

GAS AND FIRE DETECTION BY AN UNMANNED ROBOT USING IOT

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering degree in Mechatronics Engineering

by

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**DEPARTMENT OF MECHATRONICS ENGINEERING
SCHOOL OF MECHANICAL ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

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BONAFIDECERTIFICATE

This is to certify that this Project Report is the bonafide work of B.John, U.Sam Thomas who carried out the project entitled "GAS AND FIRE DETECTION BY AN UNMANNED ROBOT USING IOT" under my supervision from 01.11.2021 to 10.05.2022.

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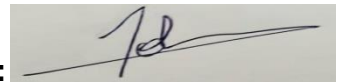
We John B(38090009) and Sam Thomas U (38090901) hereby declare that the Project Report entitled "GAS AND FIRE DETECTION BY AN UNMANNED ROBOT USING IOT" done by us under the guidance of Dr. Kanimozhi, M.E., Ph.D., is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Mechatronics Engineering.

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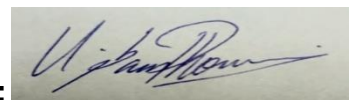
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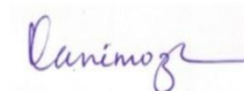
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ABSTRACT

This paper presents a robotic device that can identify and resist fire in homes and workplaces. Its non-human design makes it unrestrained to advance through the territory containing the fire even if we cannot access it. The device is equipped with sensors that can detect infrared and gas levels. The robot is constrained by an IOT worker utilizing PCs or cell phones. It can also send and receive text messages. It can also take a picture or record a video of the emergency situation.

Keywords: -Obstacle avoidance, Fire detection, L293D driver, Internet of Things (IoT)

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Budget Report

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LIST OF ABBREVIATIONS:

IOT	Internet of things
GSM	Global System for Mobile communication
LM35	Temperature sensor
GQ6	Gas Sensor
USB	Universal Serial Bus
CNN	Convolutional Neural Network
ANN	Artificial Neural Network
L293D	Motor Driver
CPU	Central Processing Unit

CHAPTER 1

INTRODUCTION

Accidents involving fires are rare. However, when they occur, they result in massive devastation and, in some cases, death. A person's negligence manifests as a fire, resulting in disaster.

So, in order to control these scenarios, we devised an IoT and deep learning-based robot based on the Raspberry Pi. The fire images are downloaded to the Raspberry Pi, processed with the CNN algorithm, and then uploaded to the cloud.

To determine the temperature and gas created by fire, an MCP3008 analogue to digital converter is required. Our system also includes a robotic setup that is simple to operate and aids in the detection of fires without the need to enter the area.

1.1. PROPOSED SYSTEM:

We have used deep learning and IoT in fire detection with a robot setup in our suggested system, which makes it easier to detect fire, gas, and intruders. It also alerts us by sending a photo of the impacted person to our phone, along with an alert message. Because the robot is portable, it can move from one end of our house to the other, covering all of the rooms. The shortcoming of the prior system is that it detects fire in a static manner, but our method detects fire dynamically. Furthermore, their systems are highly expensive, but ours is the cheapest and most effective surveillance bot available.

1.2. BLOCK DIAGRAM:

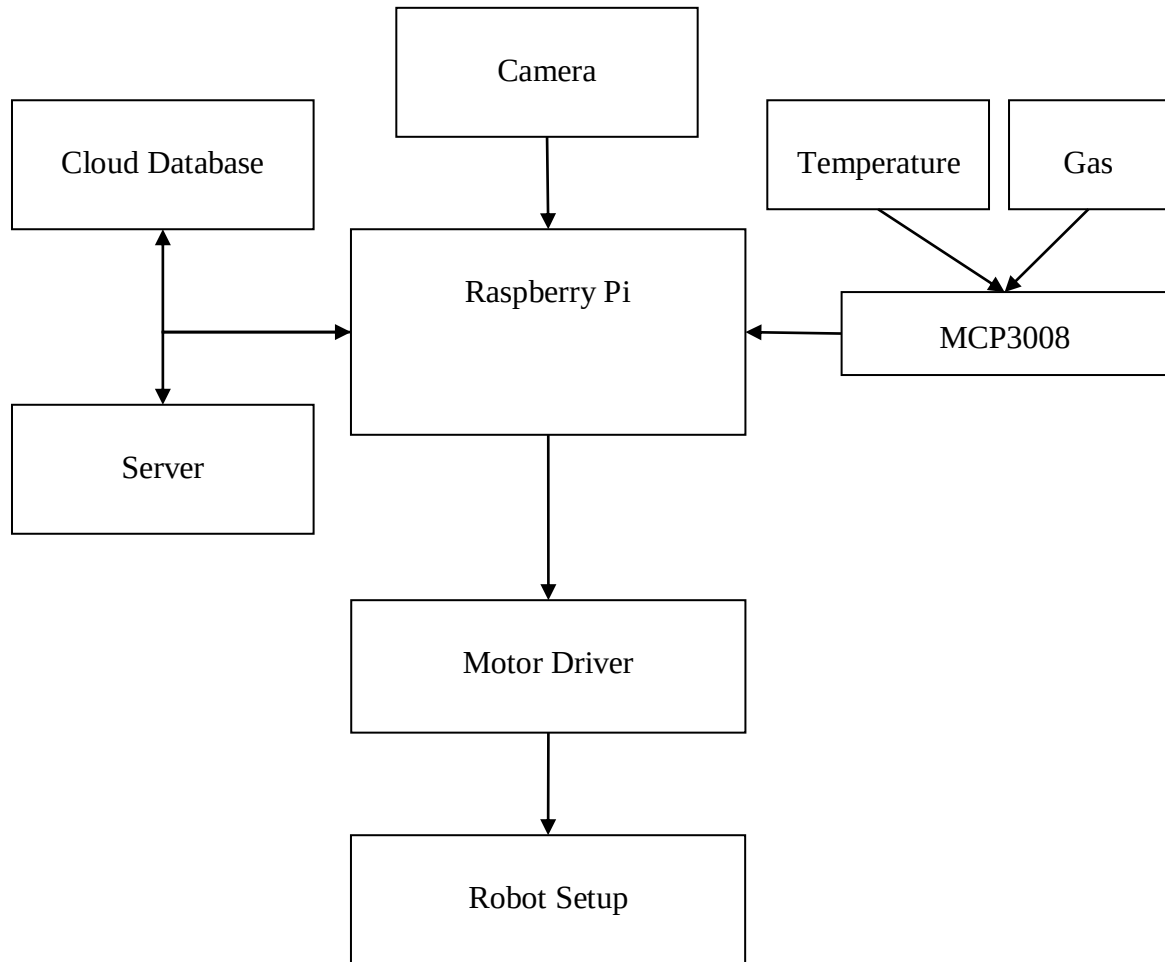


Figure 1.1: Block Diagram

1.3. HARDWARE REQUIREMENTS:

- Raspberry pi
- Camera
- Motor Driver
- Robot Setup
- MCP3005
- LM35
- Gas Sensor

- Power Bank
- Wheels

1.4. SOFTWARE REQUIREMENTS:

- Python
- LINUX OS

CHAPTER 2

LITERATURE SURVEY

2.1. FIXED SYSTEM FOR YOUR FLAME AND GAS DETECTION APPLICATION SOLUTION

ISEA proposed his theory about the fire and gas detection system but it was only theories no practical proof was showed. He work was just writing about the applications. No testing or model had been designed.

2.2. INVESTIGATION OF THE PERFORMANCE ANA IMPROVEMENT OF OPTICAL SMOKE DETECTOR

Highman To and Naikong Fong gave a model which uses FS90 firepanel. This device can be used only to detect gas. Anf the size of this device is very big which requires a lot of space to set it up. So our robot here is different and more advanced from the device they made.

2.3. DETECTION OF FIRE AND GAS LEAKAGE IN INDUSTRY TO ENSURE SAFETY CONDITION

Md. Abdullah Al Noman, Md Faishal Rahaman made a device which is similar to our robot. But our is robot is much more advanced than theirs. These authors use GSM module but this device detects only LPG gas. And also they haven't showed any testing proof or model of the device.

2.4. EARLY FIRE DETECTION BASED ON GAS SENSOR ARRAYS: MULTIVARIATE CALIBRATION AND VALIDATION

Ana Solorzano/Juan Manuel Jiménez-Soto used a very disparate method than our robot. Their main part is SVM and PLS DA. So the main fault in their robot is that it gets heated when overused and it occupies huge space. It can cover only

one room. For different places different robot is needed. So it is very expensive to install

2.5. DESIGN AND SIMULATION OF FIRE AND GAS DETECTION ROBOT

R.O.Okeke ,M.Ehikhamenle proposed in way that the device uses microcontrollers. But the main flaw in their device is that its response speed is very slow. And the main thing is that it is not automatic it is manual. So its is of no use as a surveillance bot. And it need to be maintained regularly for a period of time and the maintenance cost is very high.

CHAPTER 3

METHODOLOGY

3.1. MATERIALS

3.1.1. POWER SUPPLY

AC is used to transmit power over long distances and to power high-power equipment such as appliances and lights. AC's properties make it perfect for long-distance transmission for supplying huge volumes of power for unregulated applications. Low-capacity apparatus and equipment employs direct current power that is tightly regulated (DC). Because most homes are powered by AC, many applications require conversion to DC. Learn how to build an AC DC converter by following these instructions.

There are three different types of power supplies available. Each has its own set of advantages and disadvantages, thus they are employed in slightly different situations.

The following are the three main types of electronic power supplies:

- **Rectified and smoothed power supply:** These are the most basic electronics power supplies, and they're typically employed in non-critical applications where efficiency isn't a concern. Because it was difficult to regulate supplies and the demands were not always essential, this form of power supply was commonly utilised in thermionic valve and vacuum tube equipment.
- **Linear regulated power supply:** This type of electronics power supply may deliver exceptional performance. However, because it employs a series regulator, it can be inefficient, squandering a large percentage of the incoming power as heat. Nonetheless, these power supplies may provide very high degrees of control, low ripple values, and so on. More information about Linear Power Supplies.

- **Power supply in switch mode:** Electronic circuits employ switching technology to manage the output in this type of power supply. Although spikes appear on the output, they are extremely efficient and, as a result, may be stored in relatively small packages than their linear counterparts.

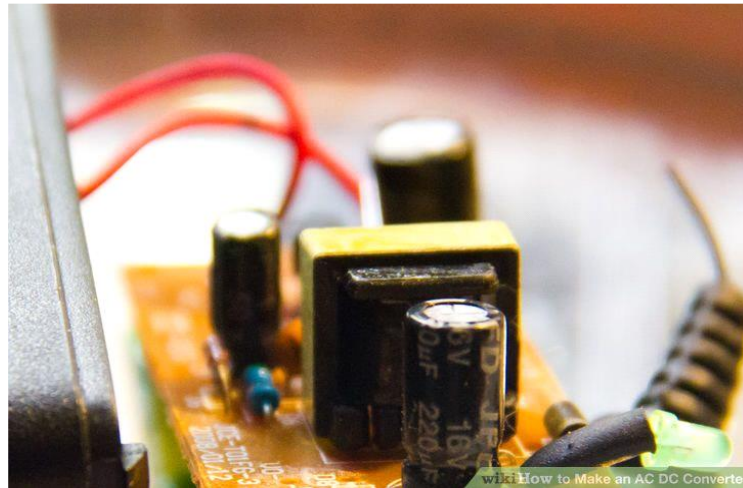


Figure 3.1: Power supply

- Transformer is made by two magnetic windings. The main is the number 1. Primary is powered by an Alternate current. The other winding is called the secondary winding. This transformer, as well as all of the other components required to construct the AC DC converter, can be found at most electrical and online stores.
- Windings of the transformer are calculated.



Figure 3.2: Secondary Winding



Figure 3.3: Primary Winding

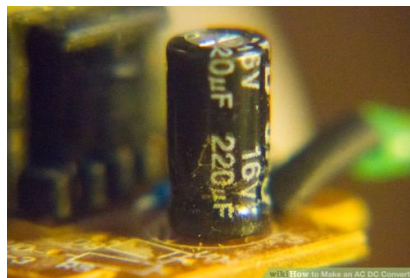


Figure 3.4: Battery

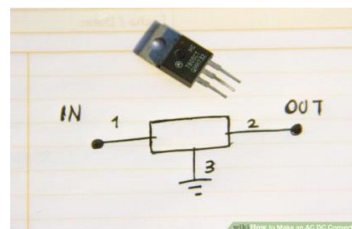


Figure 3.5: Capacitor

3.1.2. Resistor

What is a Resistor?

An electric resistor is a passive component consisting of two terminals employed to obstruct and curb the flow of current. Ohm's Law is employed for the operation of resistor, which articulates that the voltage migrating across two of its terminals is equal to the current passing through the same.

The Law of Ohms: $IR = V$

Where, V indicates the applied voltage across the employed resistor,

I indicates the current that flows through the same and

R indicates the constant for the resistance of the material.

Ohms is the unit of resistance

3.1.2.1. Types of Resistors:

The specific material utilized, the value of resistance and the power rating are all factors that can be used to classify resistors.

1. Fixed resistor
2. Variable Resistors

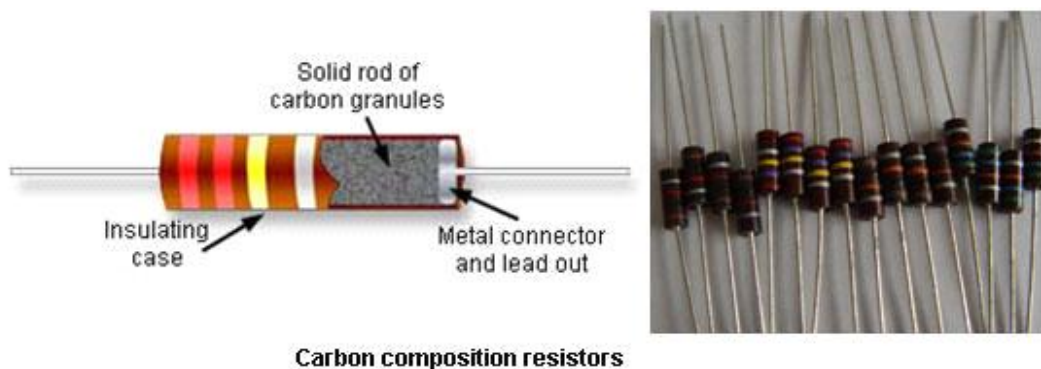


Figure 3.6: Carbon composition resistors

- **Carbon film resistors:**

A carbon film layer is deposited on an insulating substrate to create this resistor. The carbon film is then sliced helical to detect a lengthy and helical resistance channel. By changing the resistor's form the value of resistance can be altered and utilizing different resistivity carbon materials. These resistors are very inductive due to their helical resistance path, making them unsuitable for Radio Frequency applications.

The magnitude of temperature coefficient varies from -100 to -900 ppm/°C. The carbon film is insulated either by a coating of epoxy or a tube made of ceramic. This resistor's operation necessitates a high level of pulse stability.

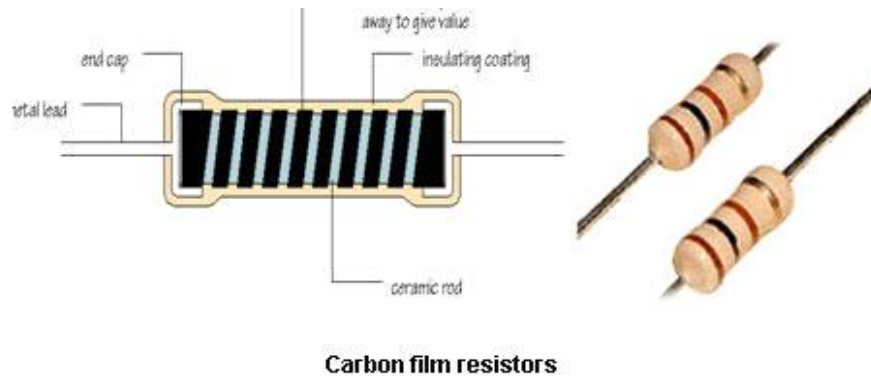


Figure 3.7: Carbon film resistors

- **Metal Film resistor:**

Metal Film resistors come in a variety of kinds, including Carbon Film, Metal Film, and Metal Oxide Film resistors. Pure metals (e.g., nickel) or oxide films (e.g., tin-oxide) are often deposited over an insulating ceramic or substrate. The Film Type Resistor's Structure

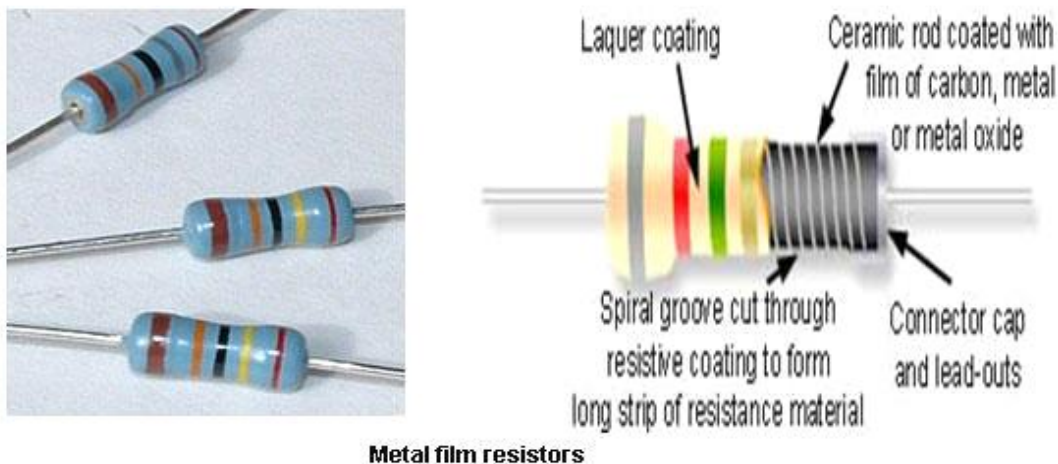


Figure 3.8: Metal film resistors

- **Wire wound resistor:**

The appearance of wire wound resistors varies in sizes and shapes. Span of wire covered in an insulating flameproof cement layer is considered as the resistive

elements and wound over a tiny glass fibre or ceramic rod , usually in an alloy such as Nickel/Chromium or Manganin. They are usually accessible in low resistance values, although they can also be found in higher resistance values but are efficient indispensation of enormous measure of power.

During use, these resistors can grow rather warm. To disperse the heat created, they are contained in a finned metal container that may be fastened to a metal chassis. Fireproof enclosures or coatings are essential for fire protection. In most cases, lead-out wires are welded to the resistor. Enamel resistors, which are encased in heat-resistant bottoms, are employed in situations where large power is required.

Wire wound resistors have higher undesired inductance than other types of resistors due to the fact that they are predominantly coils, though inductance can be reduced by encircling the wire in regions with alternately reversed directions. To minimise the coil's cross-section area, other ways use bifilar winding. Ayrton-Perry wound resistors are used in the most demanding circuits.

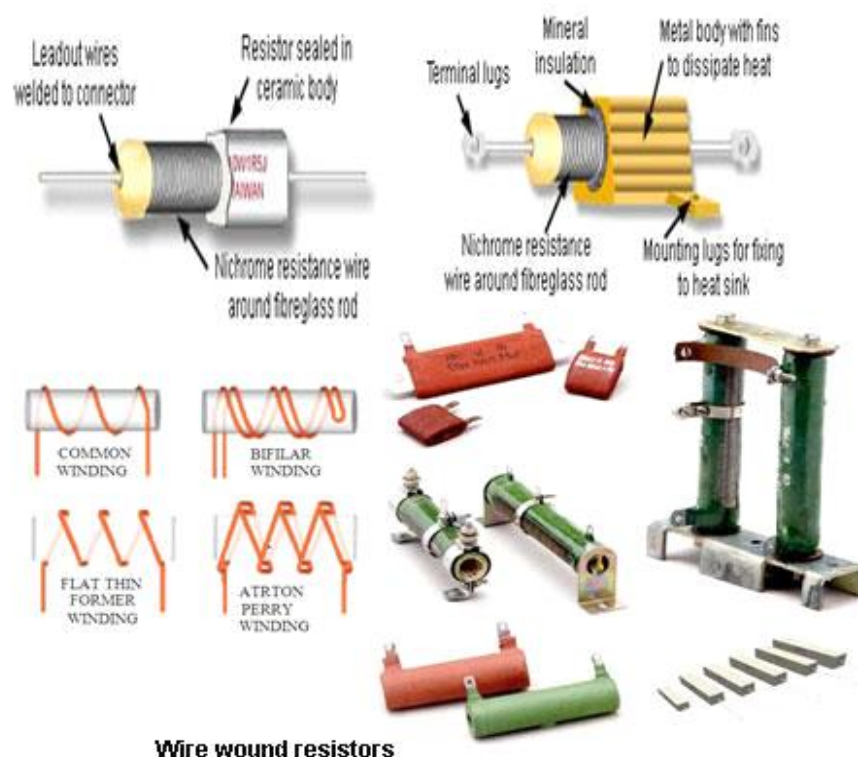


Figure 3.9: Wire wound resistors

3.1.3. Capacitor



Figure 3.10: Capacitor

A capacitor is a charge-storage component that is not active. A capacitor's charge (q) is equal to the product of the voltage (V) applied and its capacitance (C). Capacitors are used to block DC components or bypass AC signals since they have an infinite reactance at zero frequency. In AC circuits, the capacitor goes through a recursive charging and discharging cycle, with the voltage and current across it being determined by the RC time constant. As a result, capacitors are utilised to level out power supply fluctuations. Other applications include linking audio system stages, tuning radio circuits, and so on. It is used to store energy in the same way as a camera flash does.

Capacitors can be non-polarized/polarized, fixed/variable, and non-polarized/polarized. Polarized capacitors are electrolytic capacitors, whereas non-polarized capacitors are ceramic and paper capacitors. Because capacitors hold charge produced, which must be discharged cautiously ahead of troubleshooting circuits. The supply voltage must always be lesser than the maximum voltage of the capacitor. To discover more about how a capacitor works and its internal structure, [click here](#).

Pin Diagram:

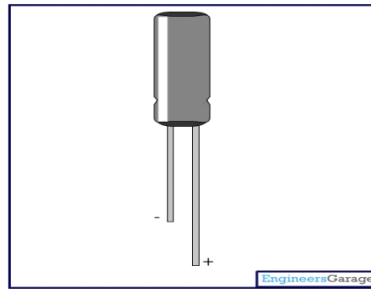
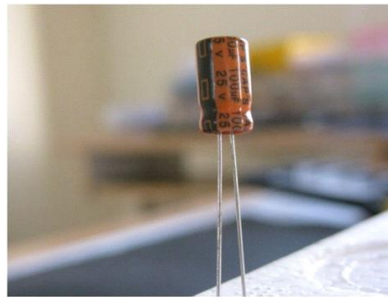


Figure 3.12: Simple Electrolyte Capacitor

FARAD is the unit of capacitance.

Let's take a closer look at how a capacitor works and how it stores charge.



Depiction of a simple capacitor is given here, with the protrusion of two delicate rods from the cylindrical shaped container. A plastic covering is used to encase the capacitor. The capacitor is labelled with this covering.

Container made of metal

A folded sheet of dielectric is sandwiched between metal plates inside the metal enclosure. The following photographs clearly depict the internal structure of the capacitor.

3.1.4. Dielectric

We can plainly see two variety sorts of layers melded like a roll in the image above. Two metal plates are placed between a dielectric layer. The dielectric acts as an insulator between the metal plates, allowing charge to be stored. To reduce the size of the capacitor, these plates are folded around.

One plate serves as a cathode, while the other serves as an anode. Electrolyte is used to boost the value of a capacitor while keeping the size minimal. Various

categories of electrolytes are employed in various manners inside a capacitor depending on the size and application. Anode is usually immersed in liquid electrolyte to increase the plate's surface area and efficiency.

3.1.4.1. Crystal Oscillator

In electronic oscillator circuitry, a quartz crystal resonator is critical. It is a very crucial part of the oscillator circuitry's feedback network, and is sometimes mispronounced as crystal oscillator. Electronic oscillators are found in practically every industry, from microscopic chips to aerospace, and are employed in frequency control applications.

The heart of such resonators is a quartz crystal. They outperform other resonators such as LC circuits, spinning forks, and ceramic resonators due to their high quality factor (Q), stability, small size, and inexpensive cost.

The inverse piezoelectric effect, or when an electric field is placed across certain materials, they begin to produce mechanical deformation, is the basic phenomena behind the operation of a quartz crystal oscillator. These mechanical deformations/movements are determined by the quartz crystal's basic structure. Quartz is a naturally occurring mineral that exhibits piezoelectric properties; nevertheless, it is artificially created for use as a resonator because processing occurring quartz is complex and expensive.

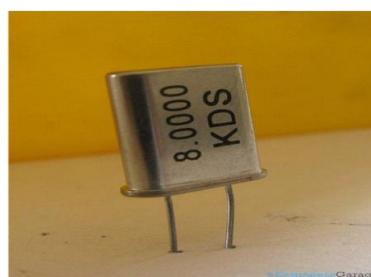


Figure 3.13: Common quartz crystal resonator

A common quartz crystal resonator is shown in the image above. Electronic oscillators circuitry is frequently utilised in microcontroller/processors and digital circuits.

3.1.5. Raspberry pi:

The Raspberry Pi Foundation developed a series of compact single-board computers in the United Kingdom to support the teaching of basic computer science in schools and underdeveloped countries. [5] [6][7] The original model gained popularity, which exceeded all expectations,[8] brought and employed for applications other than the intended uses. Accessories (such keyboards and mouse) and casings are not incorporated. Several official and unauthorized bundles, on the other hand, have included various accessories. [8]



Figure 3.14: Raspberry Pi

3.1.5.1. Generations of released model:

- Raspberry Pi has gone through several generations. A Broadcom system on a chip (SoC) with an integrated ARM-compatible central processing unit (CPU) and on-chip graphics processing unit is included in all variants (GPU).
- For the Pi 3 Model B+, processor speeds range from 700 MHz to 1.4 GHz, with on-board memory ranging from 256 MB to 1 GB RAM. SDHC and MicroSDHC cards are utilised to store the operating system and programme memory. One to four USB ports are available on the boards. HDMI and composite video are offered for visual output, with a basic 3.5 mm phono connection for audio. A handful of GPIO pins provide lower-level output and support standard protocols such as I2C. The 8P8C is found in the B-models.
- In February 2012, the first iteration (Raspberry Pi 1 Model B) was introduced, followed by the simpler and less expensive Model A. The Raspberry Pi Foundation announced a new board in 2014, the Raspberry Pi 1 Model B+, with an improved design. The basic mainline form-factor is represented by

these boards, which are about the size of a credit card. A year later, upgraded A+ and B+ models were released. In April 2014, a "Compute Module" for embedded applications was launched. In February 2015, the Raspberry Pi 2 was released, with additional RAM.

- In November 2015, a Raspberry Pi Zero was introduced for \$5, having a smaller size and less input/output (I/O) and general-purpose input/output (GPIO) capabilities. It was the newest Raspberry Pi mainline in 2017. The Raspberry Pi Zero W, a Wi-Fi and Bluetooth-enabled variant of the Zero, was released on February 28, 2017 for \$10. [16] [17] The Raspberry Pi Zero WH, a variation of the Zero W with pre-soldered GPIO headers, was released on the 12th of January 2018.
- The Raspberry Pi 3 Model B, which has a 64-bit quad-core processor, on-board WiFi, Bluetooth, and USB boot capabilities, was released in February 2016. [19] Model 3B+ debuted on Pi Day 2018 with a faster 1.4 GHz processor and a three-times faster network based on gigabit Ethernet (300 Mbit/s) or 2.4 / 5 GHz dual-band Wi-Fi (100 Mbit/s). [1] Power over Ethernet (PoE), USB boot, and network boot are some of the other possibilities (an SD card is no longer required). This enables the Pi to be used in difficult-to-reach locations (possibly without electricity)

3.1.5.2. Hardware

- The Raspberry Pi has gone through multiple iterations, each with different memory capacities and peripheral device capabilities.

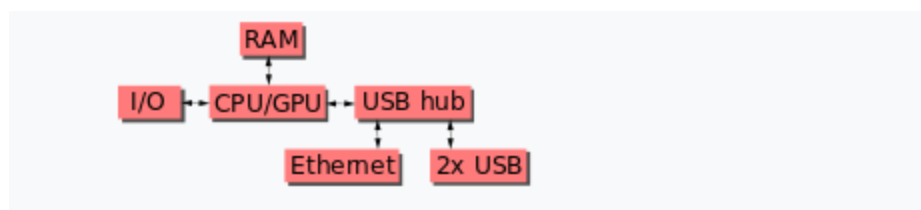


Figure 3.15: Processor

- Model B and B+ are depicted in this block diagram; Model A, A+, and the Pi Zero are identical but do not have the Ethernet and USB hub components. An second USB port is attached to the Ethernet adapter internally. The USB port

is directly attached to the system - on - chip in Model A, A+, and Pi Zero (SoC). The USB/Ethernet chip on the Pi 1 Model B+ and later variants has a five-port USB hub, whereas the Pi 1 Model B only has two. The USB port is similarly directly attached to the SoC on the Pi Zero, although it is a micro USB (OTG) connection.

3.1.5.3. Processor:



Figure 3.15: Processor

- A 32-bit 900 MHz quad-core ARM Cortex-A7 CPU powers the Raspberry Pi 2B.
- A 700 MHz ARM1176JZF-S CPU, Video Core IV graphics processing unit (GPU),[21] and RAM are included in the Broadcom BCM2835 SoC used in the first model Raspberry Pi[20]. It contains a 16 KB level 1 (L1) cache and a 128 KB level 2 (L2) cache. The GPU is the primary user of the level 2 cache. Only the SoC's edge is visible because it is placed beneath the RAM chip. The 1176JZ(F)-S uses the same CPU as the original iPhone[22], but with a higher clock rate and a much quicker GPU.
- The Raspberry Pi 2 featured a Broadcom BCM2836 SoC with a 900 MHz 32-bit quad-core ARM Cortex-A7 processor and 256 KB shared L2 cache in its older V1.1 iteration. [23] The Broadcom BCM2837 SoC with a 1.2 GHz 64-bit quad-core ARM Cortex-A53 processor was upgraded to the Raspberry Pi 2 V1.2, the same SoC 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 available (as of late 2016).

- The Broadcom BCM2837B0 SoC in the Raspberry Pi 3+ has a 1.4 GHz 64-bit quad-core ARM Cortex-A53 processor with 512 KB shared L2 cache.

3.1.5.4. Performance:

- The initial generation Raspberry Pi provided real-world performance of around 0.041 GFLOPS while operating at 700 MHz by default. [25][26] On the CPU level, it performs similarly to a Pentium II with a clock speed of 300 MHz from 1997–99. The GPU has a graphics processing speed of 1 Gpixel/s or 1.5 Gtexel/s, or a general-purpose computing performance of 24 GFLOPS. The Raspberry Pi's graphical capabilities are roughly comparable to that of the Xbox in 2001.
- A quad-core Cortex-A7 CPU running at 900 MHz and 1 GB RAM were incorporated in the Raspberry Pi 2 V1.1. It was said to be 4–6 times stronger than its predecessor. The GPU was a carbon copy of the original. [23] The Raspberry Pi 2 V1.1 could be up to 14 times quicker than a Raspberry Pi 1 Model B+ in parallelized benchmarks. [27]
- The Raspberry Pi 3 is said to have ten times the performance of the Raspberry Pi 1, thanks to its quad-core ARM Cortex-A53 processor.
- [28] This was said to be extremely reliant on task threading and the utilisation of instruction sets. In parallelized tasks, the Raspberry Pi 3 was found to be around 80% faster than the Raspberry Pi 2.

3.1.5.5. Over clocking:

- Most Raspberry Pi chips overclock upto 800 MHz, and some upto 1000 MHz. In certain cases, however in extreme cases as in suspending all features employed for safety and constraints of voltage, the Raspberry Pi 2 might be overclocked to 1500 MHz. Without voiding the warranty, presence of possibility of utilization of a software programme called "sudo raspi-config" in the Raspbian Linux distro is there. [30] In these situations, the Pi turns off overclocking when the chip temperature reaches 85 degrees Celsius (185 degrees Fahrenheit), but it is viable to override automatic over-voltage and

overclocking settings (voiding the warranty); a properly sized heat sink is required to protect the chip from serious excessive heat.

- In newer versions of the firmware, you can choose from five overclock ("turbo") presets that, when enabled, seek to maximise the SoC's performance while preserving the board's lifetime. This is accomplished by continuously monitoring the chip's core temperature and CPU load, as well as dynamically altering clock rates and core voltage. Performance is throttled when demand on the CPU is low or it is running too hot, but if the CPU is busy and the chip's temperature is appropriate, performance is momentarily raised with clock speeds of up to 1 GHz, relying on the individual board and which of the turbo settings is employed.

The seven over clock presets are:

- no overvolting; 400 MHz SDRAM, 250 MHz core, 700 MHz ARM
- low-power; 250 MHz core, 400 MHz SDRAM, 800 MHz ARM, no overvoltage
- medium; 450 MHz SDRAM, 250 MHz SDRAM, 900 MHz ARM, two overvoltings
- high performance; 450 MHz SDRAM, 250 MHz SDRAM, 950 MHz ARM, 6 overvolting
- turbo; 1000 MHz ARM, 500 MHz core, 600 MHz SDRAM, 6 overvoltage
- Raspberry Pi 2: 500 MHz SDRAM, 500 MHz core, 1000 MHz ARM, 2 overvolting
- Raspberry Pi 3: 500 MHz core, 500 MHz SDRAM, 1100 MHz ARM, 550 MHz core, and 6 overvolting. The CPU speed will be listed as 1200 MHz in the system information. When idling, the frequency drops to 600 MHz.
- The SDRAM clock in the topmost (turbo) preset was initially 500 MHz, however it was after a while modified to 600 MHz since 500 MHz can cause a SD card corruption. Instantaneously, the core clock speed in high mode was reduced from 450 to 250 MHz, while the core clock speed in medium mode was reduced from 333 to 250 MHz. The Raspberry Pi Zero has a 1 GHz processor.

- Even when overclocked, the CPU on the original and second generation Raspberry Pi boards did not require additional cooling, such as a heat sink or fan, but the Raspberry Pi 3 may produce more heat.

3.1.5.6. Ram

- 128 MB was allotted to the GPU by default on previous beta Model B boards, reserving 128 MB only for the CPU. There were possibility of three alternative segregations on the original 256MB Model B (and Model A) releases. The standard memory segregation was 192 MB (RAM for CPU), that must be sufficient for only freestanding 1080p video decoding or only rudimentary 3D, although not both at the same time. With the exception a 1080p frame buffer, 224 MB was designed for Linux alone, and any video or 3D was likely to disintegrate. 128 MB was utilized for high-resolution 3D, and possibly video decoding as well (e.g. XBMC). The Broadcom Video Core IV in the Nokia 701 is 128 MB.
- New standard memory segregation files (arm496 start.elf, arm384 start.elf, arm256 start.elf,) for 496 MB, 384 MB and 256 MB CPU RAM (as well as 16 MB, 128 MB, 256 MB and video RAM) were initially provided for the future Model B with 512 MB RAM. However, after a week, the RPF came up with a new version of start.elf that could ultimately read a entirely new entry in config.txt (gpu mem=xx) and designate an amount of RAM in 8 MB steps to the GPU, making the previous method of memory segregation completely devoid of necessity, and a single start.elf was released. For 256 MB and 512 MB Raspberry Pis, elf operated in the same way.
- The Raspberry Pi 3 and 2 each come with 1 GB of RAM. The RAM on the Zero W and Raspberry Pi Zero 512 MB.

3.1.5.7. Networking:

- Because the Pi Zero, A+ and Model A lack Ethernet circuitry, they are often linked to a network via a USB Ethernet or Wi-Fi adapter supplied by the user. The Ethernet port on the Model B and B+ is provided via a built-in USB Ethernet adapter that uses the SMSC LAN9514 chip. [39] The Raspberry Pi 3 and Pi Zero W (wireless) have 2.4 GHz WiFi 802.11n (150 Mbit/s) and Bluetooth 4.1 (24 Mbit/s) based on the Broadcom BCM43438 Full MAC chip, with no official uphold for mode for surveillance but equipped via unofficial firmware patching[40], and the Pi 3 has a 10/100 Mbit/s Ethernet port. The Raspberry Pi 3B+ has dual-band IEEE 802.11b/g/n/ac WiFi, Bluetooth 4.2, and Gigabit Ethernet

3.1.5.8. Operating systems



Figure 3.16: Operating System

- Depending on the two factors, which are the board and adapters that are available, OS for the Raspberry Pi can be installed on a MicroSD, MiniSD, or SD card; the slot provided on the base of a MicroSD on the Raspberry Pi 2 board can be viewed here.

The Raspberry Pi Foundation offers RISC OS, Windows 10 IoT Core, third-party Ubuntu, and specialised media centre distributions, as well as Raspbian. The core programming languages promoted are Python and Scratch, with reinforcement for a wide array of others. The accessibility of the official open source is possible, however, the standard firmware is a closed source. A wide array of operating system can be operated on the Raspberry Pi. RISC OS, Windows 10 IoT Core,

Ubuntu MATE, and other third-party operating systems are all accessed via the official website.

3.1.6. Webcams

Owning a webcam is like you owning a live tv channel where you can watch everything live at the same time when it is happening. It is a video camera but the video can be recorded 24/7 and watch it live. It is fun and safe for our home, workplace, public place etc. Its tiny and it is connected to our computer.

Working of a web camera?



Figure 3.17: Webcam

It is fixed in a and the power supply is given and videos are streamed. The light detectors detect light and movement. To convert into digital format image sensors are used. It does not have a memory card or any storage thing it transmits live streaming. A usb cable connected to the laptop where the stream is received and we can watch.

3.1.7. MOTOR DRIVER (L293D):

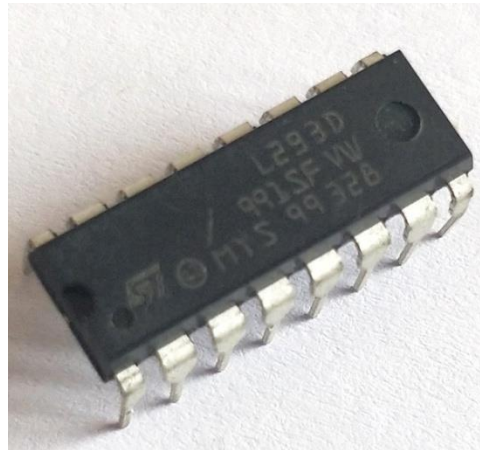


Figure 3.18: Motor driver (L293D)

It is most used motor driver. It is a motor driver which is used to drive motors. This type of motor at the same time can drive two motors DC, and the 2 motors' directions could be regulated individually. If you need to drive an motor which is less than 36V this version motor can be used.

Can be very easy to use. The H bridge principle is used to work the IC; Making the motor run clockwise and anticlockwise is the use of the H bridge principle. The circuit to accomplish this is given below.

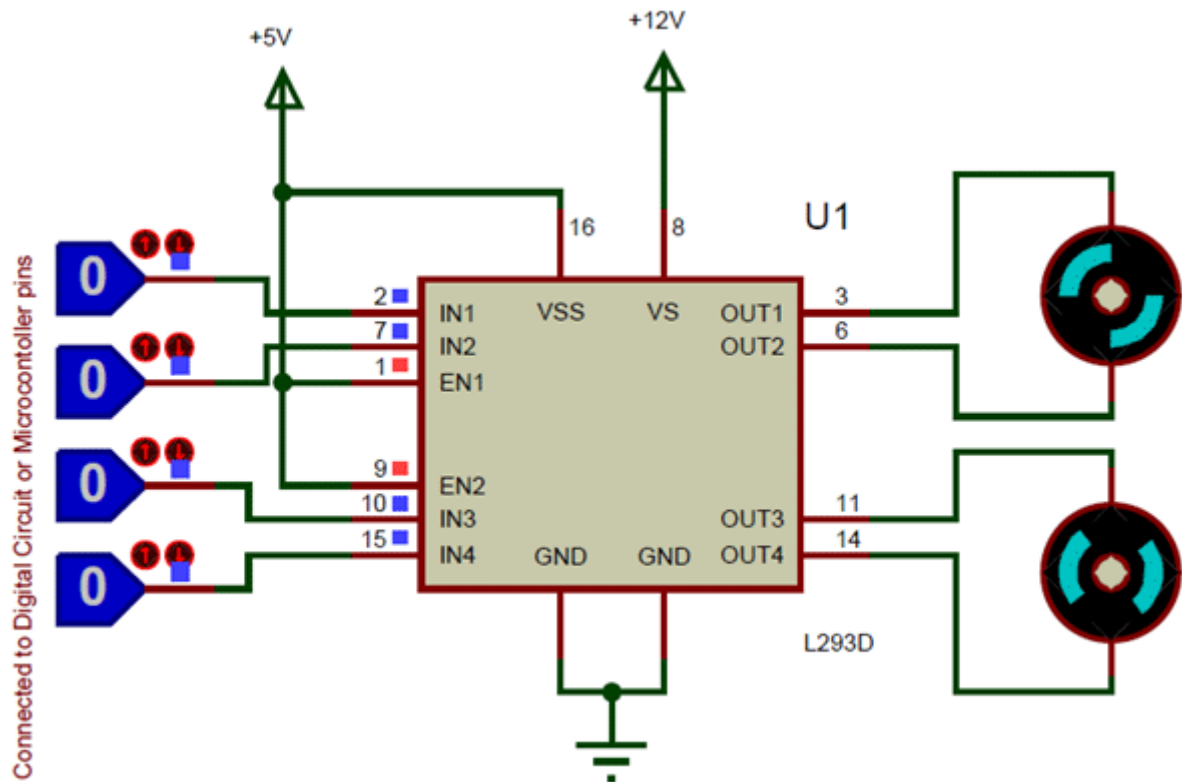


Figure 3.19: L293 D IC circuit connection

Ground all of the ground pins. The Vss (Vcc1) pin, provides power to the IC, must be given to +5V. The other is Vs (Vcc2), which gives power for the motors to work. As per the specifications given it is connected between the power 4.5 to 36v.

To enable the motor the start pins are used, respectively. As the motor is used in many places it is connected at a voltage of 5v. Pins 1, 2 are used to control motor 1 and pins 4, 3 are used to control Motor 2. Input pins are used to control the speed and direction of the motor.

3.1.7.1. Applications

- Digital Circuits can be utilised to control high current motors

- Stepper motors can be driven
- High current LEDs can be used

DC Motor or Direct Current Motor:

The electric motor operated by dc is called dc motor. This is a device that converts DC electrical energy into a mechanical energy.

3.1.8. DC Motor

3.1.8.1. Principle of DC Motor

- When a current-carrying conductor is put in a magnetic field, it is subjected to torque and has a proclivity to move. To put it another way, a mechanical force is created when a magnetic field and an electric field interact. This is how a DC motor, often known as a direct current motor, operates. Motoring action is what it's called.
- Fleming's left hand rule states In a magnetic field, the force acting on a given length of wire rises when:

The wire's current rises. The magnetic field becomes more powerful.

The force is highest when the current is 90 degrees to the magnetic field direction for any particular pair of current and magnetic field strength. If the presence of magnetic field are parallel, there is no motor effect force.

Fleming's left-hand rule can be used to determine the force's direction. A direct current motor is structurally and mechanically identical to a DC producer, but electrically, they are completely different. Unlike a generator, we use the input port to provide electrical energy and the output port to provide mechanical energy. The block diagram shows how to express it. In a DC motor, the electrical port or input port receives the supply voltage E and current I , while the mechanical port or output port receives the mechanical output, i.e. torque T and speed.

The direct current motor's output and input pin holes are linked by the parameter K .

So, as seen in the diagram above, a motor is the polar antonym of a DC backup power, and by just reversing the ports, we can get both driving and generating operation from the same unit.

3.1.8.2. Detailed Description of a DC Motor

Let's look at the diagram below to see how a DC motor works in detail.

The direct current motor is symbolised by the central round. We'll draw the edges on the circle. The outside terminals on the brushes are connected to the supply power via the external terminals

The R_a is depicted in connection on the supply terminals.

Now, edges input voltage is applied. In the presence of a attracting field, current flowing via edges on the rotor armature produces a torque T_g . The armature of the dc motor revolves as a result of this torque T_g . The armature conductors carry currents, and the armature rotates within the stator magnetic field, producing an emf E_b in a similar way to a generator. The generated Emf E_b is known as the rear Emf because it oppose the forward volts and is oriented in the opposite direction to the power supply.

In the case of a generator, the back emf is represented by

Where, P = no of poles

ϕ = is the flux

Z = quantity of conductors

A = parallel paths numbers

and N is the DC motor speed

3.1.9. Gas Sensor

In today's modern world, monitoring the gases generated is crucial. Gas monitoring is essential in a wide range of applications, from air conditioners in homes to electric chimneys and industrial safety systems. In these systems, gas sensors are essential. Gas sensors, the size of a nose, react spontaneously to the gas present, informing the system of any changes in molecule concentrations in the gaseous state.

Gas sensors are available in a range of configurations, depending on the sensitivity level, gas type, physical dimensions, and a number of other factors. This Insight is about a methane gas sensor that can detect methane-produced gases like ammonia. When one gas comes into touch with this sensor, it becomes ionized before being absorbed by the element of sensation. This adsorption generates a difference in the potential on the above mentioned element, which is delivered to the processing unit via output pins in terms of current. What is this sensing component, exactly?



Figure 3.20: Gas Sensor MQ6

The gas sensor module is protected by a steel exoskeleton that envelopes the device for sensing. The sensor element is exposed to the current through connecting leads. As a result of this current, gases that are in the proximity to the detecting element are ionised and absorbed by the sensing element. This changes the resistance of the element that senses the gas, resulting in the alteration in the value of current exiting it.

3.1.10. LM35 TEMPRATURE SENSOR:

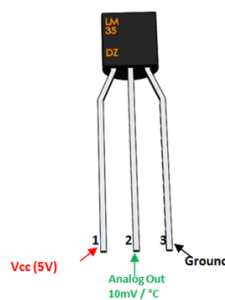


Figure 3.21: Temperature Sensor LM35

The LM35 is a sensor that senses temperature and reports to the current temperature via a corresponding analogue signal. Conversion of the voltage given as output to temperature in Celsius is possible. The external calibration is not necessary for LM35. It is also insulated against self-heating because of the covering. Because of its economical cost (about \$0.95) and improved accuracy, it is extremely popular among hobbyists, students and DIY circuit makers. Owing to this the LM35 is used in an array of economical goods. Despite it being in the market for so long, it is still employed in variety of applications.

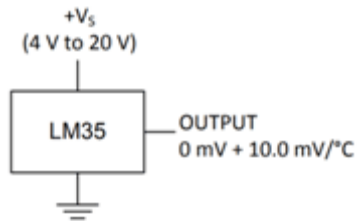
3.1.10.1. LM35 Regulator Features:

- 35V and -2V are the minimum and maximum input voltages, respectively. 5V is the most common voltage.
- Output voltage is exactly linear to temperature (i.e., for every 1°C change in temperature, there will be an increment of 10mV (0.01V).
- $\pm 0.5^{\circ}\text{C}$ Accuracy
- Economical temperature sensor
- Compact enough for remote applications
- Availability in TO-220, TO-92, SOIC and TO-CAN packages

3.1.10.2. Steps for the employment of LM35 Temperature Sensor:

- The LM35 is a sensor that senses temperature with great accuracy whose value of output voltage alternates susceptible to the environmental temperature on the temperature. It's a minuscule, economical IC that is employed in the surveillance of temperatures from -55°C to 150°C . It may be effortlessly linked to any microcontroller functioning in ADC, as well as any development platform .

Input a voltage that is controlled via the pin utilized for input of the IC and then link the ground connections of both the pin and the ground. As depicted here, you will now be able gauge the temperature, however, in terms of voltage.



$$V_{\text{OUT}} = 10 \text{ mV}/^{\circ}\text{C} \times T$$

where

- V_{OUT} is the LM35 output voltage
- T is the temperature in $^{\circ}\text{C}$

3.1.10.3. LM35 Temperature Sensor Applications:

- Monitoring Battery Temperature
- Measuring Temperatures for HVAC applications
- Measuring Temperatures in a Specific Environment
- Providing Thermal Shutdown for a Circuit/Component

3.1.10.4. 2D model of the component (TO-92):

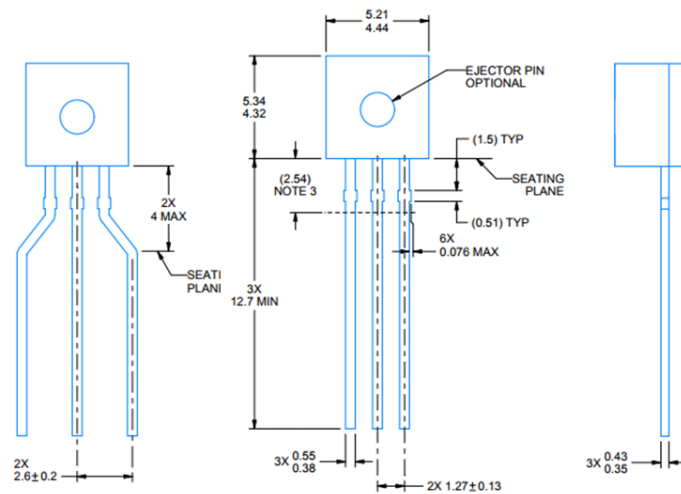


Figure 3.22: 2D model of the component TO-92

3.1.11. Power Bank

The robot of is powered by using mobile charging powerbank. So this is the first time a multi purpose surveillance bot is powered using powerbank. The powerbank is connected to the raspberry pie module using c type usb cable. The power generated by the powerbank is 15000mAh.

What is a powerbank?

- A is a type of portable charger that stores energy and then releases it to recharge other devices. However, knowing the technology is required to really comprehend what a power bank is.

How does a powerbank work?

The power bank's battery is charged by an external power source, as in a wall socket, and then stored in a chemical form. When the battery provides electrical energy through the output port to the connected device.

The process is divided into three stages: energy absorption, storage, and release. It performs similarly to a mobile phone battery, albeit depending on the design, a charging case can be more complicated and have additional functions.

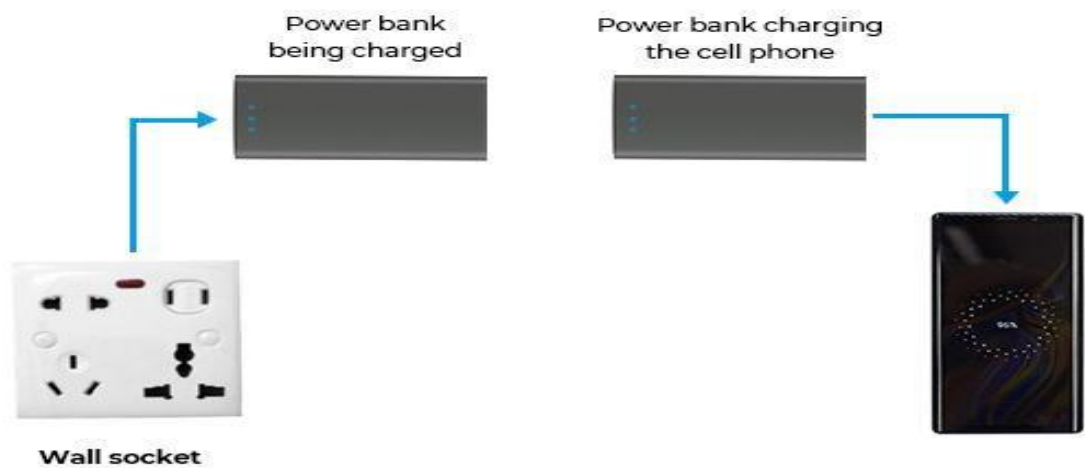


Figure 3.23 Power Bank

3.2. INTRODUCTION TO PYTHON

The most famous coding language in the world currently is Python..It was invented in 1991 by guddo van,and was fully developed by the python foundation. It has very few lines in the syntax which is for the coder, It is more efficient and quick. Some of its major uses are it can be used to construct web pages, solve equations, and programming.

3.2.1. What can Python do?

- Software applications and creating a website
- It can be combined with other languages
- Many database systems can connected to python. Writing and reading also done by python.
- It can solve very big and complex mathematical solutions

- It can build many applications.

3.2.2. Why Python?

- It is a global language in coding which can be used in everything like raspberry pie etc.
- Its syntax are so direct which is easily understandable.
- It has less line programming compared to the other programming languages.
- The code in python is executed and error is quick.

3.2.3. Python Syntax compared to other programming languages

- It was created that the reader could understand easily, its equivalent to the English language.
- Python doesn't need brackets or semi colons to end a code , just a new line can end the program.
- Whitespace and indentation are used in python while the other programming languages use brackets

3.3. INTERNET OF THINGS (IOT)

3.3.1. Introduction to IOT

A network in which all the devices we would like to be connected is called IOT. Connecting any gadget to the Internet so that it may share data with other devices on a network (including mobile phones, autos, household appliances, and other wearables equipped with sensors and actuators). It's worth noting a distinction between internet and the IOT; it's the lack of a human involvement. IoT devices may collect data about people's habits, evaluate it, and take measures based on it.

You might wonder why we're so concerned about the Internet of Things. Here's why you should be worried about the Internet of Things. For example you have a meeting and you need to be on time while driving the route knows where you want to go and knows which way is without traffic and other issues. And if you cant make it on time the mobile will alert the other person about your situation. Being able to use your smartphone to switch on the lights or heat in your house before you arrive home? Yes, the Internet of Things has made all of this feasible. A mix of sensors and actuators powers smart systems and the Internet of Things.

1. Sensors
2. Connectivity
3. The Process and the People

3.3.2. Applications Of IOT

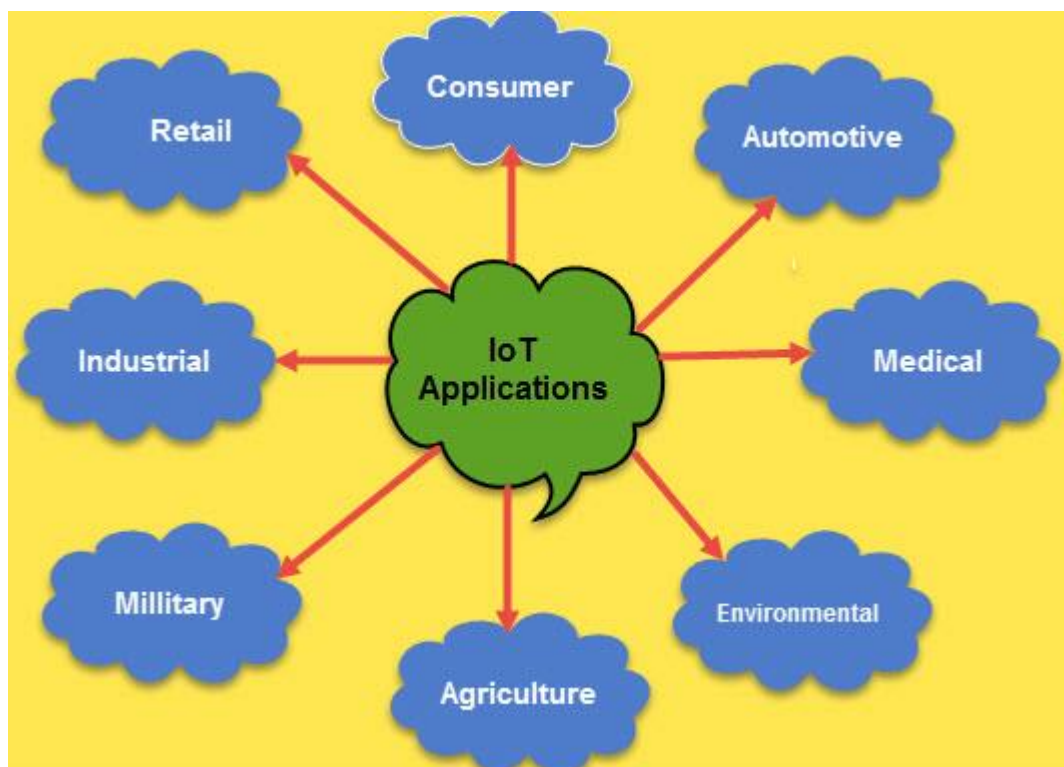


Figure 3.24: Application of IOT

- ***Smart Home***

The Smart Home concept was developed to save energy, money, and time. By the features of Smart Homes, we will be able to turn on the AC before we go home, turn down the tubelights after we leave, and open the doors to guests for limited accessibility even while we are not at home.

- ***Smart cities***

IoT technology features for smart cities includes automated surveillance without anyman, water saving, neighborhood surveillance, smart cars to name a few. It notices all the probles a city faces for example power cut, traffic issues, pollution by using IOT all these problems can be solved.

- ***Wearable's***

These smart watches have sensors and software which collects the information the person who uses it. All these information are noted and the device tells what is best for the user. It tells the heartrate, distance covered and some music to relax. Smart watches must be very power saving or very-less consumption and small in size.

- ***Healthcare***

Wearing linked gadgets, IoT in healthcare aims to enable individuals to live healthier lives and get frequent checkups. The information gathered will aid in the individualised study of an individual's health and the development of customised methods to treat sickness.

3.3.3. Challenges to IoT

Everything is connected and hooked up in the Internet of Things age, far more than we've seen in and around us. IoT brings with it a plethora of potential as well as a slew of new obstacles.

3.3.4. Security Challenges

With IoT devices, security is a major concern. How can consumers be sure that their data is secure when billions of gadgets are connected to the Internet? There are several types of security concerns that might arise.

3.3.5. Data Encryption

Huge amounts of information are produced by the IOT. Saving and protection of the data is a very important thing in IOT. To protect the personal information all data must be encrypted. On the internet, encryption is frequently used to safeguard user information exchanged between a server and a browser, such as passwords, payment information, and other sensitive information that should be kept private. Encryption is used by organisations and people to safeguard private data held on systems, servers, and handy devices such as mobiles and tabs.

3.3.6. Data Authentication

Whatever might be the data encrypted byt still it might be hacked. Assume you created a sensor for smart homes. You might think the device is in your control but some might hack into it and misuse it and even put in danger. There is no solution for these type of threat attacks.

3.3.7. Privacy Challenges

Then there's the problem of data sharing and privacy. This is due to the fact that these gadgets may not only gather personal information such as names and phone numbers, but also monitor user .

3.4. DEEP LEARNING, WHAT IS IT?

It is one type of a machine learning that learns from data representations using unsupervised, supervised, or semi-supervised learning.

It resembles the organisation and operation of the human nervous system, which uses a complicated network of interconnected processing units to process complicated data in a coordinated manner.

Machine Learning is an Artificial Intelligence technique or subset based on the premise that computers may be given access to data as well as the willingness to learn from it. Deep Learning is the next step in Machine Learning.

1. Deep Learning has a lot of different features, which are given below.
2. Hierarchical representations at several levels
3. Neural networks with several layers
4. Large-scale neural network training
5. Nonlinear transformations in several directions
6. Recognize patterns
7. Extraction of features and High-level data abstractions model

3.4.1. Human Brain vs. Artificial Neural Networks

Deep Learning's computational models are loosely based on the human brain. Artificial Neural Networks are multi-layer training systems (ANN).

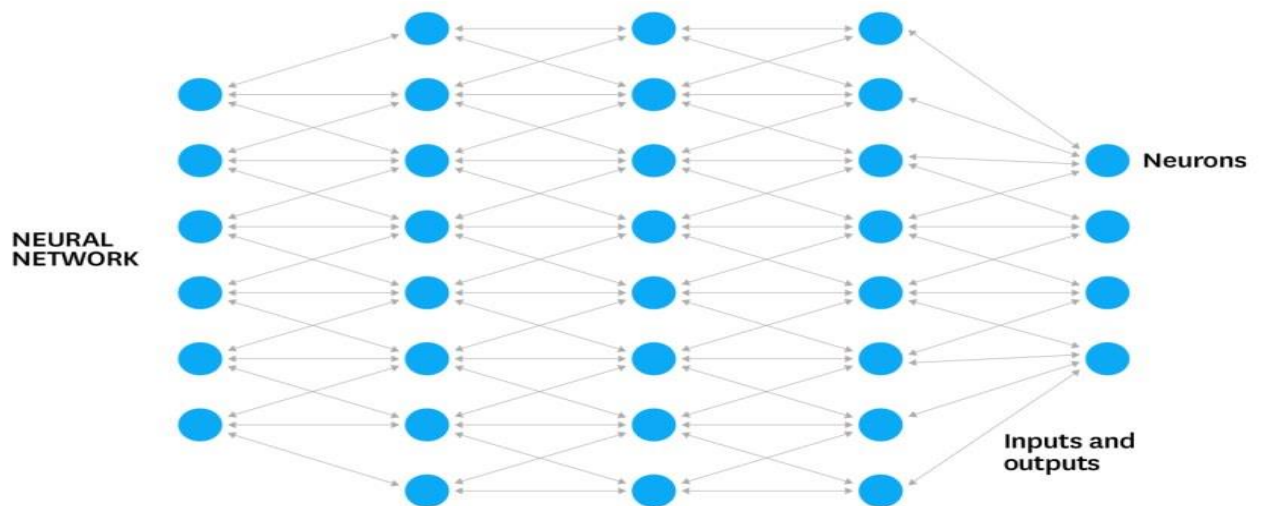


Figure 3.25: Human brain vs artificial neural network

ANNs are processing devices (algorithms or hardware) based on the neural organisation of the mammalian cerebral cortex but on a much lower scale. Deep learning is computed, where all the components work under it. It is all connected to an external output and the system runs. Artificial Neural Networks (ANN) are a type of neural network that uses artificial intelligence.

The four major components of Artificial Neural Networks are as follows:

- Neurons
- Nodes
- Input
- Output

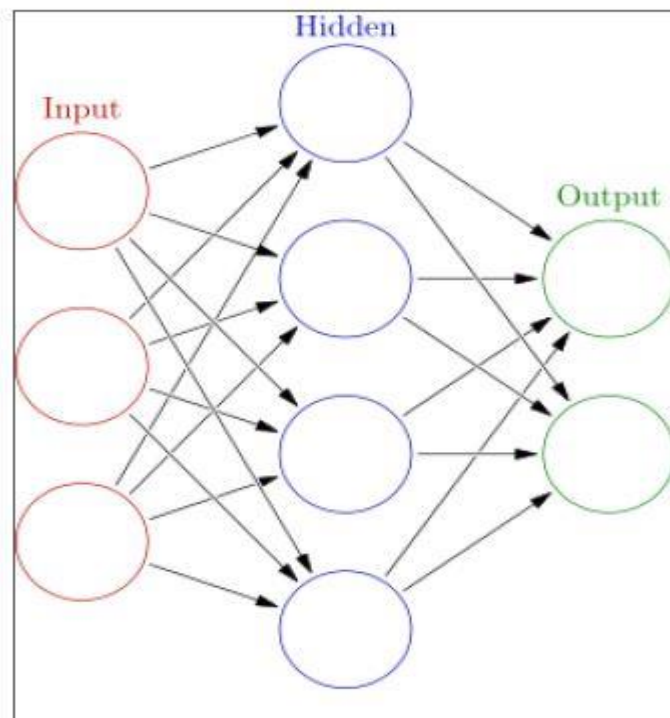


Figure 3.26: Four major human brain vs artificial neural network

3.5. CONSTRUCTION OF THE ROBOT

First the required components are checked properly and then the chassis of the vehicle is built. A big gap is left between the top and bottom of the robot to place the sensors between it. Now the sensors that's is the temperature, gas and the ultrasonic sensor are connected to the Raspberry pie chip using the jumper wires. The connections in the raspberry pie can be made only using the jumper wires. The temperature sensor is placed on the left and the gas sensor is placed on the right. Now the camera is attached to the robot. It is connected to the raspberry pie using the jumper wires. To power the raspberry pie an mobile charging powerbank is attached in the robot. The powerbank and the raspberry pie are connected to each other by c type usb cable. 4 wheels are attached to the robot. The wheels are connected to the dc motor which produces 12v power supply. The other end of the motor is connected to the raspberry pie. Now the connection part is over. To make all these work simultaneously and to start the raspberry pie some codings are needs. We all know raspberry pie IOT device so it works on coding. In our laptop raspberry pie software is downloaded and we create our id and password now we connect our laptop with the raspberry pie using wifi. And after connecting each other the coding is done carefully. We also feed the codes carefully. We enter our mail id to the raspberry pie so that we can receive mail of the situation with picture. The "if" and "else" command plays the biggest role in this project. Now the construction of the robot is over both hardware and software and finally the robot is tested.

3.6. MODEL OF THE ROBOT

The robot first was designed using the CATIA software. And was fabricated according to the 3d model created in the software. The fabrication process is carefully done and all the measurements are accurate, The connections are properly done. The codes are given without any errors. The coding is done Python programming . Raspberry pie is like the motherboard of the robot.

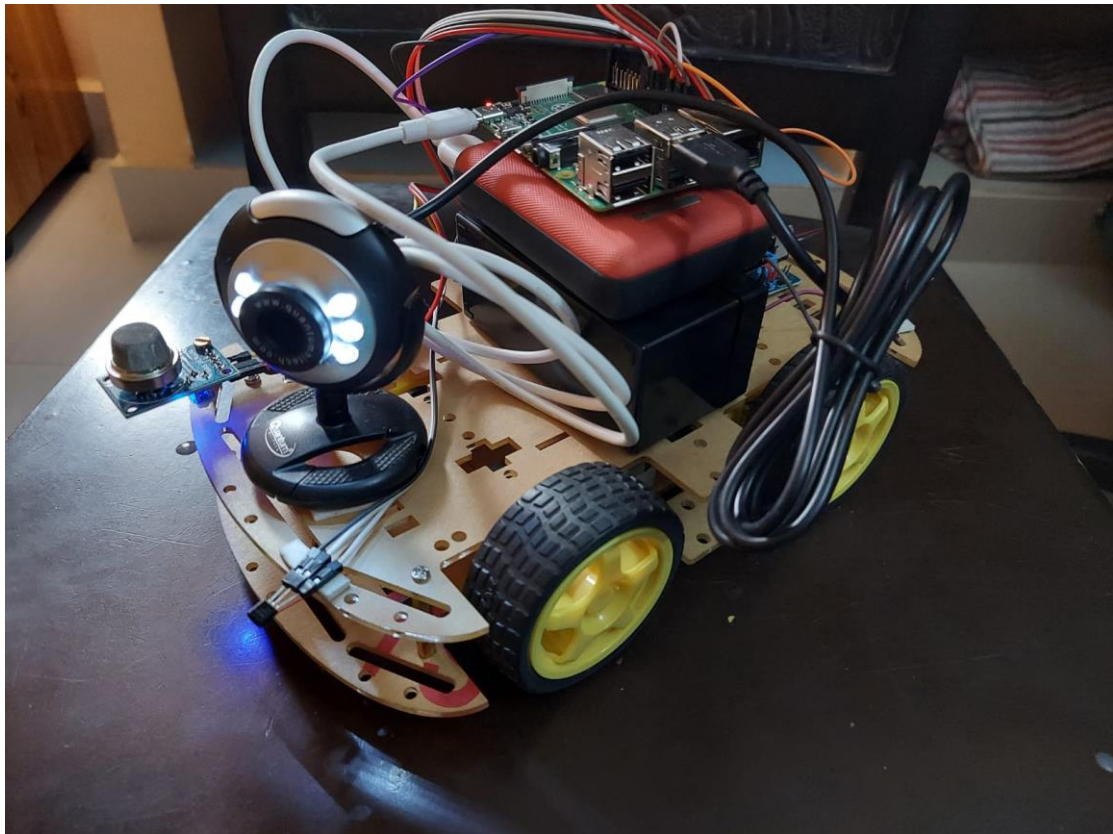


Figure 3.27: Project Model

CHAPTER 4

RESULT AND APPLICATIONS

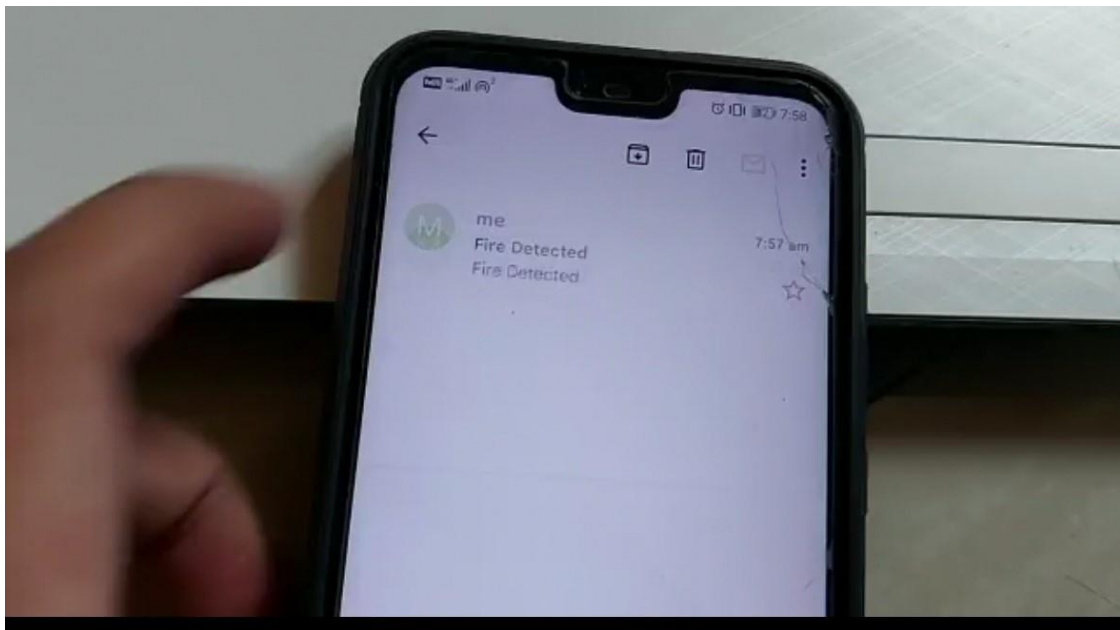
4.1 RESULT

After the completion of the fabrication, the robot is now tested for its features.

The features are

- 1.) To move in a predefined path
- 2.) Remote controlled movement as it is a semi automomos robot.
- 3.) Gas and fire detecting results
- 4.) Emergency message receiving when danger is detected
- 5.) Intruder alerting .

Everything has been checked and the robot has passed all it features. It is now fully functional. Some of working pictures of the robot has been attached below.



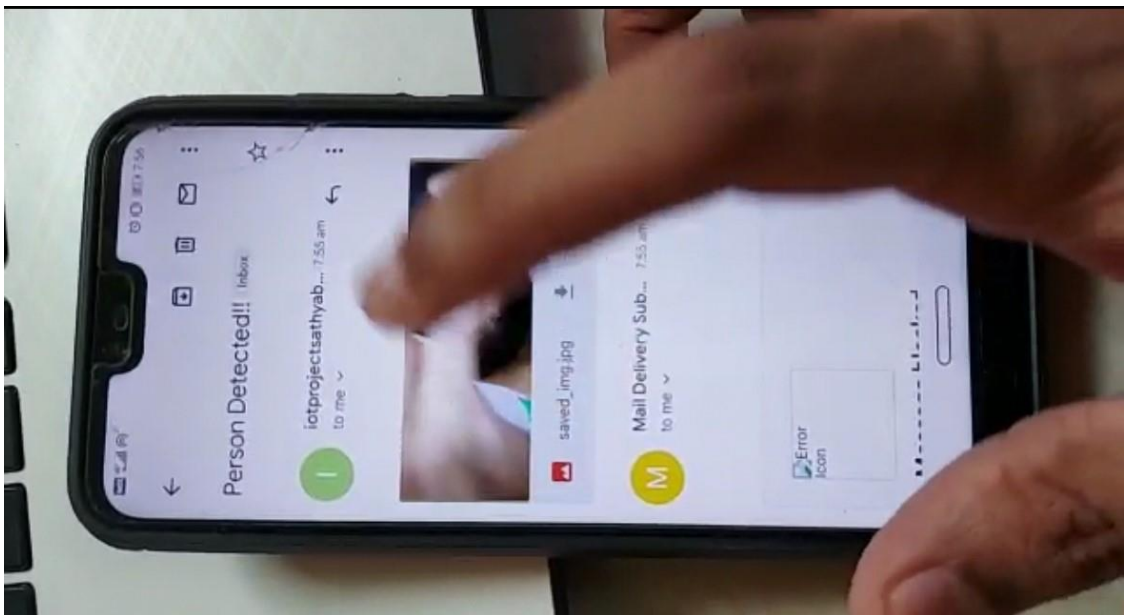


Fig 4.1 – 4.3: Fire detection alarm (mail with buzzer); Obstacle detection and path alignment; Intruder alert (mail with buzzer).

4.2 APPLICATIONS

- Warehouse surveillance and campus monitoring to check for illegal activity.
- Locating terrorist organisations and planning an assault at a convenient moment.
- Setting up video monitoring in any disaster-affected location where people are unable to go.
- Surveillance of interior and outdoor business complexes, industrial, and government buildings/organizations from a field perspective.
- Complete house surveillance for fire, gas detection, and intruder detection.

CHAPTER 5

CONCLUSION

5.1 SUMMARY

Therefore deep learning and IOT in fire, gas, intruder detection helps to detect the fire easily in dynamic which tends to save lives in dangerous situations in more efficient way. This project uses RASPBERRY pie as it is the most modern and latest technology for communication. We can connect it with the internet and monitor from any part of the world.

5.2 BUDGET REPORT.

LM35 TEMPERATURE SENSOR	250
RASPBERRY PIE 3B+	3000
MQ6 GAS SENSOR	180
GSM MODULE	900
ULTRASONIC SENSOR	300
CAMERA	600
BATTERY(12V)	210
DC MOTOR 12V	400
WHEELS	145
JUMPER WIRES	150

Table 10.21

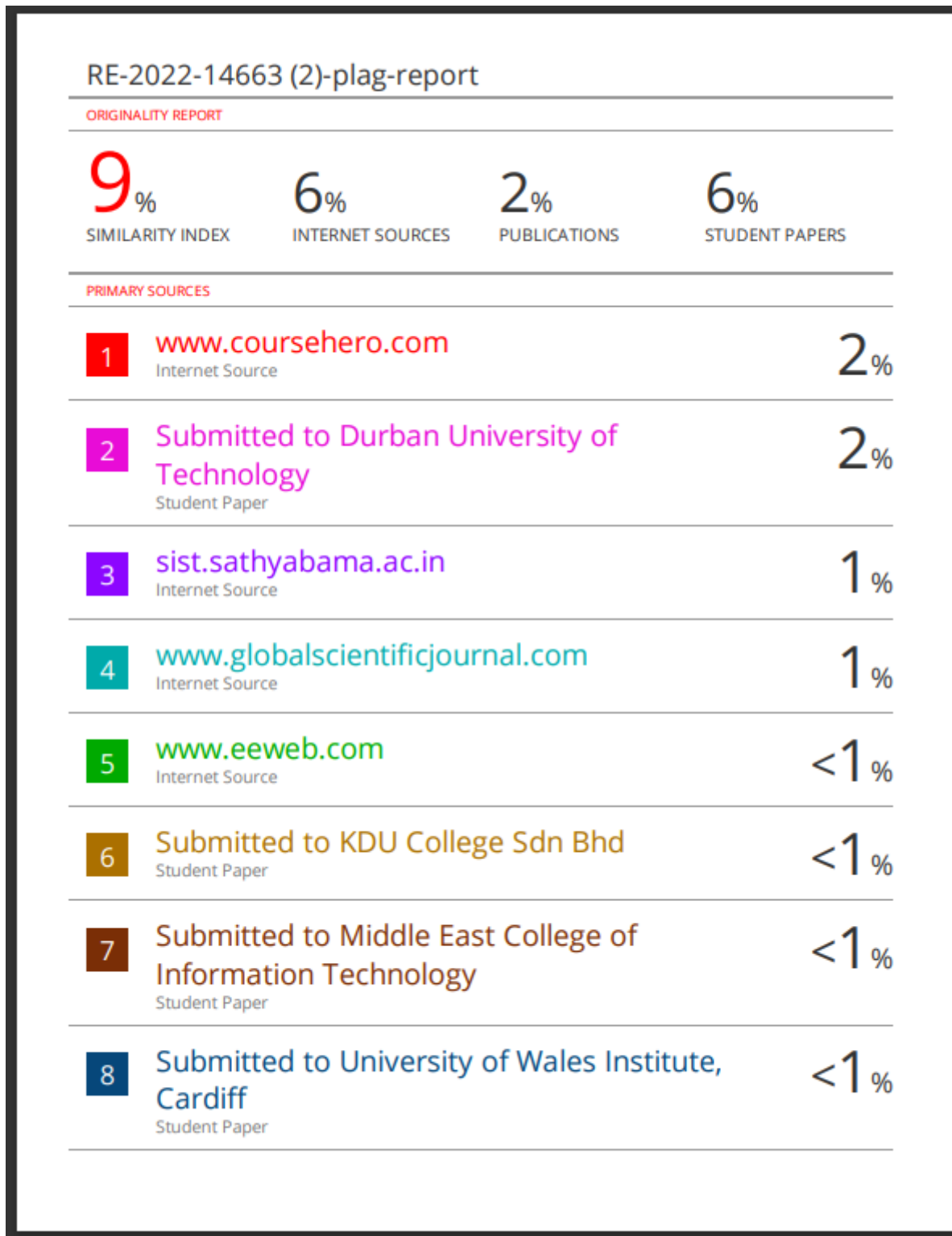
TOTAL COST OF THE PROJECT – 6135

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IT HAS BEEN PRESENTED IN ICEMSE CONFERENCE AND WILL GET PUBLISHED.

GAS, FIRE & INTRUDER DETECTION BY AN UNMANNED ROBOT USING IOT.

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ABSTRACT

This paper presents a robotic device that can detect and fight fire in our homes and workplaces. Its non-human design makes it free to move in the area of fire even if we cannot access it. The device is equipped with sensors that can detect infrared and gas levels. The robot is constrained by an IOT worker utilizing PCs or cell phones. It can also send and receive text messages.

Keywords: -Detection of fire, Internet of Things (IoT), Obstacle avoidance, L293D driver

A. INTRODUCTION

As technology progresses, people are getting increasingly compelled to employ automated systems. The task is made simple and straight forward. The automation system is reliable [1]. Different people prefer different things, depending on their level of comfort. The automation system is used for a variety of purposes, various goals. It's used by some to produce such as designing, to make their life easier. Auto-closing doors, auto-fan speed, Home automation systems and controllers. Others utilize it to make activities easier, for example. For instance, a pre-programmed train line crossing advanced door regulators or programmable advanced door regulators. Metros with cellphones [2],[3],[4]. The internet of things, on the other hand, would not be possible without it. None of these devices or systems could work (IOT). The model is reliant on. The development of GPRS and GSM, as

well as open compliance correspondence items and public acquiescence transmission. A gas or firefighting robot might be useful [5] be used to protect our homes, businesses, and other assets workplaces, as well as a variety of organizational structures a fire or poisonous gases. When there is no one else around.

Our robot will walk in the same direction whether it is at home or at work. A suffocating fire or toxic chemicals in our environment, dwellings or in various constructions workplaces. This robot will be able to identify the

Detecting the presence of fire with an infrared sensor. When the LM35 and the MQ6 gas sensor are combined, the when a fire or flame is discovered, it will fight it. Using fans to create a fire and transmit the word to in the form of a signal, an IOT server. These devices can be put to use incredibly troublesome. All of this must be regulated without

