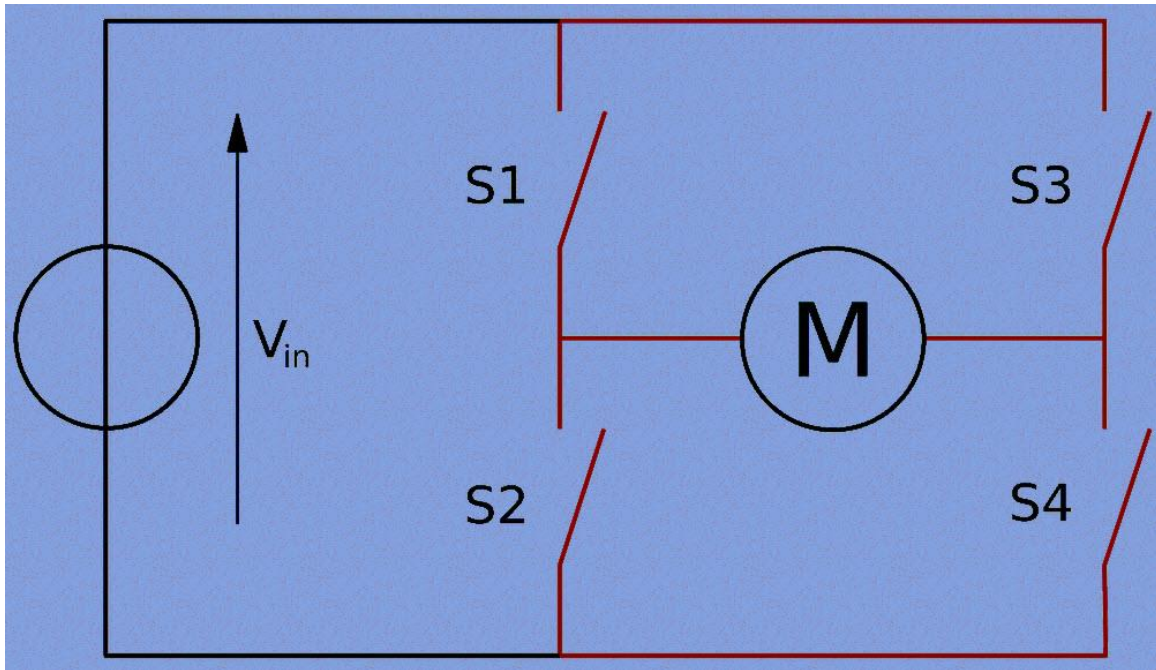
**PIN DIAGRAM:**



Common DC gear head motors need current above 250mA. There are many integrated circuits like ATmega16 Microcontroller, 555 timer IC. But, IC 74 series cannot supply this amount of current. When the motor is directly connected to the o/p of the above ICs then, they might damage. To overcome this problem, a motor control circuit is required, which can act as a bridge between the above motors and ICs (integrated circuits). There are various ways of making H-bridge motor control circuit such as using transistor, relays and using L293D/L298.

### **H-Bridge Circuit:**

A H bridge is an electronic circuit that allows a voltage to be applied across a load in any direction. H-bridge circuits are frequently used in robotics and many other applications to allow DC motors to run forward & backward. These motor control circuits are mostly used in different converters like DC-DC, DC-AC, AC-AC converters and many other types of power electronic converters. In specific, a bipolar stepper motor is always driven by a motor controller having two H-bridges



A H-bridge is fabricated with four switches like S1, S2, S3 and S4. When the S1 and S4 switches are closed, then a +ve voltage will be applied across the motor. By opening the switches S1 and S4 and closing the switches S2 and S3, this voltage is inverted, allowing invert operation of the motor.

Generally, the H-bridge motor driver circuit is used to reverse the direction of the motor and also to break the motor. When the motor comes to a sudden stop, as the terminals of the motor are shorted. Or let the motor run free to a stop, when the motor is detached from the circuit. The table below gives the different operations with the four switches corresponding to the above circuit.

### **L293D MOTOR DRIVER:**



### **L293D Motor Driver ic:**

L293D IC is a typical Motor Driver IC which allows the DC motor to drive on any direction. This IC consists of 16-pins which are used to control a set of two DC motors instantaneously in any direction. It means, by using a L293D IC we can control two DC motors. As well, this IC can drive small and quiet big motors.

This L293D IC works on the basic principle of H-bridge, this motor control circuit allows the voltage to be flowing in any direction. As we know that the voltage must be change the direction of being able to rotate the DC motor in both the directions. Hence, H-bridge circuit using L293D ICs are perfect for driving a motor. Single L293D IC consists of two H-bridge circuits inside which can rotate two DC motors separately. Generally, these circuits are used in robotics due to its size for controlling DC motors.

#### **4.5 PI CAMERA:**

The Raspberry Pi Camera Module is a 5MP CMOS camera with a fixed focus lens that is capable of capturing still images as well as high definition video. Stills are captured at a resolution of 2592 x 1944, while video is supported at 1080p at 30 FPS, 720p at 60 FPS and 640x480 at 60 or 90 FPS. The camera is supported in the latest version of Raspbian, Raspberry Pi's preferred operating system.

#### **FEATURES:**

- 1.4  $\mu\text{m}$  X 1.4  $\mu\text{m}$  pixel with OmniBSI technology for high performance (high sensitivity, low crosstalk, low noise)
- Optical size of 1/4"
- Automatic image control functions:
- Automatic exposure control (AEC)
- Automatic white balance (AWB)
- Automatic band filter (ABF)
- Automatic 50/60 Hz luminance detection
- Automatic black level calibration (ABLC)
- Programmable controls for frame rate , AEC/AGC 16-zone size/position/weight control, mirror and flip, cropping, windowing, and panning
- Digital video port (DVP) parallel output interface
- 32 bytes of embedded one-time programmable (OTP) memory



#### **4.6 METAL SENSOR:**

A **Metal Sensor** is an electronic instrument which detects the presence of metal nearby. Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. They often consist of a handheld unit with a sensor probe which can be swept over the ground or other objects. If the sensor comes near a piece of metal this is indicated by a changing tone in earphones, or a needle moving on an indicator. Usually the device gives some indication of distance; the closer the metal is, the higher the tone in the earphone or the higher the needle goes. Another common type are stationary "walk through" metal detectors used for security screening at access points in prisons, courthouses, and airports to detect concealed metal weapons on a person's body. The simplest form of a metal detector consists of an oscillator producing an alternating current that passes through a coil producing an alternating magnetic field. If a piece of electrically conductive

metal is close to the coil, eddy currents will be induced in the metal, and this produces a magnetic field of its own. If another coil is used to measure the magnetic field (acting as a magnetometer), the change in the magnetic field due to the metallic object can be detected. The first industrial metal detectors were developed in the 1960s and were used extensively for mineral prospecting and other industrial applications. Uses include de-mining (the detection of land mines), the detection of weapons such as knives and guns (especially in airport security), geophysical prospecting, archaeology and treasure hunting. Metal detectors are also used to detect foreign bodies in food, and in the construction industry to detect steel reinforcing bars in concrete and pipes and wires buried in walls and floors.

### **FEATURES:**

- Coil technology
- Coil size
- Target identification
- Tone id
- Low battery indicator
- Multiple modes

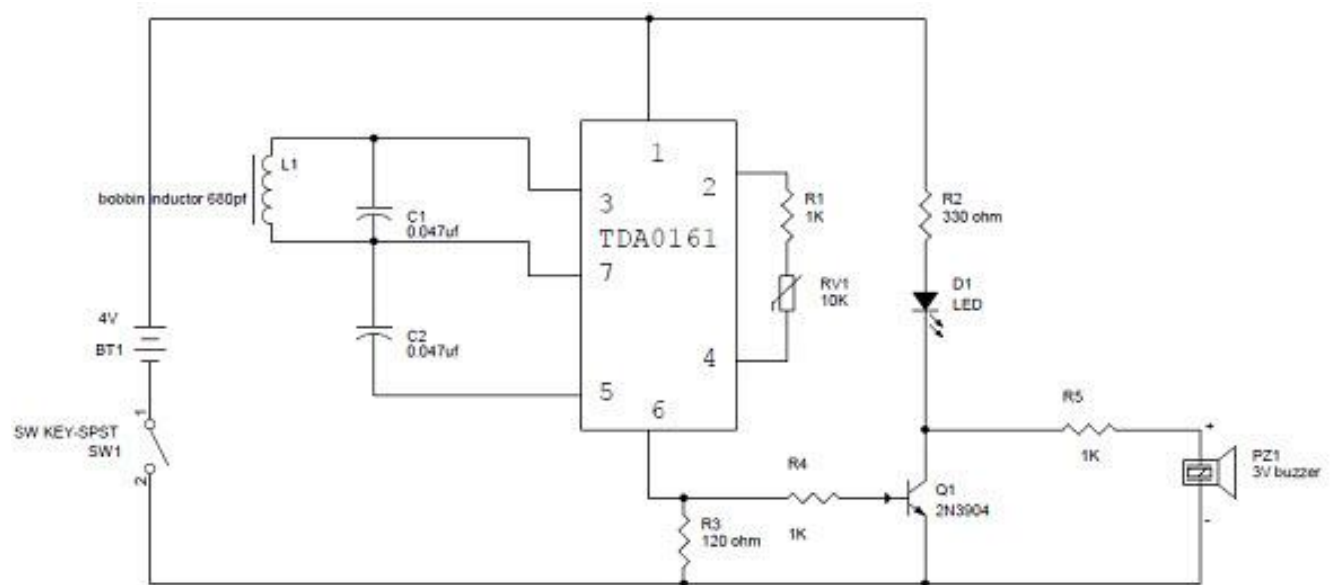
### **APPLICATIONS:**

- Widely used in machinery
- Chemicals
- Paper
- Light industry for spacing

- Positioning
- Detection
- Counting
- Guns
- Other sensing application

### **Simple Metal Detector Circuit:**

The main components a simple metal detector circuit are LC circuit, proximity sensor and the buzzer. The LC circuit is nothing but inductor and capacitor, which are connected in parallel. This circuit activates the proximity sensor when it senses any metal close to it. This sensor glow the LED and makes a buzzer.



### **Metal Detector Circuit:**

When the LC circuit has any resonating frequency from any metal which is close to it, the electric field will be created, that will lead to induce current in the coil and change the signal in the flow of the signal through the coil.

A Variable resistor is used to change the value of the sensor, which is equal to the LC circuit. When the metal is detected, the circuit will have changed signal. This changed signal will be given to the proximity detector, which will detect the change in the signal and react accordingly. When the metal is detected by the coil, the o/p of the sensor will be of 1mA. When the coil is near to the metal, then the o/p of the sensor will be around 10mA.

When the o/p pin is high, the R3 resistor will provide positive voltage to transistor the Q1 to turn ON the LED, which will glow and generate a buzzing sound. Here, R2 resistor is used to limit the current flow.

This is the circuit diagram of a low cost metal detector using a single transistor circuit and an old pocket radio. This is nothing but a Colpitts oscillator working in the medium band frequency and a radio tuned to the same frequency. First, the radio and the circuit are placed close. Then the radio is tuned so that there is no sound from the radio. In this condition, the radio and the circuit will be in the same frequency and the same frequencies beat off to produce no sound. This is the set up. When the metal detector circuit is placed near to a metal object the inductance of its coil changes, and so do the frequency of oscillations. Now the two frequency will be different, there will be no cancelling and the radio produces a hissing sound. This means a metal object is detected.

### **Applications:**

The applications of metal detectors are many. You can see them in airports and anywhere that needs a security check for entry. Other than that;

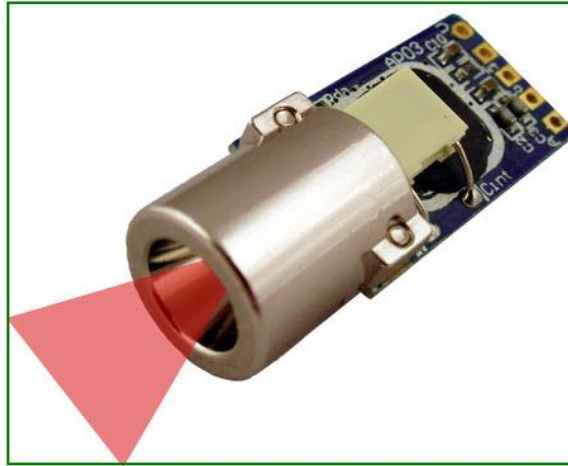
- You can use this as a cool mini project for engineering, or at least for showoff
- To detect metal objects in conveyor belts. In food processing industries it is important that no metals are accidentally included so having a metal detector near the conveyor belts which carry the items for packing will do the job.

### **4.7 IR SENSOR:**

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations.

These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.

### **IR SENSOR:**

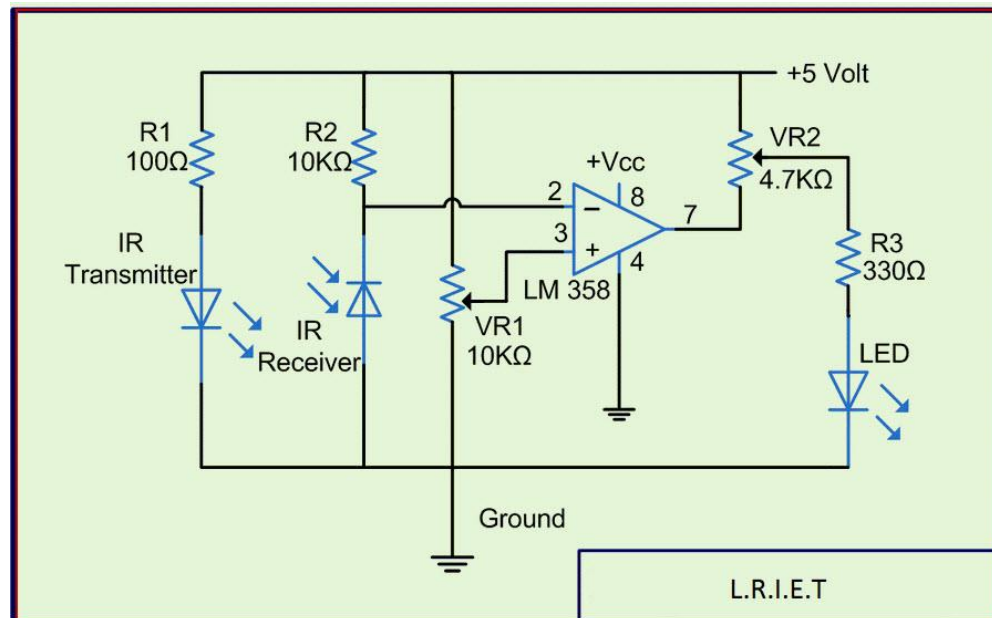


### **IR Sensor Circuit Diagram and Working Principle:**

An infrared sensor circuit is one of the basic and popular sensor module in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real time. This circuit comprises of the following components

- LM358 IC 2 IR transmitter and receiver pair
- Resistors of the range of kilo ohms.
- Variable resistors.
- LED (Light Emitting Diode).

### **CIRCUIT DIAGRAM:**



In this project, the transmitter section includes an IR sensor, which transmits continuous IR rays to be received by an IR receiver module. An IR output terminal of the receiver varies depending upon its receiving of IR rays. Since this variation cannot be analyzed as such, therefore this output can be fed to a comparator circuit. Here an operational amplifier (op-amp) of LM 339 is used as comparator circuit.

When the IR receiver does not receive a signal, the potential at the inverting input goes higher than that non-inverting input of the comparator IC (LM339). Thus, the output of the comparator goes low, but the LED does not glow. When the IR receiver module receives signal to the potential at the inverting input goes low. Thus, the output of the comparator (LM 339) goes high and the LED starts glowing. Resistor R1 (100), R2 (10k) and R3 (330) are used to

ensure that minimum 10 mA current passes through the IR LED Devices like Photodiode and normal LEDs respectively. Resistor VR2 (preset=5k) is used to adjust the output terminals. Resistor VR1 (preset=10k) is used to set the sensitivity of the circuit Diagram. Read more about IR sensors.

### Different Types of IR Sensors and Their Applications

IR sensors are classified into different types depending on the applications. Some of the typical applications of different types of sensors are

The speed sensor is used for synchronizing the speed of multiple motors. The temperature sensor is used for industrial temperature control. PIR sensor is used for automatic door opening system and Ultrasonic sensor are used for distance measurement.

### IR Sensor Applications

IR sensors are used in various Sensor based projects and also in various electronic devices which measures the temperature that are discussed in the below.

### Radiation Thermometers

IR sensors are used in radiation thermometers to measure the temperature depend upon the temperature and the material of the object and these thermometers have some of the following features

- Measurement without direct contact with the object
- Faster response
- Easy pattern measurements

### Flame Monitors:

These types of devices are used for detecting the light emitted from the flames and to monitor how the flames are burning. The Light emitted from flames extend from UV to IR region types. PbS, PbSe, Two-color detector, pyro electric detector are some of the commonly employed detector used in flame monitors.

### Moisture Analyzers:

Moisture analyzers use wavelengths which are absorbed by the moisture in the IR region. Objects are irradiated with light having these wavelengths (1.1  $\mu\text{m}$ , 1.4  $\mu\text{m}$ , 1.9  $\mu\text{m}$ , and 2.7 $\mu\text{m}$ ) and also with reference wavelengths. The Lights reflected from the objects depend upon the moisture content and is detected by analyzer to measure moisture (ratio of reflected light at these wavelengths to the reflected light at reference wavelength). In GaAs PIN photodiodes, Pbs photoconductive detectors are employed in moisture analyzer circuits.

### Gas Analyzers:

IR sensors are used in gas analyzers which use absorption characteristics of gases in the IR region. Two types of methods are used to measure the density of gas such as dispersive and non-dispersive.

### GAS ANALIZER:



*Dispersive:* An Emitted light is spectroscopically divided and their absorption characteristics are used to analyze the gas ingredients and the sample quantity.

*Non dispersive:* It is most commonly used method and it uses absorption characteristics without dividing the emitted light. Non dispersive types use discrete optical band pass filters, similar to sunglasses that are used for eye protection to filter out unwanted UV radiation.

This type of configuration is commonly referred to as non-dispersive infrared (NDIR) technology. This type of analyzer is used for carbonated drinks, whereas non dispersive analyzer is used in most of the commercial IR instruments, for an automobile exhaust gas fuel leakage.

### **IR IMAGING DEVICES:**

IR image device is one of the major applications of IR waves, primarily by virtue of its property that is not visible. It is used for thermal imagers, night vision devices, etc.



### **IR IMAGING DEVICES**

For examples Water, rocks, soil, vegetation, an atmosphere, and human tissue all features emit IR radiation. The Thermal infrared detectors measure these radiations in IR range and map the spatial temperature distributions of the object/area on an image. Thermal imagers usually composed of a Sb (indium antimonite), Gd Hg (mercury-doped germanium), Hg Cd Te (mercury-cadmium-telluride) sensors.

An electronic detector is cooled to low temperatures using liquid helium or liquid nitrogen. Then the Cooling the detectors ensures that the radiant energy (photons) recorded by the detectors comes from the terrain and not from the ambient temperature of objects within the scanner itself an IR imaging electronic device.

Thus, this is all about IR sensor circuit with working and applications. These sensors are used in many sensors based electronics projects.

## **SOFTWARE DESCRIPTIONS**

### **4.8 PYTHON:**

Python is an interpreted, high-level, general-purpose programming language. Created by Guido van Rossum and first released in 1991, Python has a design philosophy that emphasizes code readability, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales. Van Rossum led the language community until stepping down as leader in July 2018.

Python features a dynamic type system and automatic memory management. It supports multiple programming paradigms, including object-oriented, imperative, functional and procedural, and has a large and comprehensive standard library.

Python interpreters are available for many operating systems. Python, the reference implementation of Python, is source software and has a community-based development model, as do nearly all of Python's other implementations. Python and Python are managed by the non-profit Python Software Foundation.

#### **Statements and control flow:**

- The `if` statement, which conditionally executes a block of code, along with `else` and `elif` (a contraction of else-if).
- The `for` statement, which iterates over an iterable object, capturing each element to a local variable for use by the attached block.

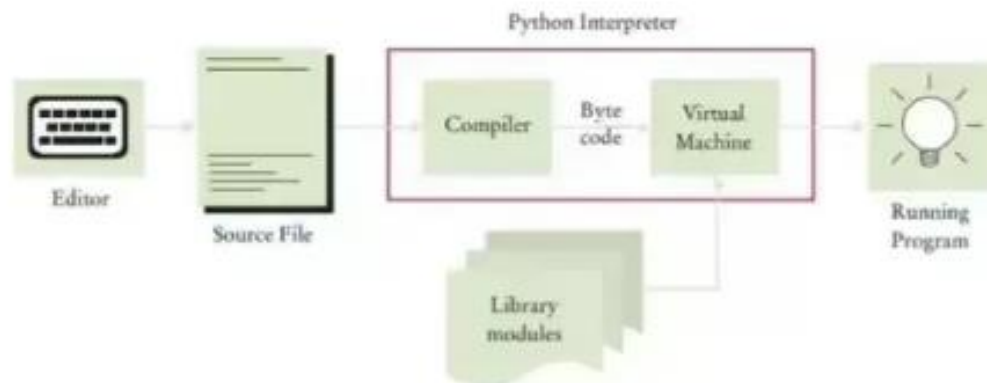
- The `while` statement, which executes a block of code as long as its condition is true.
- The `try` statement, which allows exceptions raised in its attached code block to be caught and handled by `except` clauses; it also ensures that clean-up code in a `finally` block will always be run regardless of how the block exits.
- The `raise` statement used to raise a specified exception or re-raise a caught exception.
- The `class` statement, which executes a block of code and attaches its local namespace to a class, for use in object-oriented programming.
- The `def` statement, which defines a function or method.
- The `with` statement, from Python 2.5 released on September 2006, which encloses a code block within a context manager (for example, acquiring a lock before the block of code is run and releasing the lock afterwards, or opening a file and then closing it), allowing Resource Acquisition Is Initialization (RAII)-like behavior and replaces a common try/finally idiom.

### **Expressions:**

Some Python expressions are similar to languages such as C and Java, while some are not:

- Addition, subtraction, and multiplication are the same, but the behavior of division differs. There are two types of divisions in Python. They are floor division and integer division. Python also added the `**` operator for exponentiation.
- From Python 3.5, the new `@` infix operator was introduced. It is intended to be used by libraries such as NumPy for matrix multiplication.

- In Python, `==` compares by value, versus Java, which compares numeric by value and objects by reference. (Value comparisons in Java on objects can be performed with the `equals()` method.) Python's `is` operator may be used to compare object identities (comparison by reference). In Python, comparisons may be chained, for example `a <= b <= c`.
- Python uses the words `and`, `or`, `not` for its Boolean operators rather than the symbolic `&&`, `||`, `!` used in Java and C.
- Python has a type of expression termed a list comprehension. Python 2.4 extended list comprehensions into a more general expression termed a generator expression.
- Anonymous functions are implemented using lambda expressions; however, these are limited in that the body can only be one expression.
- Conditional expressions in Python are written as `x if c else y` (different in order of operands from the `c ? x : y` operator common to many other languages).



### **CODE:**

```
import RPi.GPIO as GPIO
import time
import picamera

import os.path
import cv2
from subprocess import Popen, PIPE

from picamera import PiCamera
from time import sleep
import smtplib
from email.mime.text import MIMEText
from email.mime.multipart import MIMEMultipart
from email.mime.base import MIMEBase
from email import encoders

motor1=31
motor2=33
motor3=35
motor4=37

GPIO.setwarnings(False)

channel=11

sensor =16

IR=40

GPIO.setmode(GPIO.BOARD)
GPIO.setup(channel, GPIO.IN)
GPIO.setup(sensor,GPIO.IN)
GPIO.setup(IR,GPIO.IN)
GPIO.setup(motor1, GPIO.OUT)
GPIO.setup(motor2, GPIO.OUT)
GPIO.setup(motor3, GPIO.OUT)
GPIO.setup(motor4, GPIO.OUT)

GPIO.output(motor1,True)
GPIO.output(motor2,False)
GPIO.output(motor3,True)
GPIO.output(motor4,False)
```

```

while True:
    c = GPIO.input(IR)
    print (c)
    if c==0:
        print("obstacle detected")
        GPIO.output(motor1,True)
        GPIO.output(motor2,False)
        GPIO.output(motor3,False)
        GPIO.output(motor4,False)
    else:
        GPIO.output(motor1,True)
        GPIO.output(motor2,False)
        GPIO.output(motor3,True)
        GPIO.output(motor4,False)
        a = GPIO.input(sensor)
        print (a)

        b = GPIO.input(channel)
        print (b)
        print ("-----")
        if a==0:
            print("metal detected")
        if b==0:
            print ("Sound Detected!")
            print("robot stop")
            GPIO.output(motor1,False)
            GPIO.output(motor2,False)
            GPIO.output(motor3,False)
            GPIO.output(motor4,False)
            time.sleep(3)
            camera = PiCamera()
            sleep(0.5)
            camera.capture('/home/pi/Desktop/patrolling robot/example.jpg')
            sleep(2)
            camera.stop_preview()
            camera.close()
            time.sleep(0.1)
            print ("mail")
            email_user = 'rpimail446@gmail.com'
            email_send = 'galiakhil2@gmail.com'
            subject = 'RaspberryPi Took images'
            email_password = 'ng7612waz'

            msg = MIMEMultipart()
            msg['From'] = email_user

```

```

msg['To'] = email_send
msg['Subject'] = 'python'

body = 'night patrolling robot! detects human activity'
msg.attach(MIMEText(body,'plain'))

filename='/home/pi/Desktop/back up files/patrolling robot/example.jpg'
attachment=open(filename,'rb')

part = MIMEBase('application','octet-stream')
part.set_payload((attachment).read())
encoders.encode_base64(part)
part.add_header('Content-Disposition',"attachment; filename= "+filename)

msg.attach(part)
text = msg.as_string()
server = smtplib.SMTP('smtp.gmail.com',587)
server.starttls()
server.login(email_user,email_password)

server.sendmail(email_user,email_send,text)
server.quit()
time.sleep(0.1)
print("mail sent")

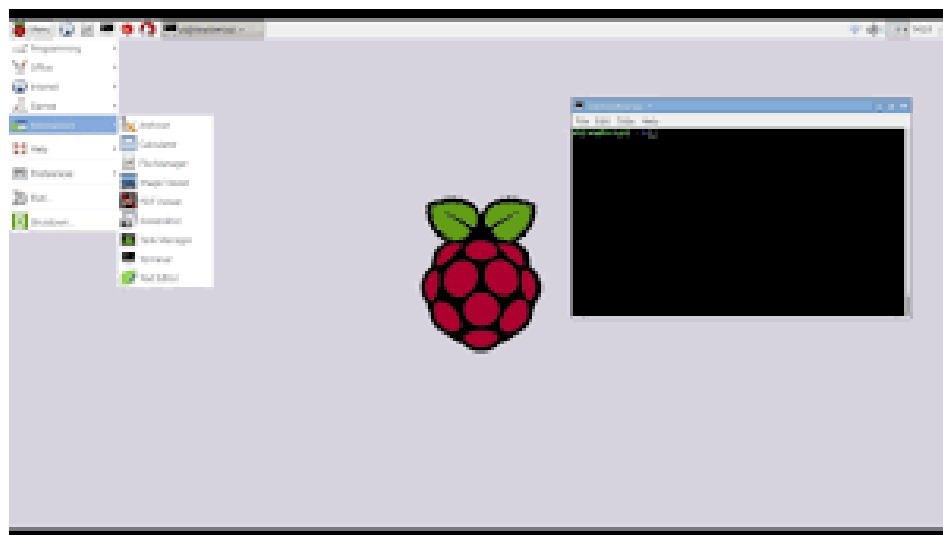
GPIO.output(motor1,True)
GPIO.output(motor2,False)
GPIO.output(motor3,True)
GPIO.output(motor4,False)
else:
    print("hi")
sleep(1)
print("Working")

```

#### 4.9 RASPBIAN OS:

**Raspberry Pi OS** (formerly **Raspbian**) is a Debian-based operating system for Raspberry Pi. Since 2015, it has been officially provided by the Raspberry Pi Foundation as the primary operating system for the Raspberry Pi family of compact single-board computers. The first version of Raspbian was created by Mike Thompson and Peter Green as an independent project. The initial build was completed in June 2012.

Previous, Raspberry Pi OS versions were 32-bit only and based on Debian, taking the name Raspbian. Since the more recent 64-bit versions no longer use Debian, the name was changed to Raspberry Pi OS for both the 64-bit and 32-bit versions. As of 1 February 2021, the 64-bit version is in beta and is not suitable for general use.



Raspberry Pi OS is highly optimized for the Raspberry Pi line of compact single-board computers with ARM CPUs. It runs on every Raspberry Pi except the Pico microcontroller. Raspberry Pi OS uses a modified LXDE as its desktop environment with the OpenBox stacking window manager, along with a unique theme. The distribution is shipped with a copy of the algebra

program Wolfram Mathematica<sup>[4]</sup> and a version of Minecraft called Minecraft: Pi Edition, as well as a lightweight version of the Chromium web browser.

## **FEATURES:**

### User Interface

Raspberry Pi OS looks similar to many common desktops, such as macOS and Microsoft Windows. The menu bar is positioned at the top and contains an application menu and shortcuts to Terminal, Chromium, and File Manager. On the right is a Bluetooth menu, a Wi-Fi menu, volume control, and a digital clock

### Package Management

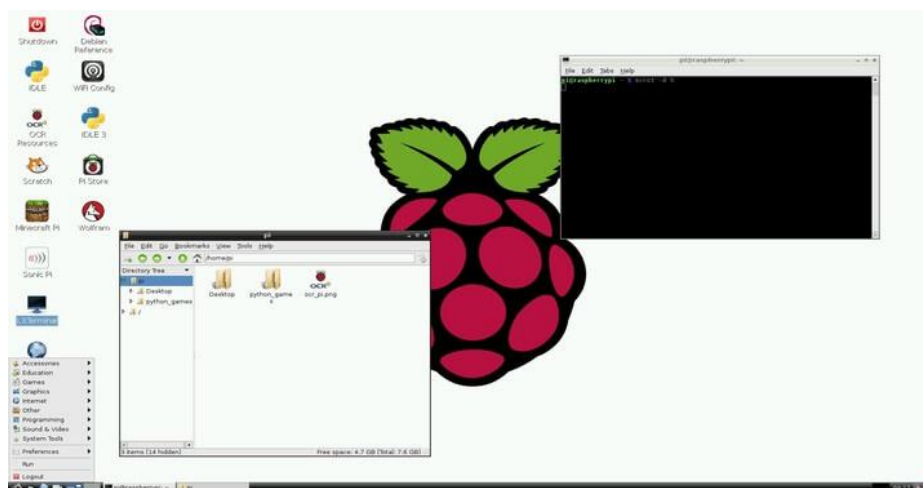
Packages can be installed via APT, the Recommended Software app, and by using the Add/Remove Software tool, a GUI wrapper for APT

### Microsoft Repository Controversy

In late January 2021, Raspberry Pi OS' raspberry pi-sys-mods package added a trusted GPG key and sources List. entry to APT without user consent. This addition granted Microsoft the ability to install and run any software during the daily critical update process on all Pi that had done a manual apt upgrade to receive the change. The change was not pushed as a critical update and, as of yet, the excessive permission has not been abused by Microsoft and would seem unlikely to ever be abused. The author of the change acknowledged on GitHub that too many rights were granted to Microsoft and also acknowledged delaying the public release of the source code for the change.

In addition to the permissions, the change also causes Pi running an updated Raspberry Pi OS to contact packages.microsoft.com daily and thereby reveal

their IP address as a Raspberry Pi OS user for potential use in tracking or marketing efforts. On 8 February 2021, the original author made another change that restricted Microsoft's ability to install software to packages beginning with the string "code" but Microsoft can still run code as root so this restriction is trivial to bypass. As of 8 February 2021, the issue is not resolved and the Raspberry Pi Foundation has locked or deleted many of the related threads on their public forum and their GitHub pages but has acknowledged there is a problem to be resolved and that they are working on it.



### **Components:**

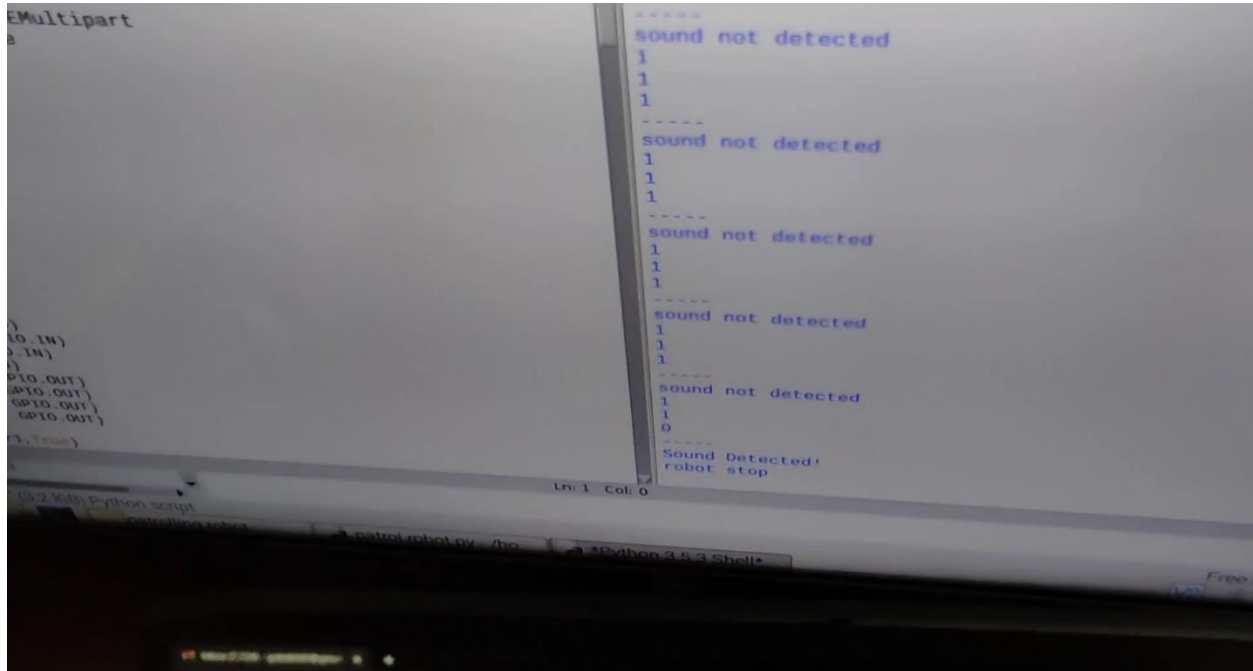
PCManFM is a file browser allowing quick access to all areas of the computer and was redesigned in the first Raspberry Pi OS Buster release (2019-06-20).

Raspberry Pi OS originally used Epiphany as the web browser, but switched to Chromium with the launch of its redesigned desktop.<sup>[13]</sup>

Raspberry Pi OS comes with many beginner IDEs, such as Thonny Python IDE, Mu Editor, and Greenfoot. It also ships with educational software like Scratch and Bookshelf.

## CHAPTER-5

### RESULTS AND PERFORMANCE



```
EMultipart
8
)
IO.IN)
) IN)
)
P10.OUT)
GP10.OUT)
GP10.OUT)
GP10.OUT)
r1.1run)

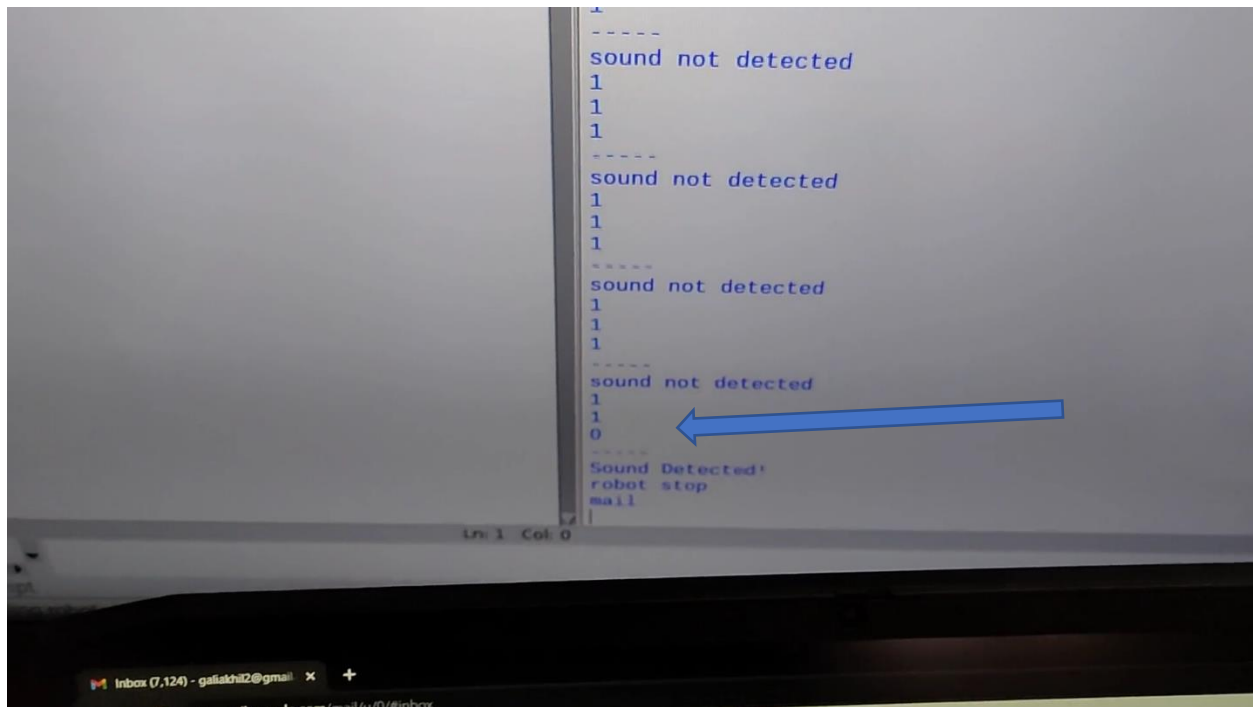
-----
sound not detected
1
1
1
-----
sound not detected
1
1
1
-----
sound not detected
1
1
1
-----
sound not detected
1
1
0
-----
Sound Detected!
robot stop

Ln: 1 Col: 0
```

When we run the code the system starts to detect the parameters through the sensors, the above figure shows the python shell in which we know the robot is moving and taking values and sending to the raspberry pi.

The shell shows that the sound is not detected, the other values(1,1,1) are given by the sensors that there is no input from the sensors and robot can proceed. If there is an input then it shows 0.

The system stops when it detects sound and takes the picture of the intruder and sends to the registered email-id. This whole process is done in the background. Raspberry pi computes the data given and processes it.



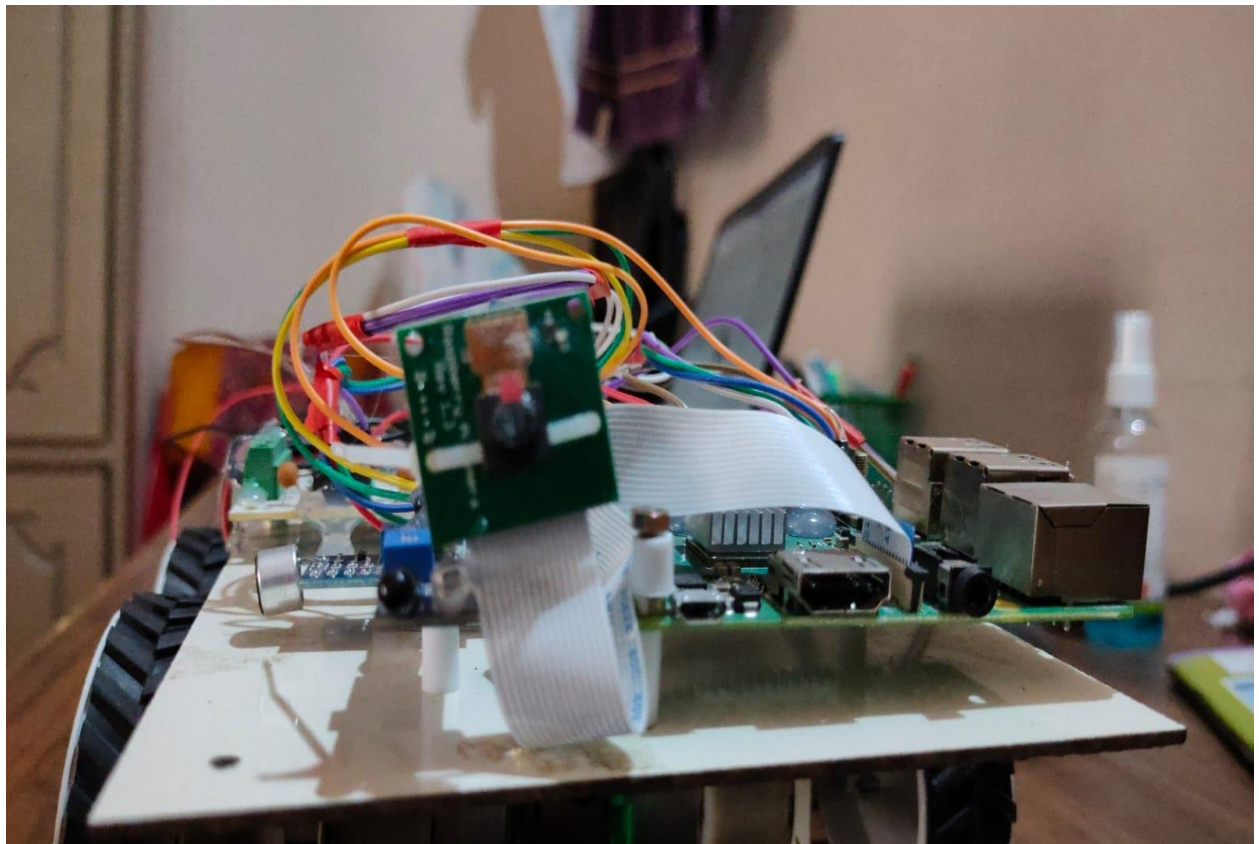
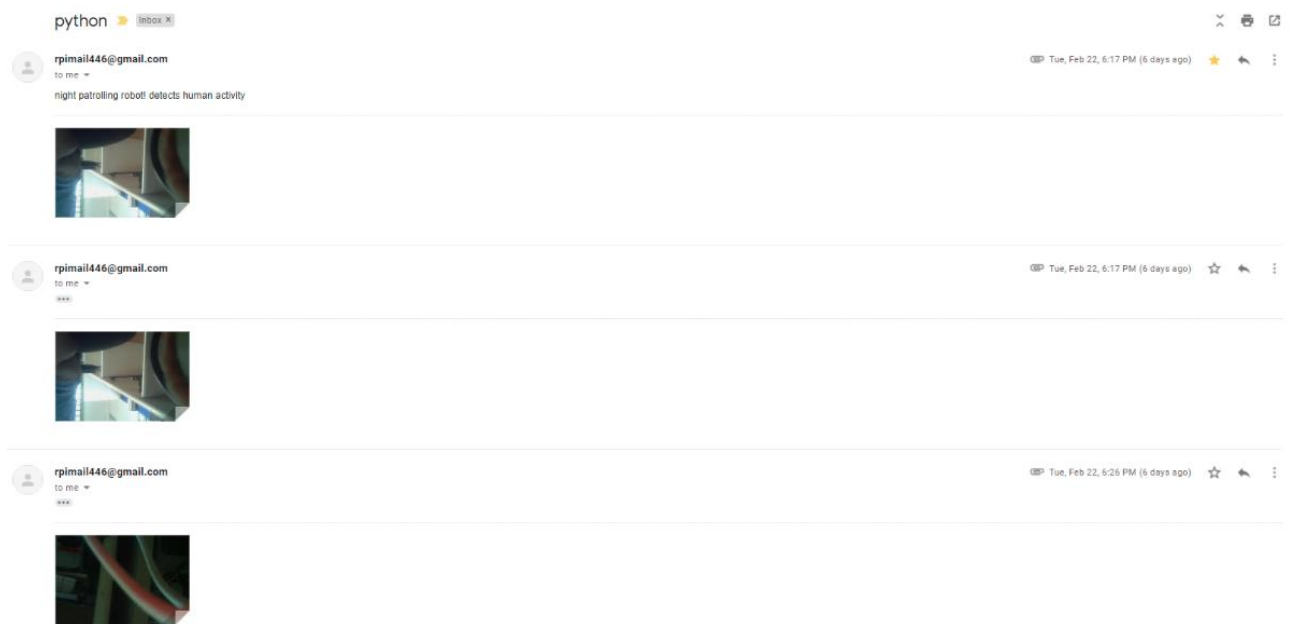
```
-----  
sound not detected  
1  
1  
1  
-----  
sound not detected  
1  
1  
1  
-----  
sound not detected  
1  
1  
1  
-----  
sound not detected  
1  
1  
0  
-----  
Sound Detected!  
robot stop  
mail
```

Ln: 1 Col: 0

In the above figure we can see that the robot detects sound so '1' changed to '0' which is given by the sound sensor. When the sound is detected the robot stops and takes picture and send to the email-id.

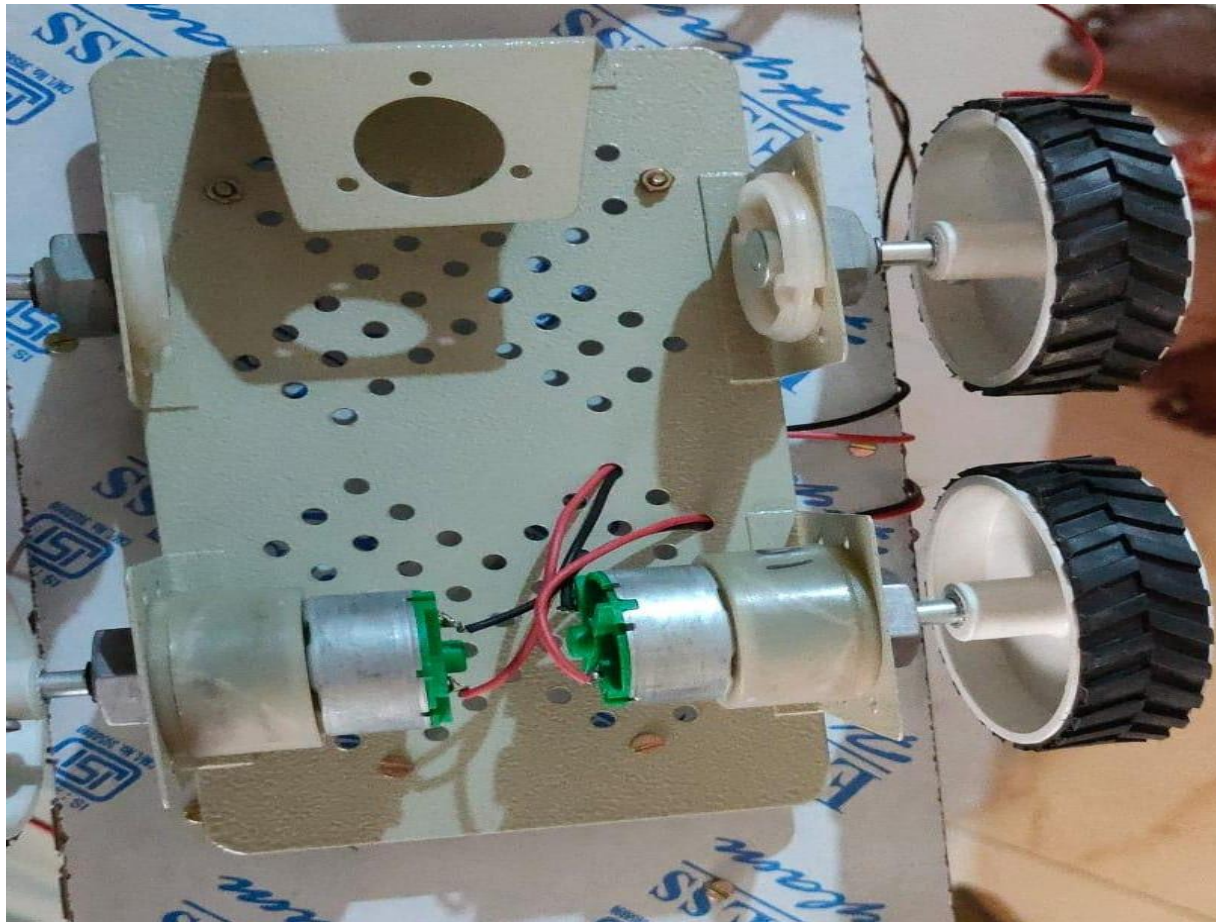
If there is an obstacle detected it automatically changes direction, the system only responds when there is sound. The information is send to the registered email-id. The figure below is the screenshot of the registered email. In which we can see the pictures of the intruders.

The robot starts again after sending the email to the user. In this way the patrolling is done.



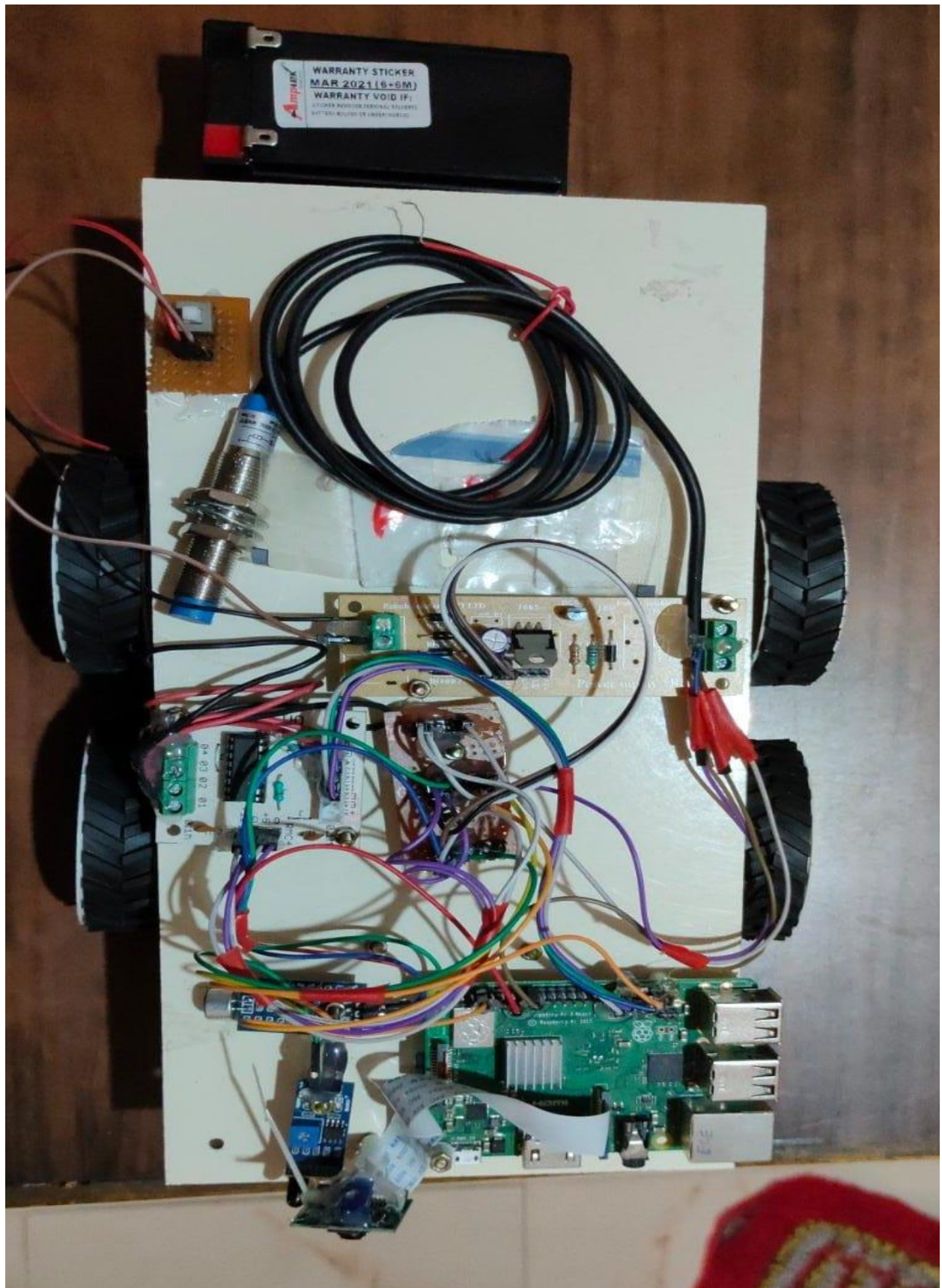


In above figure we can see metal sensor and below we can see DC motors connect the L293D driver and connected to the integrated bread board.



In the below figure we can see the full robot connect to the battery with a switch and connections are connected through bread board with resistors and diodes to control current.

This project is done in rasbian os and the code is written python, the operations and starting of the robot is monitored through a HDMI cable connected to the external monitor from raspberry pi 3 B+ model.



## **CHAPTER 6**

### **SUMMARY**

In this project we have constructed a patrolling robot using raspberry pi and sensors like IR sensor, sound sensor and metal sensor. For the movement of the device we have used dc motors and drivers, a pi-cam is used to take pictures of the intruders and send them to the registered email-id. And this whole process is done autonomously.

### **CONCLUSION**

The benefit of having such a system in every home is that it gives the user peace of mind concerning his belongings even while he is not at home. Because of its minimal power consumption, this system may be easily installed in any type of home. It may also be used for a long time if the right battery is used. It will allow the system to function for several weeks at a time. Even if you currently have a security camera, this system may be added to it to give additional security. Users will be able to keep an eye on their loved ones at home when they are away from home working. When elderly adults and children are alone at home, it ensures their safety.

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