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IOT Based Surveillance Robotic Car Using Raspberry Pi

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***Abstract*- Robots have found a drastically increasing demand in day-to-day life. In this present work, a Raspberry Pi based spy robot with remote monitoring and control through Internet of Things (IoT) has been developed. Because of IoT feature, it overcomes the problem of limited range surveillance. The spy robot system comprises the Raspberry Pi (small single-board computer), night vision pi camera and sensors. This robot can be controlled with the help of laptop/mobile. The proposed robot is small in size thus capable of manoeuvring into area where human access is not easily possible. This surveillance system using spy robot can be customized for various fields like industries, banks and shopping malls. This system will save human live, and protect the country from enemies. We have also developed a webpage consisting of Graphical User Interface (GUI) application to facilitate the robot control. The live streaming ability of the Pi allows the camera feed to be analysed from any location using internet.**

***Keywords*- Raspberry Pi, Robot, Webpage, Python, Pi Camera, Surveillance.**

I. INTRODUCTION

Manually inspecting or monitoring a large area is challenging as it will take a long time to patrol a large area. Similarly, if we use camera for surveillance, then also we need to install a number of cameras at different places to cover the entire area. Even if we are required to do the surveillance of a large building with many levels, then also we are required to install many cameras at each floor. This approach ultimately increases cost of the surveillance system.

To address these challenges, in this project, we have designed surveillance robotic car which can be used to monitor or inspect the large area easily because of moving ability. The paper presents the implementation details of this IoT based system developed using Raspberry PI.

The Raspberry pi is working as a small computer. We can integrate camera and other sensor onto this robotic system to get real time video feed and sensor values. By using PIR sensor, we can capture the movement of a person located at a particular place in real time. The other big advantage is the proposed system is that it is easy to design and easy to use.

In this system, Raspbian OS is used to transmit the image to the control unit. This type of Surveillance robot can also be used for military purposes. In this project, we use the internet to establish communication between the user and a robotic vehicle.

By using this internet, we get continuous video feedback to control the robot. Due to the use of the web, there is no limitation on the range or distance between the user and the robotic vehicle.

II. LITERATURE SURVEY

An overview of related research work has been presented in this section. Several authors carried out work using IoT and Raspberry 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

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.

III. METHODOLOGY

The block diagram of the project represented in Fig.1 consists of components like Raspberry Pi 3B Model, Raspberry Pi camera Module, DC Motor, L293D Motor driver, Power supply (Battery), Laptop/Smartphone, and Sensors. All these components are described in this section.

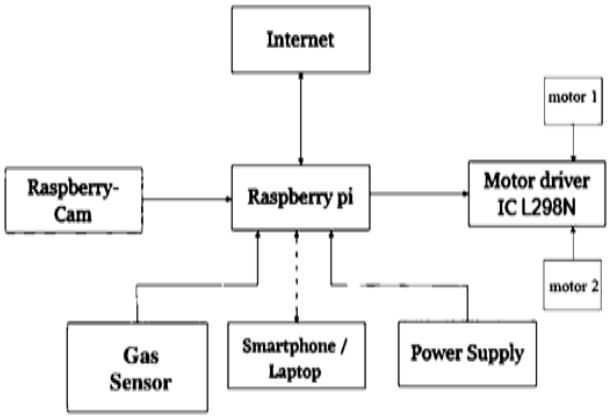

Fig 1. Block Diagram.

Flow Chart:
Figure 2 represents the flow chart of this project.

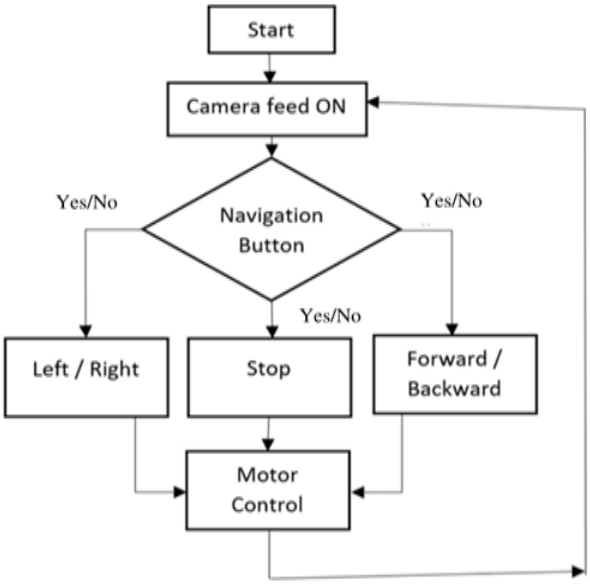

Fig 2. Flow Chart.

1. Raspberry Pi 3:
Raspberry Pi is used for making robot wireless and web based. Raspberry Pi camera videos are transmitted wirelessly from the robot to the user's monitor, from where the user can conveniently control the robotic vehicle's movement and also the robotic arm movement.

Raspberry pi is connected with the dongle which enables raspberry pi to transmit over the web network. Raspberry-Pi Module, as shown in F uses an SD card for booting and for memory as it doesn't have an inbuilt hard disk for storage.

Fig 3. Raspberry Pi 3 Model B.

Raspberry Pi requires 5 volt supply with minimum of 700-1000 mA current and it is powered through micro USB cable. The core ARM11 requires only 3.3 volt of supply which it takes with the help of linear regulator. It operates at 700M Hz. We use python or embedded C to write code

into the raspberry pi. It has a strong processing capability due to the ARM11 architecture and Linux-based system.

In terms of interface and control, it has 1 SPI, 1 UART, 1 I2C and 8 GPIO, which basically meets the control requirements. There are easy to use open source peripheral driver libraries.

2. Raspberry Pi Camera Module:
The Pi camera module, as shown in Fig. 4 is a portable light weight camera that supports Raspberry Pi. It communicates with Pi using the camera serial interface protocol, whose interfacing pins are represented in Fig.5. It is normally used in image processing, machine learning or in surveillance projects. It is commonly used in surveillance drones since the payload of camera is very less.

Apart from these modules Pi can also use normal USB webcams that are used along with computer. It is 5MP colour camera module without microphone for Raspberry Pi, and supports both Raspberry Pi Model A and Model B.

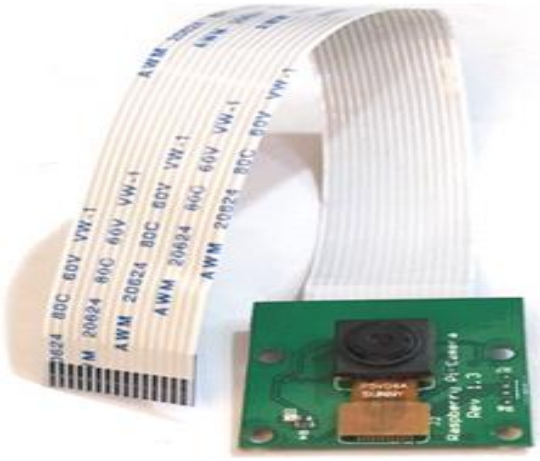

Fig 4. Pi Camera Module.

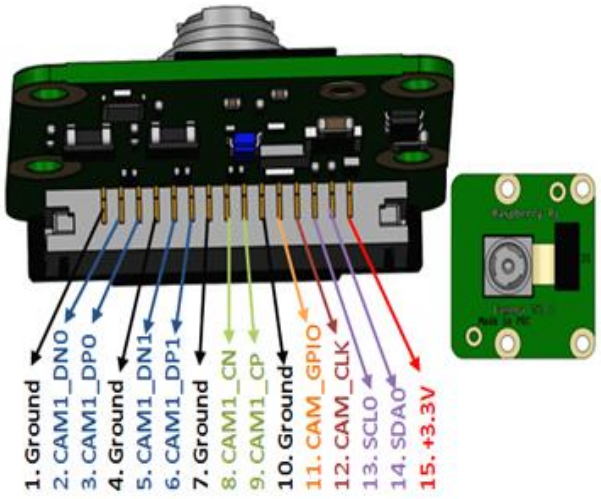

Fig 5. Pi Camera Pinout.

It has Omnivision 5647 Camera Module with resolution of 2592 * 1944. It Supports 1080p, 720p and 480p video Quality. It is Light weight and portable (3g only).

3. Motor Driver IC L293D:
Usually, the current required by the DC motor is more than what is available at the Raspberry Pi pins. Therefore, when we need to control the DC motor through Raspberry Pi, Motor driver ICs are required to boost the current level.

Fig.6 shows the L293D motor driver which allows the driving of the DC motor in the desired direction. This IC consists of 16-pins that can be used to control two DC motors simultaneously.

The current capacity of this driver is 600 mA, thus using this we can drive small and medium-sized motors.

Fig 6. Motor Driver IC L293D Module.

4. DC Motor:
The project requires two geared 12-volt dc motors of 100 rpm for the movement of the wheel. These motors are driven by the motor driver L293D module to boost the current as motors require more current to work properly.

Similarly, another 12V dc motor of 1000 rpm is used to rotate the cutter blade fitted onto the robot. The motor used in the project is shown in Fig.7.

Fig 7. DC Motor.

5. MQ-3 Gas Sensor:
MQ 3, shown in Fig.8, is Alcohol, Ethanol, and Smoke sensor. It requires 5VDC with current of about 165 mA. It is connected to Raspberry Pi which gives output when Gas Leakage is occurs.

Fig 8. MQ 3 Gas Sensor.

IV. RESULTS AND DISCUSSUION

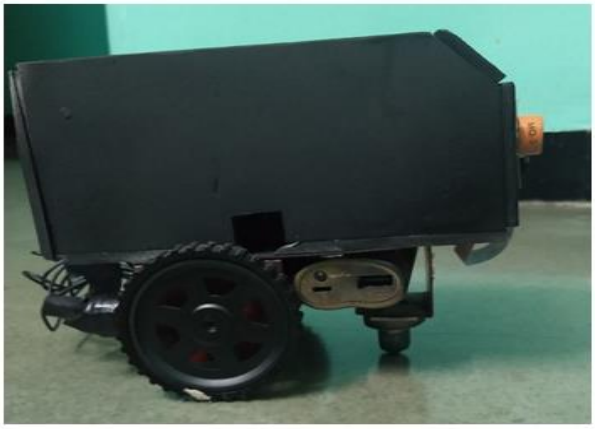

Fig 9. Side View of Hardware.

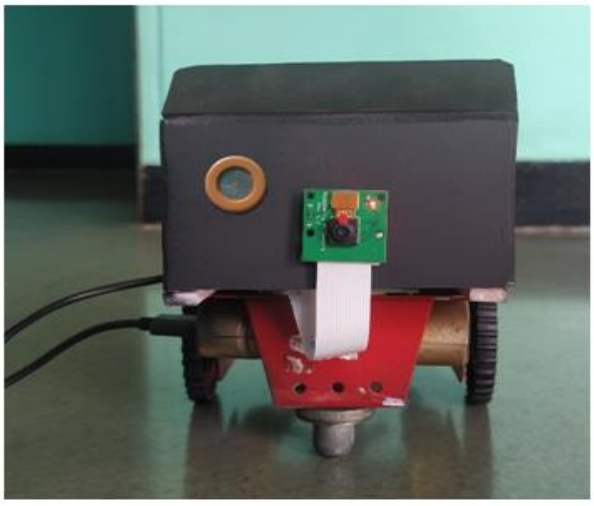

Fig 10. Front View of Hardware.

Fig. 9 and Fig. 10 depicts the Side view and Front view of the hardware where the sensors mounted on the robotic module can be viewed.

Fig. 11 and Fig. 12 shows the working of this project. As depicted in Fig. 12, we have developed a webpage that contains the buttons for controlling the robot. The same webpage also shows the live video captured by robot.

Fig 11. Final Working.

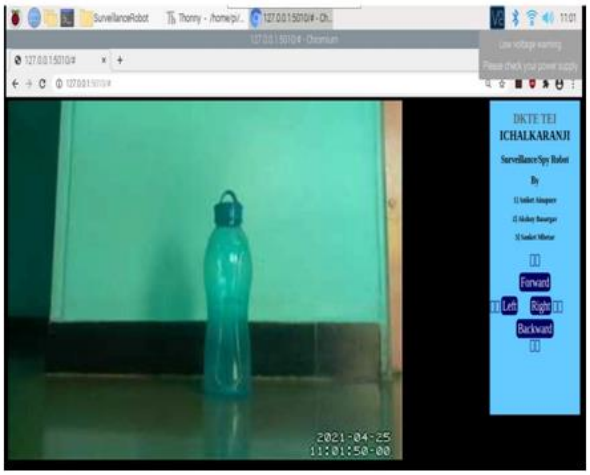

Fig 12. Webpage.

V. CONCLUSION

The proposed system is completed successfully. The movement of the robot is being controlled manually using a webpage. The input given to the webpage is sent through the internet and desired movement occurs at the robot end.

The proposed system has an added advantage that the robot can be controlled even from any longer distance as we are taking the help of internet and IoT technology.

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