



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

# IJRSET

International Journal of Innovative Research in  
**SCIENCE | ENGINEERING | TECHNOLOGY**



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 6, June 2024

**ISSN** INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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# Multi-purpose Public Safety Patrolling Robot

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**ABSTRACT:** The project deals with the utilize of Raspberry Pi based to overview Smart checking framework. These days' video surveillance is vital in terms of security. High end cameras are required in commercial spaces, schools and healing centers, stockrooms and other requesting indoor and openair situations. Current advances require costly RFIDs and subsequently the security space gets to be costly in all, so work on this was required. The project clarifies the utilize of raspberry pi, a low fetched single onboard computer. This unused innovation is less costly, and is utilized as a standalone picture preparing stage in this extend. It makes more utilize of portable innovation. Security frameworks as of now require tons of exorbitant components and a complicated establishment prepare.

## I. INTRODUCTION

Security is a vital asset for lot of companies and homeowners. It also avoids damage done to individuals and avoids stolen or destroyed personal belongings. Each year, companies and homeowners set aside a large budget only for security measures. On average a security guard's yearly compensation is around \$25,000. It cost increments with the number of alert frameworks, reconnaissance cameras and contracted security watches. In 2011 property holders went through around \$20.64 billion on joined together state domestic security frameworks. These measurements appear how basic security is for companies and property holders alike.

Alongside security watches, there are a assortment of innovations that offer assistance to guarantee security. Security Camera is one of the most common sorts of reconnaissance. This security strategy does not prevent the crime, but helps to identify criminals to law authorization when a wrongdoing happens. There are also security systems, where a security may sound once activated to anticipate guilty parties from assist breaking in. These frameworks ordinarily send a caution to law requirement or a security station, and can be activated inside a certain extend by sound, development. Inaccessible controlled robot of meanderer frame is too accessible. It is not inaccessible controlled and fair serves as another collection of ground-level cameras and an caution. The Security watching independent robot displayed in this report will combine a few innovations to include a robot with capabilities for location and confirmation. It will too act as a preparatory alert gadget, a observation camera, and work in an indoor / open air environment. It can be found in office buildings, shopping centers or indeed bigger homes. Raspberry Pi is a computer measured to a card.

It works nearly indistinguishable to a computer. Different sorts of reconnaissance frameworks are accessible, such as screen, CCTV, etc. In these sorts of observation frameworks, the individual who is stationary and arranged in that region can as it were see what is happening in that area. And here, indeed in spite of the fact that the client voyages from one area to another, he / she can keep track at the correct minute of what is going on in that specific put. Moreover, it gives secrecy on both sides, is another also. Raspbian OS is the working framework which is utilized here.

## II. BLOCK DIAGRAM

Block diagram of the project is shown in figure 1.

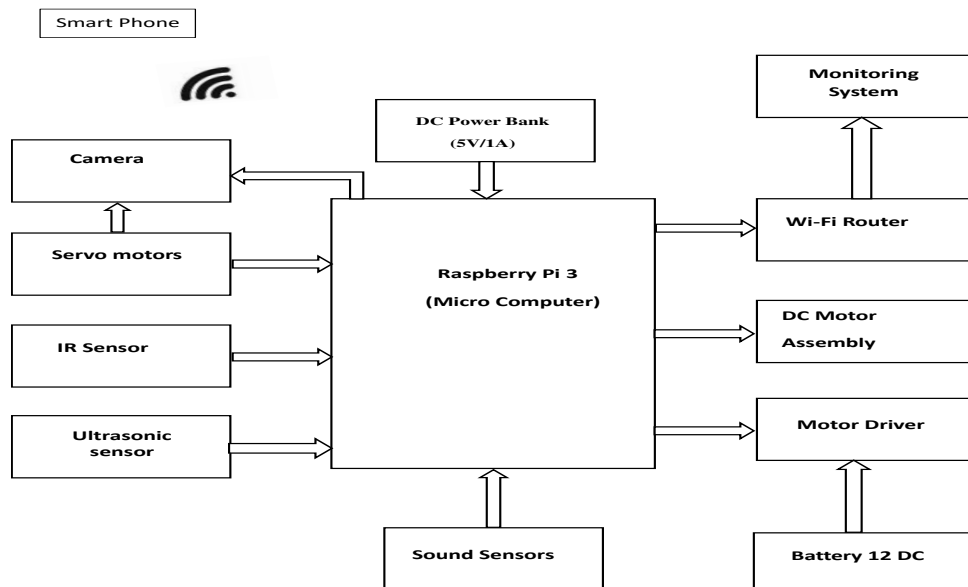


Fig 1

A multi-purpose public safety patrolling robot leveraging a Raspberry Pi as its core control unit incorporates various components for efficient operation and enhanced safety. The Raspberry Pi serves as the central processing hub, interfacing with sensors and actuators to manage the robot's functions. Connected sensors, such as a camera module for visual surveillance, ultrasonic sensors for obstacle detection, and infrared sensors for heat signature detection, provide essential environmental data. The Raspberry Pi processes this data, executing control algorithms and potentially AI models for navigation and threat assessment. A motor controller, controlled by the Pi, drives the robot's motors, enabling mobility. Additionally, communication modules, such as Wi-Fi and optional Bluetooth, facilitate wireless communication with a central control station or other devices. A power supply, typically comprising a battery pack, ensures uninterrupted operation, while safety features like an emergency stop button and collision avoidance algorithms enhance safety in public spaces. This design, integrating Raspberry Pi with a range of sensors and actuators, offers a versatile and cost-effective solution for public safety patrolling robots.

## III. METHODOLOGY

In this proposed framework, Raspberry pi is introduced with the night vision camera which offer assistance the framework to go for the mechanization and offer assistance to discover the human or any issue recognized utilizing the sound sensor and agreeing to the sound delivered it consequently goes to that range and capture the picture and send it to client utilizing IOT.

Robot Section:

- IR Sensor is utilized to make the robot move naturally taking after a path.
- Sound sensor is utilized to make know the sound in specific area.
- IOT is utilized to send the captured picture of the person.
- Connect USB camera with Raspberry pi
- Connect control supply for Raspberry pi.
- Plug the HDM1 cable from screen utilizing VGA to HDM1 converter cable.
- Connect USB mouse and USB console to the Raspberry pi.

**HARDWARE REQUIREMENTS:**

- Raspberry Pi Uno
- DC Motors
- H-Bridge
- IR Sensor
- Sound Sensors
- Ultrasonic Sensor
- Camera

**SOFTWARE REQUIREMENT:**

- Open CV
- Python

**IV. HARDWARE DESCRIPTION**

**a. Raspberry Pi 3 board**

The Pi is a credit-card measured computer that connects to a computer screen or TV and uses input devices like keyboard and mouse. It is able of performing different functionalities such as reconnaissance framework, military applications, surfing web, playing high-definition recordings, live diversions and to make information bases.

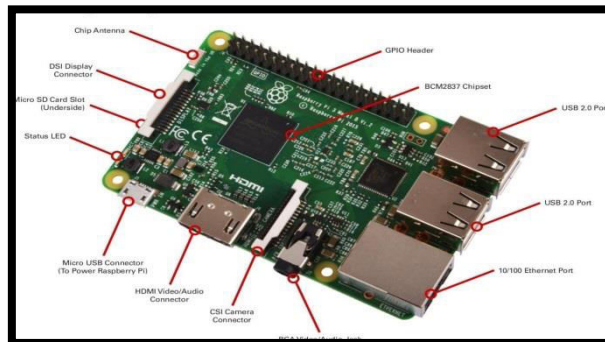


Fig:2 Specification of Raspberry-PI

1. **Processor / SoC (System on Chip):**
2. **Power Source:**
3. **SD Card:**
4. **GPIO – (General Purpose Input Output)**

General-purpose input/output (GPIO) is a nonexclusive stick on an coordinates circuit whose behavior, counting whether it is an input or yield stick, can be controlled by the client at run time. GPIO pins have no uncommon reason characterized, and go unused by default. fig 3 .

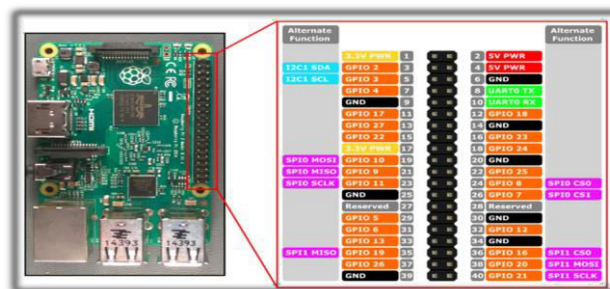


Fig 3: GPIO connector on Raspberry-PI

**b. DC MOTOR and L293d DRIVER**

A machine that changes over DC electrical control into mechanical control is known as a Coordinate Current engine. DC motor working is based on the rule that when a current carrying conductor is set in a attractive field, the conductor encounters a mechanical force.

**1. Working guideline of a DC motor**

An electric motor is an electrical machine which changes over electrical vitality into mechanical vitality. The essential working rule of a DC motor is: "at whatever point a current carrying conductor is set in a attractive field, it encounters a mechanical constrain".

- L293D L293D** is a normal Motor driver or Motor Driver IC which permits DC motor to drive on either heading. L293D is a 16-pin IC which can control a set of two DC motors at the same time in any course. It implies that you can control two DC motor with a single L293D IC. Dual H-bridge Motor Driver coordinates circuit (IC).

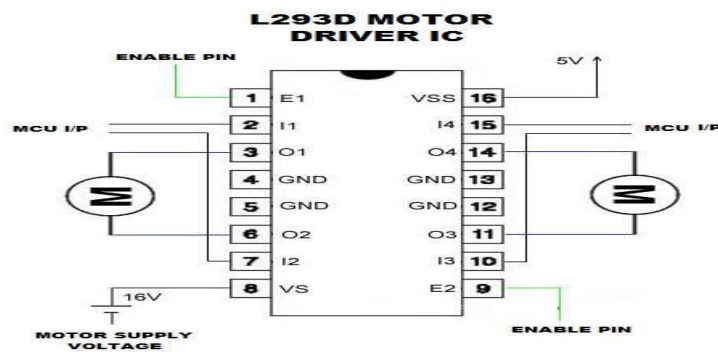


Fig 4

**c. INFRARED SENSOR**



Fig 5

An Infrared Sensor works in the following sequence:

- IR source (transmitter) is utilized to radiate radiation of required wavelength.
- This radiation comes to the object and is reflected back.
- The reflected radiation is identified by the IR collector.
- The IR Receiver recognized radiation is at that point advance processed based on its concentrated. By and large, IR Recipient yield is little and enhancers are utilized to increase the recognized flag.

**d. SOUND SENSOR**

The sound sensor is one sort of module utilized to notice the sound. For the most part, this module is utilized to identify the concentrated of sound. The applications of this module primarily incorporate switch, security, as well as checking. The exactness of this sensor can be changed for the ease of utilization.

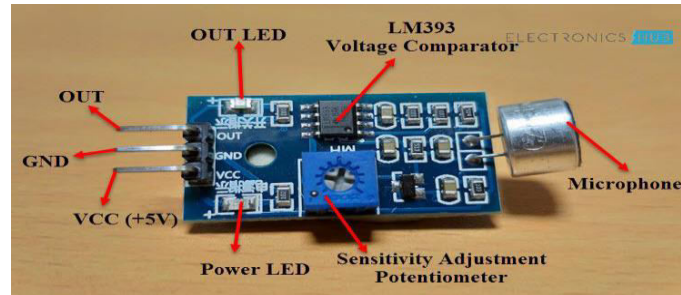


Fig 6

- Pin1 (VCC): 3.3V DC to 5V DC
- Pin2 (GND): This is a ground pin
- Pin3 (DO): This is an output pin

#### e. Ultra Sonic Sensor

An ultrasonic sensor in a patrolling robot emits sound waves and measures the time it takes for the echoes to return, enabling the robot to detect objects and obstacles in its path. This helps the robot navigate and avoid collisions by providing real-time distance measurements. Ultrasonic sensors are essential for ensuring the robot's autonomous and safe movement in varying environments.

#### f. Camera

A typical USB webcam connected to a Raspberry Pi will have the following components:



Fig 7

- **Image Sensor:** Captures the image. Most webcams use CMOS or CCD sensors.
- **Lens:** Focuses light onto the image sensor.
- **Microcontroller:** Manages the camera operations and communication with the Raspberry Pi.
- **USB Interface:** Connects the webcam to the Raspberry Pi, facilitating power and data transfer

### 5. Software Description

Some of the important Software requirements required in our project are:

#### PYTHON

Python is a high-level, interpreted, intelligently and object-oriented scripting language. Python is outlined to be exceedingly discernable. It employs English keywords regularly where as other languages utilize accentuation, and it has fewer linguistic developments than other languages.

#### Python's standard library

- Pandas
- Numpy
- Sklearn
- Seaborn
- Matplotlib
- Importing Datasets
- OpenCV

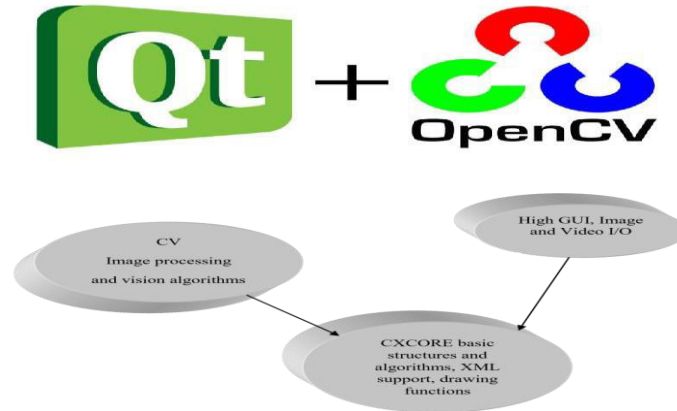


Fig 8

Creating a patrolling robot with a Raspberry Pi involves combining several software components to enable autonomous movement, obstacle detection, and remote monitoring. The Raspberry Pi runs Raspbian OS and utilizes Python as the main programming language. Key libraries include GPIO Zero and RPi.GPIO for motor and sensor control, OpenCV and web camera for image processing, and Flask for building a web interface. The robot's behavior is scripted to move forward, detect obstacles with ultrasonic sensors, capture images using the web camera, and provide real-time monitoring and control through a web interface. This integration enables a versatile and intelligent patrolling robot.

### V. RESULT

The final result of the project "Multi-purpose Public Safety Patrolling Robot" Using a Raspberry Pi, a patrolling robot can effectively navigate and monitor designated areas with enhanced precision and reliability. The Raspberry Pi serves as the central processing unit, integrating various sensors, including ultrasonic sensors, cameras, and GPS modules, to gather environmental data. With its computational power, the Raspberry Pi processes this data in real-time, enabling the robot to detect obstacles, map its surroundings, and make autonomous decisions. This setup allows for efficient and flexible programming, making it possible to implement complex algorithms for path planning, obstacle avoidance, and surveillance tasks. Overall, a Raspberry Pi-based patrolling robot offers a versatile and cost-effective solution for security, monitoring, and maintenance applications.

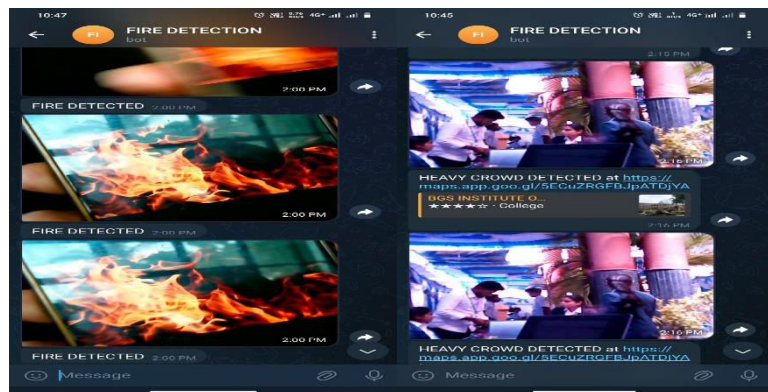
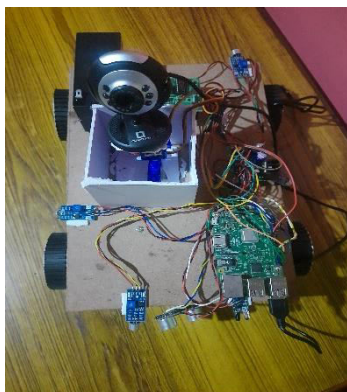


Fig 9

### VI. CONCLUSION

In this project, we have designed and implemented a multi-purpose public safety patrolling robot that can perform various tasks such as surveillance, detection, rescue, and communication in different scenarios. The robot is equipped with sensors, cameras, speakers, and a robotic arm to interact with the environment and the humans. The robot can autonomously navigate in indoor and outdoor settings, using a combination of map-based and map-less methods. The

robot can also coordinate with other robots and human operators to form a cooperative team for patrolling. The robot can adapt to different situations and switch between different modes of operation, such as regular patrolling, adversarial patrolling, and emergency response. The robot can also generate reports and alerts based on its observations and actions.

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