IMPLEMENTATION OF SPY ROBOT FOR SURVEILLANCE SYSTEM USING INTERNET PROTOCOL OF RASPBERRY PI

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ABSTRACT

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 eachand every moment. An essential requirement of this situation is a robot that automatically detectstrespasser at the border and report nearby board security control unit. Many of the military departments now utilize the robots to carry out risky jobs that the soldiers cannot do. In this presentwork, a Raspbian operating system-based spy robot platform with remote monitoring and control algorithm through the Internet of Things (IoT) has been developed which will save human life, reduce 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 the PIR sensor is sent to the users through the web server and the pi camera captures the moving object which is posted inside the webpage simultaneously. The user in the control room can 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 avoid collision. This surveillance system using spy robots can be customized for various fields like industries, banks, and

I.INTRODUCTION

1.1 OVERVIEW OF THE PROJECT

In today's world the robotics field is growing exponentially and some of the popular robotic products are used largely by the industries, defence, academic and research communities. The design and implementation cost of a robot is very less than hiring a human caregiver.The robots can be reprogrammed faster and more efficient.

The robot has sufficient intelligence to cover the largest area to provide a secured space. The intelligent robots can perform preferred tasks in unstructured environments with or without human direction. The real time object detection is required because safety and security are essential in the remote monitoring and control systems such as intelligent homeenvironments, consumer surveillance system, etc.

The real-time human body detection is essential for various fields like home security systems, surveillance systems, communication systems and more. In this modern world, crime has become ultra-modern too! In this current time a lot of incidents occur like robbery, stealing, etc.

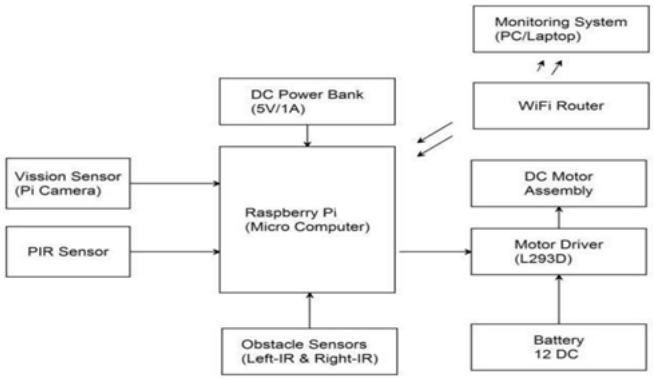
Doors are meant to be secured and to prevent intrusions from unwanted persons. Individuals and cooperate bodies are becoming more aware of the dangers associated with relying on keys and parameter fencing to provide security to exclusive areas of their apartments and organization because criminals and fraudsters can forge keys or makemaster keys that can be used to break into such rooms or offices. So,

the security doesmatter in this daily life.

1.2 OBJECTIVE OF THE PROJECT

The People always remain busy in their day-to-day work also want to ensure the safety of their beloved things. Sometimes they forget to look after their necessary things like keys,wallets, credit cards, etc.

Surveillance literally means to watch from a distance, while surveillance robots are used tomonitor the behaviour, activities, and other changing information that is gathered for the general purpose of managing, directing, or protecting one's assets or position.



II.LITERATURE SURVEY

2.1 EXISTING SYSTEM

In the existing surveillance systems, static cameras or manually operated devices arecommonly used.

These systems have limitations in terms of coverage, flexibility, and real-time monitoring capabilities.

Static cameras are fixed in position, restricting their field of view and making it difficultto monitor large areas or inaccessible locations.

Manual operation of surveillance devices requires human intervention, which can be time consuming and inefficient.

Additionally, the existing systems may not have the ability to transmit real-time videostreams over a network for remote monitoring and control.

2.2 PROPOSED SYSTEM

Spy Robot For A Surveillance System Using Internet Protocol Of Raspberry PI:

The entire proposed system consists of a Processing unit, PIR and IRs sensors, Proximity sensor, Catalytic gas sensor, GPS system, L298N motor driver, Solar panel, Rechargeable battery and robot chassis. ARM cortex M4 could be a processor developed to handle digital signal management and signal processcapabilities.

The combination of high-efficiency signal process practicality with the low

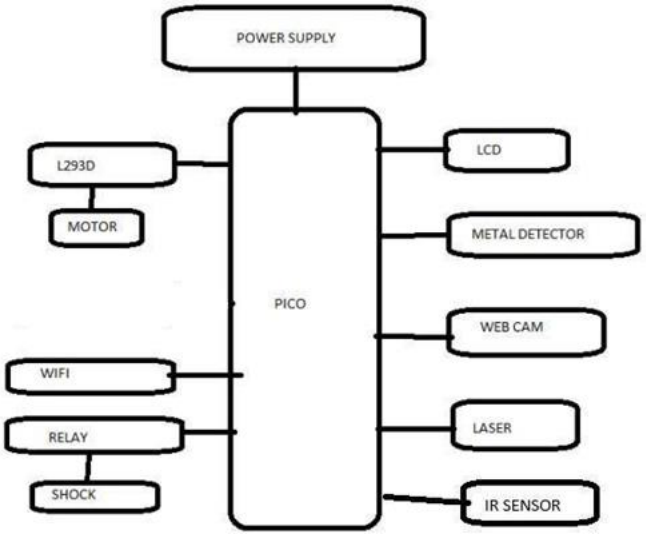
powervalue and ease-o fuse advantages of the cortex-M family processors is intended to satisfy the rising class of versatile solutions specifically targeting the

control, automotive, power management, embedded audio and industrial automation markets. It has designed with Armv7E-M Harvard architecture and 3-stage + branch speculation pipelining.

DSP extension of Single cycle 16/32-bit waterproof, Single cycle twin 16-bit waterproof and 8/16-bit SIMD arithmetic Hardware Divide (2-12 cycles) area unit supplied with it. The GPIO18 (Physical pin 12) of processor is connected to the PIR motion sensor. The GPIO23 (Physical pin 16) and the GPIO24 (Physical pin 18) are connected to the Left IR sensor, and Right IR sensor respectively. The GPIO27 (Physical pin 13) and therefore the GPIO22 (Physicalpin 15) are connected to IN1 and IN2 of L298N module severally, to drive the left motor. The GPIO20 (Physical pin 38) and the GPIO21 (Physical pin 40) are connected to IN3 and IN4 of L298N module respectively, to drive the right motor.

The Night vision Camera is 5MP static sensitive type camera. The camera module is connected to CSI port of processor. A Passive Infrared (PIR) sensor is a pyro electric device which detects level of IR radiation from the livingobjects. The PIR device does not emit IR signal, rather passively detects the infrared radiations coming back from the body within then compassing space. The PIR sensor has a bunch of supporting circuitry. The detected infrared pulses are passed to FET amplifier circuit which will reset or set the sensor output.

BLOCKDIAGRAM



III.HARDWARE COMPONENTS

ARM Processor

The Raspberry Pi is a credit-card-sized single-board computer developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools. The Raspberry Pi is manufactured through licensed manufacturing deals with Newark element14 (Premier Farnell), RS Components and Egoman. All of these companies sell the Raspberry Pi online. Egoman produces a version for distribution solely in China and Taiwan, which can be distinguished from other Pi by their red coloring and lack of FCC/CE marks. The hardware is the same across all manufacturers.

The Brand New Raspberry Pi Zero Wireless WH (with Pre-Soldered Header) has landed at Modify The Raspberry Pi Zero is an ultra-low-cost and ultra-small variant of the original Raspberry Pi. It's tiny, measuring just 65mm x 30mm, and is perfectly designed for embedded applications, wearables, prototyping and any other Pi-based tinkering you can think of, on a micro scale! The Raspberry Pi Zero Wireless features onboard Wireless Internet & Bluetooth for all your connectivity needs!

The Raspberry Pi Zero features a BCM2835 chipset, overclocked to 1Ghz with 512MB RAM, and the same 1080p video output, so there's plenty of oomph in that little board. It also features the same 40 pin GPIO layout as the Raspberry Pi 2/B+/A+, which you'll need to solder your own headers too. With its small form factor and reduction in connectors, the Raspberry Pi Zero only uses ~ 140mA at 5V! Unlike it's larger brothers and sisters, the Raspberry Pi Zero has an unpopulated GPIO, unpopulated composite (RCA) header and an unpopulated reset header. There's also no DSI screen port, no ethernet, no analog audio and no full-sized USB ports. Instead, the Pi Zero features a micro-USB power port, a micro-USB OTG host port (for peripherals e.g. WiFi dongle), and a mini-HDMI port for video.

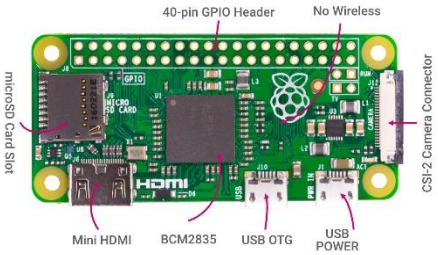


Figure 3.2: Raspberry pi zero

3.3 POWER SUPPLY:

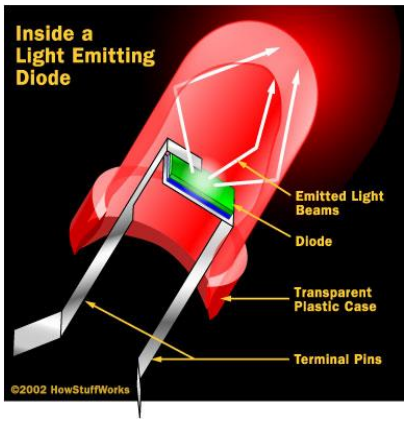
Adapter : The AC adapter, AC/DC adapter or AC/DC converter is a type of external power supply, often enclosed in a case similar to an AC plug. Other names include plug pack, plug-in adapter, adapter block, domestic mains adapter, line power adapter, wall wart, or power adapter. AC adapters are used with electrical devices that require power but do not contain internal components to derive the required voltage and power from mains power. The internal circuitry of an external power supply is very similar to the design that would be used for a built-in or internal supply.

External power supplies are used both with equipment with no other source of power and with battery-powered equipment, where the supply, when plugged in, can sometimes charge the battery in addition to powering the equipment.

Use of an external power supply allows portability of battery-powered equipment without the added bulk of internal power components and makes it unnecessary to produce equipment for use only with a specified power source

3.4. LED:

A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practical electronic component in 1962, early LEDs emitted low-intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness. The internal structure and parts of a led are shown in figures 3.4.1 and 3.4.2 respectively.



LCD DISPLAY

LCD Background: One of the most common devices attached to a micro controller is an LCD display. Some of the most common LCD's connected to the many microcontrollers are 16x2 and 20x2 displays. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

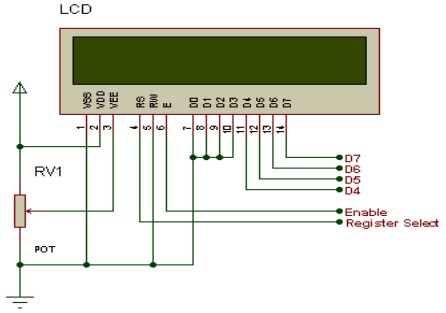


Figure : LCD Pin diagram

Battery power supply:

A battery is a type of linear power supply that offers benefits that traditional line-operated power supplies lack: mobility, portability and reliability. A battery consistsof multiple electrochemical cells connected to provide the voltage desired. Fig: showsHi- Watt 9V battery

Fig. : Hi-Watt 9V Battery

The most commonly used dry-cell battery is the carbon-zinc dry cell battery. Dry- cell batteries are made by stacking a carbon plate, a layer of electrolyte paste, and a zinc plate alternately until the desired total voltage is achieved. The most common dry-cell batteries have one of the following voltages: 1.5, 3, 6, 9, 22.5, 45, and 90. During the

discharge of a carbonzinc battery, the zinc metal is converted to a zinc salt in the electrolyte, and magnesium dioxide is reduced at the carbon electrode. These actions establish a voltage of approximately 1.5 V.

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 calleda passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. 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 that is sensitive to IR light of the same wavelength asthat emitted by the IR LED. When IR light falls on the photodiode, the resistances and theoutput voltages will change in proportion to the magnitude of the IR light received.

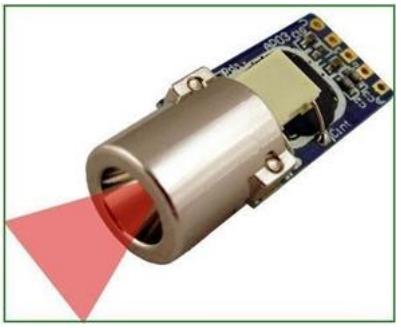


Fig. IR Sensor

METAL DETECTOR INDUCTIVE

- SENSE FERROUS & NON-FERROUS METAL OBJECTS TO "ZERO SPEED"
- 2-WIRE CURRENT SOURCE (NAMUR) & 3-WIRE NPN TRUE OPENCOLLECTOR OUTPUTS
- 5 SIZES & 3 SENSING DISTANCES FOR APPLICATIONVERSATILITY
- L.E.D. TARGET INDICATOR (PSA 2B, 6B, 7B, & 8B)

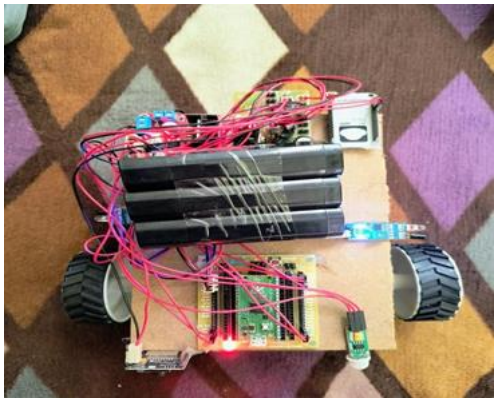
ESP 32

The ESP32-CAM is a small size, low power consumption camera module based on ESP32.It comes with an OV2640 camera and provides onboard TF card slot.

The ESP32-CAM can be widely used in intelligent IoT applications such as wireless video monitoring, WiFi image upload, QR identification, and so on.

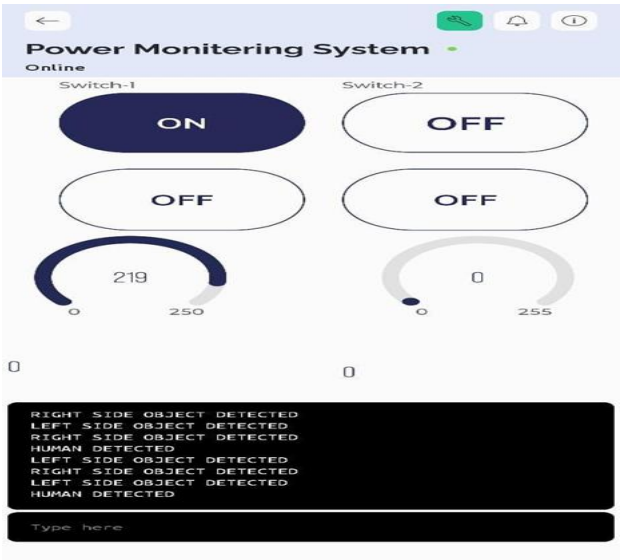
IV.WORKING OF PROJECT

Power on the spy robot, and the Raspberry Pi boots up the operating system. Connection Establishment:Connect the robot to a Wi-Fi network or other communication channels, allowing it toaccess the internet.



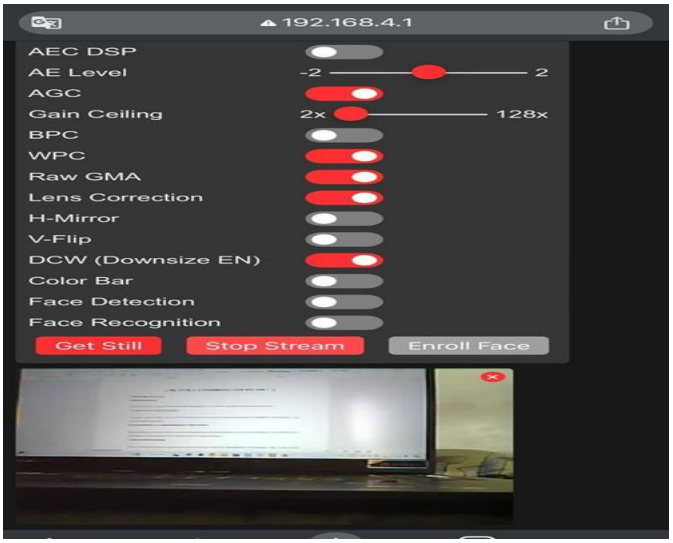
User Control or Autonomous Operation:

Depending on the mode selected (manual or autonomous), the user controls the robot or it navigates autonomously using built-in algorithms.



Camera Streaming:

The camera module captures video footage, and the Raspberry Pi streams the video feedover the internet using the implemented IP-based communication protocol.



Remote Monitoring:

Users can remotely monitor the video feed through a web-based interface, receiving real-time updates on the surveillance area.

Obstacle Avoidance:

The robot utilizes sensor data to detect obstacles and adjust its path accordingly, ensuringsafe navigation.

Data Processing:

If video analytics features are implemented, the Raspberry Pi processes the video datausing the designated algorithms. **Alerts and Notifications:**

Implement alerts or notifications based on predefined criteria, such as detecting a specificobject or unusual activity.

Security and Privacy:

Ensure that the communication channel is secure, and implement measures to protect theprivacy of individuals within the surveillance area.

Continuous Operation:

The spy robot continues its surveillance operation until instructed otherwise or until itsbattery needs recharging.

This working process provides a basic framework, and the specific implementation details may vary based on the project requirements and desired features. Continuous testing and refinement are essential to optimize the performance and reliability of the spy robot surveillance system.

V.CONCLUSION

The Spy Robot used for this secure purpose can operate effectively in order to collect various types of information that required by users. For instance, the presence or absence of the unwanted folks in war areas whose are not allowed in such areas can be determinedby the PIR sensor which sends a signal to the Raspberry Pi when a human - being

is in the ambient of the Robot. In turn, the Pi triggers the camera module immediately to capture an image and send it to the web page. The PIR sensor and proximity sensors are activated depend on external stimuli via IoT. The control room collects this information for later reference. The brain of the spy robot is the Raspberry Pi minicomputer. The Robot is operated by three modes. Firstly, only run the code and leave the Robot to navigate freely based on the sensor status. Secondly, control the moving to a specific direction by the Laptop Keyboard. Thirdly, monitor the information available on the web page, and control accordingly with various buttons.

VI.FUTURE SCOPE

The implementation of a spy robot for a surveillance system using Internet Protocol (IP) and Raspberry Pi opens up several exciting possibilities. Here are some potential future scopes for such a project:

1. Enhanced Mobility and Navigation:

- Implement advanced navigation algorithms to enhance the robot's mobility, allowing itto navigate through complex environments autonomously.
- Integration with sensors like LiDAR and advanced computer vision for obstacleavoidance and efficient path planning.

2. Real-time Video Analytics:

- Incorporate real-time video analytics using machine learning algorithms to detect andrecognize objects or people of interest.
- Implement features such as facial recognition, object tracking, and anomaly detectionfor more intelligent surveillance.

3. Integration with AI Assistants:

- Integrate the spy robot with popular AI assistants like Amazon Alexa, Google Assistant, or others, allowing users to control and interact with the robot using voice commands.

4. Edge Computing for Faster Processing:

- Utilize edge computing capabilities on the Raspberry Pi to process data locally, reducinglatency and enabling faster response times for critical surveillance tasks.

REFERENCES

[1] J. Zhang, G. Song, G. Qiao, T. Meng and H. Sun, "An indoor security system with a jumping robot as the surveillance terminal," in IEEE Transactions on Consumer Electronics, vol. 57, no. 4, pp. 1774-1781, November 2011.

[2] G. Song, Z. Wei, W. Zhang and A. Song, "A Hybrid Sensor Network System for Home Monitoring Applications," in IEEE Transactions on Consumer Electronics, vol. 53, no. 4,pp. 14341439, Nov. 2007.

[3] W. Lao, J. Han and P. H. n. De With, "Automatic video-based human motion

analyzer for consumer surveillance system," in IEEE Transactions on Consumer Electronics, vol. 55, no. 2, pp. 591-598, May 2009.

[4] C. Micheloni, G. L. Foresti, C. Piciarelli and L. Cinque, "An Autonomous Vehicle for Video Surveillance of Indoor Environments," in IEEE Transactions on Vehicular Technology, vol. 56, no. 2, pp. 487- 498.

[5] K. S. Kumar, S. Prasad, P. K. Saroj and R. C. Tripathi, "Multiple Cameras Using Real Time Object Tracking for Surveillance and Security System," 2010 3rd International Conference on Emerging Trends in Engineering and Technology, Goa, 2010, pp. 213-218.

[6] M. S. Mukundaswamy and G. L. Bhat, "Embedded controller based wireless power monitoring and controlling," 2015 International Conference on Emerging Research in Electronics, Computer Science and Technology (ICERECT), Mandya, 2015, pp. 392-397.

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