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Design and Implementation of Advanced Long Range Real Time Surveillance Robo Using Raspberry Pi Board

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***ABSTRACT*: Security is desperately needed, particularly at homes, workplaces, military installations, and border crossings. Demand for security systems that might safeguard people, property, and international borders has long been high. This project intends to provide monitoring in extremely sensitive places without endangering human life, such as border zones, terrorist hotspots, and large structures. In this project, a 360-degree night vision camera and an Android smartphone are connected to a Raspberry Pi for surveillance purposes via Wi-Fi. This robotic vehicle implementation with real-time video feedback is managed via a webpage over the internet. Via our smartphone, we can view the photos and videos that the surveillance robot took. The camera offers a real-time surveillance.**

***Keywords:* Raspberry pi, Surveillance System, Live Streaming, Security, Mobile Application, Gesture Control**

INTRODUCTION

It is difficult to manually examine or monitor a wide region since it takes a lot of time to patrol it. In a similar vein, installing several cameras at various locations is necessary if we utilize cameras for surveillance in order to cover the whole region. Even if we have to monitor a big building with multiple stories, we also have to install a lot of cameras on each floor. In the end, this strategy raises the surveillance system's cost. In order to overcome these obstacles, we have created a surveillance robotic car for this project. Thanks to its mobility, it can be used to conveniently monitor or examine a wide region. The implementation specifics of this Internet of Things-based system, which was created utilizing. One type of computer system that is primarily made to do several jobs, such as accessing, processing, storing, and controlling data in various electronics-based systems, is called an embedded system. Hardware and software are combined to create embedded systems; the software is typically referred to as firmware and is embedded inside the hardware. One of these systems' most crucial features is that it provides the output within the allotted time. Embedded systems help to improve the efficiency and convenience of work. Thus, embedded systems are widely used in both basic and complicated devices.

In our daily lives, embedded systems are mostly used in a variety of gadgets such as microwaves, calculators, TV remote controls, home security systems, and traffic control systems in our neighborhoods. An
embedded system needs a hardware platform to operate on, just like any other electronic system. Hardware for embedded systems is constructed using microprocessors or microcontrollers. The user interface, memory, input/output (I/O) interfaces, and display system software are components of the embedded system hardware. A certain task is written into the embedded system software. Usually, it is written in a high-level format and then compiled to produce code that can be stored in the hardware's non-volatile memory. An embedded system needs a hardware platform to operate on, just like any other electronic system. Hardware for embedded systems is constructed using microprocessors or microcontrollers. The user interface, memory, input/output (I/O) interfaces, and display system software are components of the embedded system hardware.A certain task is written into the embedded system software. Usually, it is written in a high-level format and then compiled to produce code that can be stored in the hardware's non-volatile memory. There are three different steps involved in turning your embedded software's source code representation into an executable binary image:1. To create an object file, every source file needs to be compiled or assembled.2. In order to create a single object file known as the re-locatable program, all of the object files that emerge from the first step must be linked together.3. The relocation procedure is the assignment of physical memory addresses to the relative offsets inside the relocatable software.The last step yields a file with an executable binary image that can be loaded onto the embedded system and run.

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LITERATURE SURVEY

An overview of related research work has been presented in this section. Several authors carried out work using IoT andRaspberry Pi. Mayank Dharaskar et al. [2018] proposed IOT Based Surveillance Robotic Car Using Raspberry PI

[1]. In this paper authors have used raspberry pi working on Raspbian OS. As the communication is done with the help of internet so limitation of range of operation does not arise and one can easily monitor as well as control the activity of the robotic unit from any remote areas. G. Anandravisekar et al. [2018] proposed IOT based surveillance robot

[2]. In this paper, a framework for making a robot for surveillance purpose is presented. This robot can be controlled with the help of laptop/mobile manually and at the same time automatic monitoring can also be done. Wireless technology is used to serve this project as a supreme part of surveillance act. This provides highly efficient and a cost effective robot that replaces human work and reduces human labour and performs the monitoring works in a well effective manner. Abdalla et al. (2017) proposed Implementation of spy robot for a surveillance system using Internet protocol of Raspberry Pi

[3]. 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 © 2021 IJSRET 1285 International Journal of Scientific Research & Engineering Trends Volume 7, Issue 3, May-June-2021, ISSN (Online): 2395-566X drive control buttons on the webpage. The movement of a robot is also controlled automatically through obstacle detecting sensors to avoiding the collision. Harshitha et al. (2018) proposed Surveillance Robot Using Raspberry Pi and IoT

[4]. This paper addresses the issue of remote surveillance and monitoring of our homes particularly when we are outside and our kids are at home. Authors have put forward a surveillance robot whose base controller is powerful Raspberry Pi 3 Model B. A webcam attached to the Pi monitors the area and sends a notification when any trespassing is detected. The camera also possesses face recognition algorithm which possess the ability to identify the person responsible for the motion triggering. When an unauthorized person is the trespasser, then the notification will be sent and also live streaming of the webcam feed gets activated. Shalvi Patil et al. [2020] proposed Internet Controlled Techrobot using Raspberry Pi

[5]. In this research project, authors have carried out rigorous task of design and implementation of robot for Home automation. This robotic vehicle was controlled via internet. It also used the camera mounted on the robot that can wirelessly transmit real time video using Wi-Fi technology. The camera mounted on the robot will keep on capturing the videos from the surroundings to keep a record of the details of the incident happened and this is readily available to user and only the authenticated users can see the recorded details. It also describes the use of obstacle detector mounted on the robot. In the presence of obstacle, the robot will stop and take turns. In presence of metal it will give buzz sounds. In darkness, it will turn on the LED'S to show path.

EXISTING SYSTEM:

Because the current systems rely on RF technology, Zigbee, and RF, the robots in them have a restricted communication range. Short-range wireless cameras are used in some current projects. Certain current robots can only be operated manually, requiring human oversight over the entirety of the surveillance procedure.

DRAWBACKS OF EXISTING APPROACH:

- It takes a lot of time;
- It can lose connection under certain circumstances;
- It is not an exact approach.

PROPOSED SYSTEM:

This is an internet of things (IOT) project in which the robotic automobile setup is built using a Raspberry Pi, an IP webcam, two DC motors, and a robot chassis. The intriguing thing about this robot is that we can operate and move it from a web browser over the internet. It has a web camera mounted over it, so we can watch a live video feed. Since we can operate it via a webpage, we can also operate it with other smart devices that are compatible with webpages. By clicking on the links on the which indicate Left, Right, Forward, and Backward, we will be able to move the robot in any way. We refer to this as "Motion" here. To obtain real-time video data from an IP camera. This data will be shown to the user on their monitor. The robotic vehicle will be controlled by the user based on the intended movement.

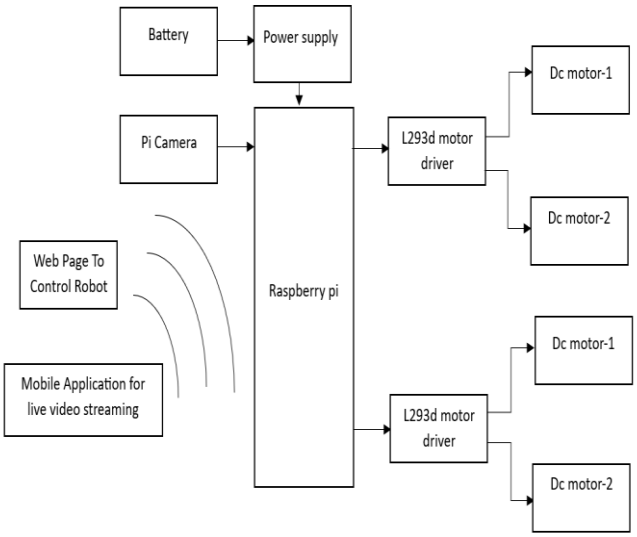

fig.1.1 Proposed Block Diagram

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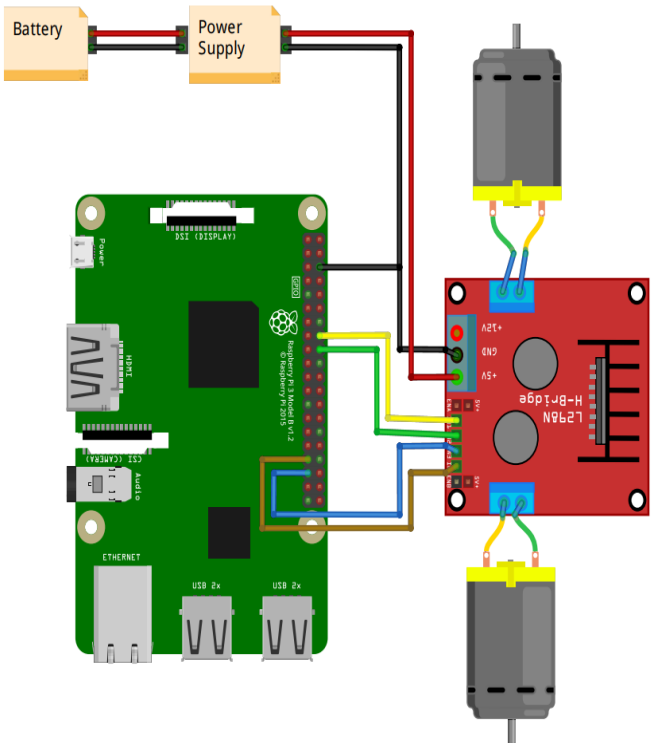

fig.2.1 Circuit Diagram

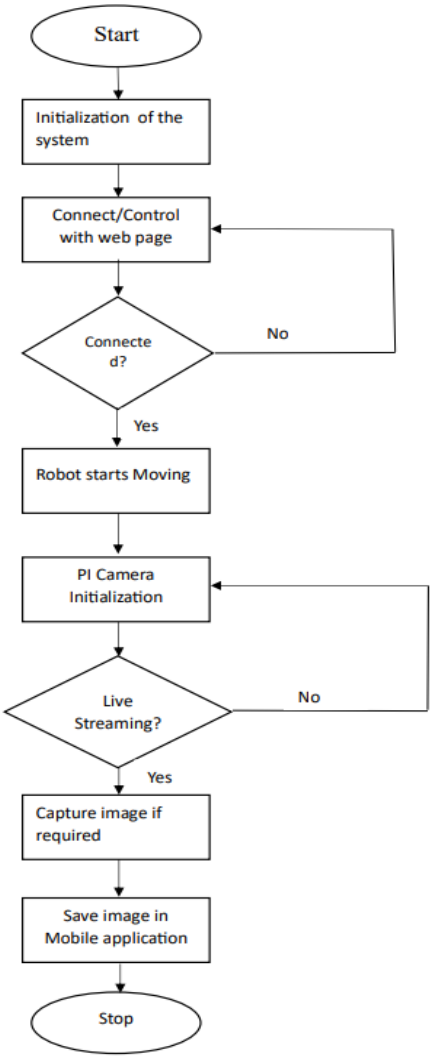

fig.3.1 Flow Chart

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REQUIRED COMPONENTS

A)HARDWARE REQUIREMENTS

1.RASPBERRY PI:

A mainstay in the fields of small-scale computing applications, educational projects, and DIY electronics, the Raspberry Pi is a small and multipurpose single-board computer. The Broadcom system-on-a-chip (SoC), which is developed by the Raspberry Pi Foundation, gives this credit card-sized computer a lot of power. It usually has an ARM-based processor, RAM, USB ports, HDMI output, and GPIO (General Purpose Input/Output) connections. The Raspberry Pi stands out because to its accessibility, cost, and strong community support. It is compatible with multiple Linux distributions and provides a stable foundation for a wide range of projects, from simple beginner programming exercises to complex applications in robotics, home automation, and other fields. Because of its open-source design and wide selection of compatible accessories, the Raspberry Pi is a great option for professionals, educators, and hobbyists looking for an affordable, flexible computing solution for a variety of creative projects. The Raspberry Pi foundation created the credit-card-sized Raspberry Pi computer in the United Kingdom with the goal of teaching computer science fundamentals to students and anyone else interested in computer hardware, programming, and do-it-yourself projects.RS Components, Egoman, and Newark element 14 (Premier Farnell) have licenses to manufacture three different board versions of the Raspberry Pi. These businesses offer Raspberry Pi for sale online. A variant made by Egoman that is only sold in China and Taiwan is identifiable from other Pis by its red color and absence of FCC/CE markings. Every manufacturer uses the same hardware.

fig.4.1 Diagram of Raspberry pi

2.BATTERY:

A rechargeable battery is an energy storage device that can be charged again after being discharged by applying DC current to its terminals. Rechargeable batteries allow for multiple usages from a cell, reducing waste and generally providing a better long-term investment in terms of dollars spent for usable device time. This is true even factoring in the higher purchase price of rechargeable and the requirement charger. A rechargeable battery is generally a more sensible and sustainable replacement to one-time use batteries, which generate current through a chemical reaction in which a reactive
anode is consumed. The anode in a rechargeable battery gets consumed as well but at a slower rate, allowing for many charges and discharges.

fig.5.1 Diagram of Battery

3.IP CAMERA:

When it comes to surveillance technologies, adding an IP camera is essential to enhancing our robotic system's capabilities. Our Internet of Things (IoT)-based surveillance robotic automobile can record and send high-definition video feeds via the network by adding an IP camera. This IP camera expands our monitoring capabilities outside the immediate physical vicinity in addition to acting as the robotic entity's eyes. By utilizing Internet Protocol (IP), the camera allows for smooth connectivity and allows users to view live video feeds remotely, keep an eye on their surroundings, and make decisions instantly. Our robotic car's capacity to see objects is improved with the addition of an IP camera, which also highlights the scalability and flexibility of contemporary surveillance systems.

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fig.6.1 Diagram of IP Camera

4.DC MOTOR:

Our lives have been completely transformed by this incredible piece of electrical machinery, but who created the DC motor? Like any significant innovation, the creation of such mechanisms involved a large number of individuals. Thomas Davenport is credited with creating the first electric motor in the United States, and it is undeniable that he was the first to patent a workable electric motor in 1837. However, at the time Davenport filed his invention, a number of European inventors had already created more potent versions of the electric motor, therefore he was not the first to make one.

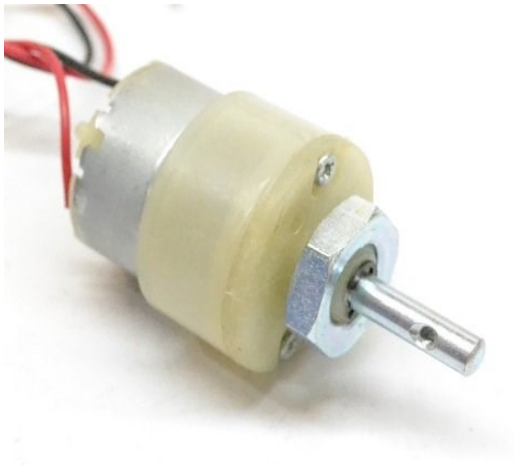

Fig.7.1 Diagram of DC Motor

5.L293D MOTOR DRIVER:

To make controlling DC motors easier, the L293D is a twin H-bridge motor driver integrated circuit that is frequently used in robotics and electronics projects. Its twin H-bridge design enables bidirectional movement by providing independent control over two motors or one stepper motor. The L293D is adaptable and appropriate for a range of motor types, with a voltage compatibility of typically up to 36V and the capacity to handle currents of up to 600mA per channel (1.2A peak). Its 16-pin dual-in-line (DIP) package has integrated protective diodes, power supply connectors, and pins for controlling the direction and speed of the motor. Because users may control these input pins to specify motor movement, the L293D is a good choice for robotics, automation, and electronics projects.

Fig.8.1 Diagram of L293d Motor Driver

B)SOFTWARE REQUIREMENTS

1.PYTHON IDLE:

The built-in integrated development environment for the Python programming language is called Python IDLE, or Integrated Development and Learning Environment. This feature-rich integrated development environment (IDE) makes authoring, running, and debugging Python programs easier. Developers have the ability to run Python commands in an interactive shell within IDLE, which makes it easy to test and explore. To further improve the scripting experience, IDLE comes with a script editor that has features like code completion and syntax highlighting. With features like breakpoint setup and variable inspection during runtime, the integrated debugger helps find and fix issues. IDLE accommodates both novices and experts with its built-in help system and file explorer for simple project navigation and quick access to Python documentation. While ideal for smaller projects, more sophisticated IDEs like PyCharm or Visual Studio Code may be preferred by certain developers for more ambitious and difficult tasks.

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RESULTS:

The surveillance robot in this project is fully operational and able to watch and surveil large areas in real time. In order to provide mobility, camera feed, and control capabilities, the built system successfully incorporates hardware components such as the Raspberry Pi board, L293D motor
driver, IP camera, and power supply. Users are able to remotely control the motions of the robot and view live video feeds thanks to the software, which was created using Python IDLE and allows smooth communication between the hardware components. Through rigorous testing, the project showcases the surveillance robot's competence and dependability in a variety of settings, highlighting its capacity to negotiate obstacles, record crystal-clear video, and provide data instantly.

All things considered, the project is successful in accomplishing its goals of developing and deploying a sophisticated monitoring system with readily available and reasonably priced technology.

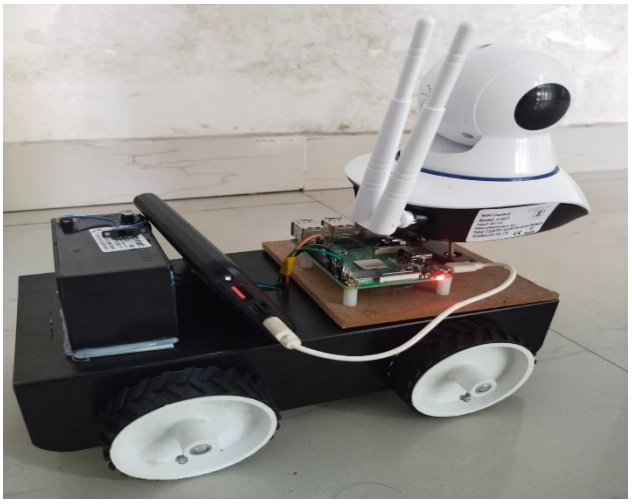

Fig.9.1 Final hardware implementation

Fig.10.1 Gestures to control Robot

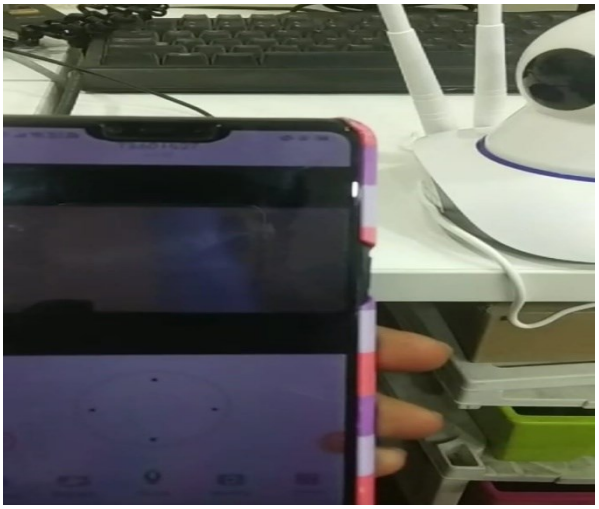

Fig.11.1 Surveillance of camera through v380 app

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FUTURE SCOPE

There are numerous exciting avenues for growth and development in the future. The robot's ability to recognize and react to various threats or anomalies in its surroundings can be expanded by incorporating more sensors and technology, such as gas sensors or thermal imaging cameras. This would increase its usefulness in more contexts, such as emergency response, environmental monitoring, and industrial safety. Additionally, by creating smartphone applications for remote monitoring and control and incorporating gesture- or voice-based interfaces, the system's accessibility and usability can be increased, making it easier for operators to communicate with the robot. Last but not least, looking into integration possibilities with smart city or smart home infrastructure can facilitate the surveillance system's smooth integration into larger IoT ecosystems, enabling more effective data sharing and coordination with other linked systems and devices.

CONCLUSION

This project has great educational value in addition to providing a workable option for surveillance. The project provides students and hobbyists with hands-on experience in robotics, IoT, and embedded systems. It is an accessible platform for learning these topics. Exploring the intricacies of contemporary technologies is made tangible and interesting by the integration of sensors, cameras, and the Raspberry Pi. The project also fosters critical thinking and problem-solving abilities by having users work through programming, hardware integration, and system optimization difficulties. The Internet of Things (IoT)-based surveillance robotic automobile serves as a useful teaching tool that encourages people to explore the fields of automation and smart systems by connecting theoretical knowledge with real-world application. Projects like these are essential to developing the skills required for the next generation of engineers and innovators as technology continues to improve.

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