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IOT Based Surveillance Robotic Car Using Raspberry PI

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Abstract - *Developing surveillance and monitoring systems can be quite challenging at times, since the systems should be designed with consideration of the environment to be monitored. Good surveillance systems need to have dynamic features, e.g. monitoring cameras. Monitoring such a large area would also be a challenge for the security officers, as they will need to spend too much time to patrol covering all places. To address the challenges like surveillance of a large building with many levels, which would insure a high cost to install many cameras at many places dynamic surveillance systems include dangerous areas.*

***Key Words*: Raspberry Pi3, Robotic Chassis, Web, USB Cameras.**

1. INTRODUCTION

Raspberry Pi is a card sized computer. It functions almost same as a computer. There are different types of surveillance systems available such as camera, CCTV etc., In these types of surveillance systems, the person who is stationary and is located in that particular area can only able to view what is happening in that place. Whereas, here, even if the user is moving from one place to another, he/she can keep track of what is happening in that particular place at exact time. Also, another advantage is that it offers privacy on both sides since it is being viewed by only one person. The other big advantage is that, it is a easy and simple circuit for understanding and designing. The operating system used here is Raspbian OS. Raspbian OS has to be installed so that the image can be transmitted to the smartphone Closed circuit television monitoring system has now become an indispensable device in today's society. Robots have found an drastically increasing demand for different range of work in our life. Their use in army and other security sector increases day by day. Our paper includes one such instance of how a robot can be of use to human race in general.. In this project, we use the internet to establish communication between the user and a robotic vehicle. This is a dependable connection and a continuous video feedback is available to control the robotic vehicle. Due to the use of the web, there is no limitation on range or distance between the user and the robotic vehicle. It is proposed to address the lower side at cost, efficient, high-speed processing & control hardware for the self-navigating robotics application. Design and Implementation of a Robotic Vehicle with Real-Time Video Feedback Control via Internet/web paper illustrate on an approach to control a robotic vehicle using the internet as the communication medium between the user and robotic vehicle. Raspbian OS has to be installed so that the image and videos can be seen to the smartphone directly. Closed circuit television monitoring system has now become an indispensable device in today's society. There are afferent places such as school, supermarkets, society security where we are having their own CCTV system for 24/7 monitoring

2. METHODOLOGY

This is the internet of things (IOT) based project , where we are particularly uses the Raspberry Pi, USB web camera and two DC motor with Robot chassis to build this Robotic car setup. It has a web camera mounted over it, through which we will get live video feed and the interesting part here is that we can control and move this robot from a web browser over the internet. As it can be controlled using webpage, means it can also be controlled by using the other smart devices where we can control through the webpage. We built a webpage in HTML which has Left, Right Forward Backward links, clicking on which we can move the robot in any direction. Here we use the term "Motion" for getting live Video information from USB camera and used "Flask" for sending commands from webpage to Raspberry Pi using python script to move the Robot. The webcam will capture live data with regards to its surroundings and then send it to a desired device through internet. The user will be observing this data on the monitor at the user end. According to the desired movement, the user will control the robotic vehicle through the webpage available at the user end.

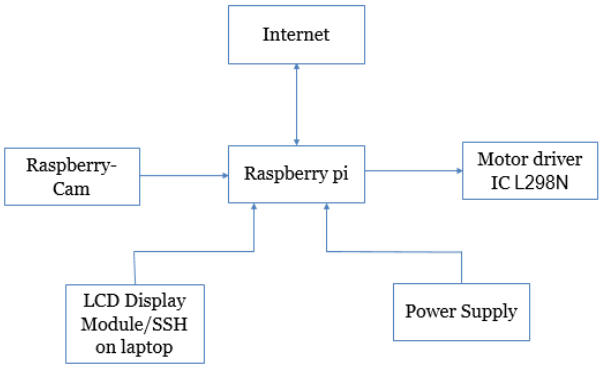


Fig.: Block Diagram of Setup

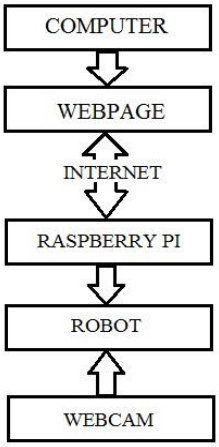


Fig.: Flow Chart of the working

3. DESIGN AND IMPLEMENTATION

3.1 Raspberry Pi 3

Raspberry Pi is used for making robot wireless and web based.ge Raspberry Pi and then the 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 Raspberry Pi uses an SD card for booting and for memory as it doesn't have an inbuilt hard disk for storage.

Raspberry Pi requires 5 volt supply with minimum of 700-1000 mA current and it is powered through micro USB cable. ARM11 only requires 3.3 volt of supply which it takes with the help of linear regulator. 5 volt is required for the USB ports. 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 meet the control requirement. There are easy to use open source peripheral driver libraries.

Fig.: Raspberry Pi 3

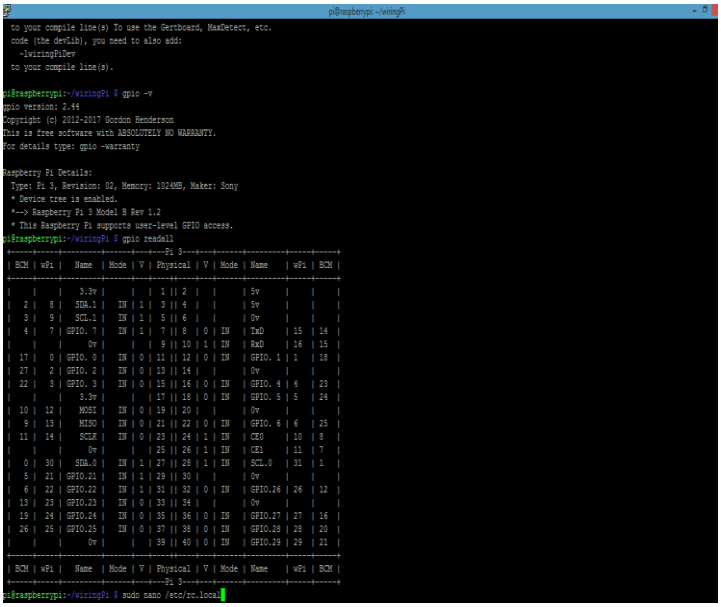


Fig.: Terminal Window of Raspberry Pi

3.2 MOTOR DRIVER IC L298N

The L298N H-bridge module can be used with motors which have a voltage range of between 5 and 35V DC.

With the help of L298N H-bridge module, it is quite easy to control one or two DC motors.

First, connect each motor to the A and B connections on the L298N module.

Ensure that the polarity of the motors is the same on both inputs if you are using two motors for a robot or anything. Otherwise, you may need to exchange them over when both motors are set to forward and one goes backward.

Next, connect the power supply to pin number 4 on the L298N module and negative/GND to pin number 5 of the L298N module.

In this project, we have two DC motors, therefore digital pins D9, D8, D7 and D6 will be connected to pins IN1, IN2, IN3 and IN4 respectively. Then connect D10 to pin number 7 on the module (remove the jumper first) and D5 to pin number 5 of the module (again, remove the jumper).

The direction of the DC motor is controlled by sending a HIGH or LOW signal to the drive for each of the motors. For example for motor one, a HIGH signal to IN1 and a LOW signal to IN2 so that motor will be turning one direction, and a LOW signal to IN1 and HIGH signal to IN2 will move the motor in other direction.

However, the motors will not move until a HIGH signal is set to the enable pin (7 for motor one, 12 for motor two). And they can be turned off when the LOW signal is set to the same pin. However, if you need to control the speed of the motors, the PWM signal from the digital pin connected to the enable pin.

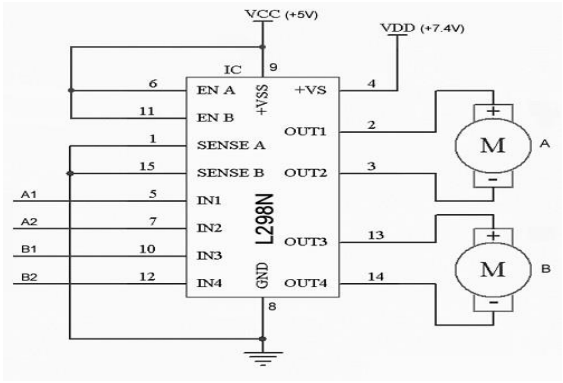


Fig.: Pin IC Diagram of L298N

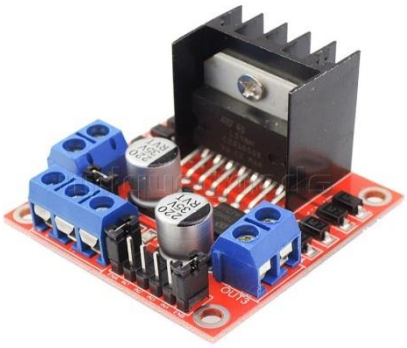


Fig.: L298N Module

3.3 WHY SSH?

SSH is also known as secured shell. It is a network protocol by which we can communicate one computer with another in an encrypted way. This is a kind of tunnel with the help of which we can remotely access one computer from other or we can securely send our files or documents to public Wi-Fi. For example, if you want to send a confidential file to your friend and both of you are connected to same public Wi-Fi. In this case, as many other people are also connected with that public Wi-Fi, there is the fair possibility that someone can access your data, so the file you wanted to share with your friend can be hacked by the middle person. To avoid this and to overcome this drawback we can use a secure shell protocol. SSH uses public key cryptography, so whatever message you send, it will be first encrypted and that message will be decrypted in the receiver end. For encryption and decryption, sender and receiver have a secured key so that middle person cannot hack your data because he will not have the address of the secured key. In this way, we can communicate from one computer to another with the help of SSH protocol with fair security thorough cryptography.

4. NETWORK IMPLEMENTATION

Bot consists of a web camera, voltage regulator circuitry with L298N motor driver and raspberry pi. The real time video and control are displayed in the webpage which can be viewed from anywhere in the world using internet or within the Wi-Fi range and one can control it using those control provided. Setting up the raspberry pi and installation of Operating system from raspberrypi.org. Here we are using raspbian OS. Install the required packages in the pi using suitable commands in terminal window and connect the raspi cam to slot beside the Ethernet port. Now design the control page that provides a way to control our robot this page is designed HTML and python and write the controlling of the robot code based on the L293N IC logic we have used. Connect to a network through on board Wi-Fi .Once it is connected through putty software configure we got the IP address we can use it for controlling purpose.

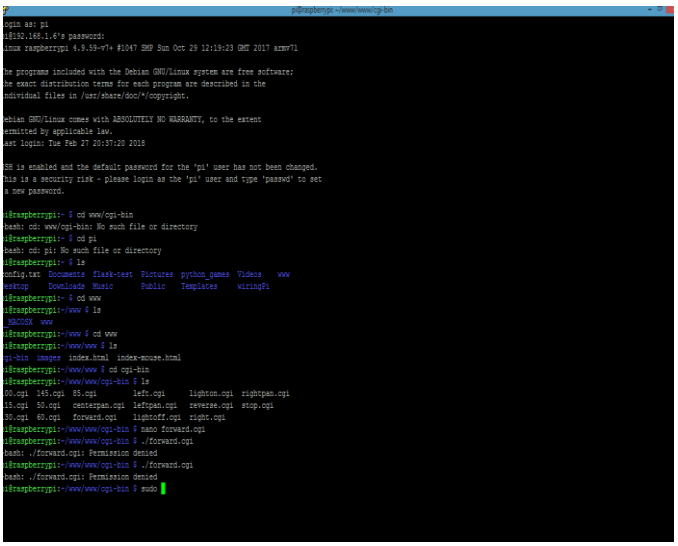
5. PROGRAMMING

Python programming is used here. Software design is divided into 4 codes namely: Webcam Server is the code run in the Raspberry Pi to capture the images and stream them over the internet. Here the images will be compressed into .jpg format to reduce their size prior to their transmission over the internet. They are sent using byte array over the UDP soccer.

Webcam Client is run by the user to receive this images in the form of byte array. They are then displayed on the monitor at a rate closer to 5 images per second so that they appear like a continuous video.

Motor Server is run by the user. Monitoring the video, the user manoeuvres the robotic vehicle or the robotic arm accordingly. This is done by accepting input either from the keyboard or the webpage. It is done by checking the key press events.

Motor Client as per the input from the user, either the robotic vehicle or the robotic arm move. This is done by making High or Low the desired GPIO pins of the Raspberry Pi. 4 GPIO pins are connected to the 4 servo motors and 4 to the motor driver IC l293d.



6. APPLICATION

1. Indoor spying of warehouse, campus surveillance to check the improper activities.
2. Tracking locations of terrorist organizations and then plan an attack at a suitable time.
3. Making video surveillance of any disaster affected area where human beings can't go.
4. Field view surveillance of indoor & outdoor commercial complex, factories & government buildings/organization.

7. FUTURE SCOPE

There are lots of improvements that can be made on the current design and technology and lots of additional feature scan be added. We can use different types of sensor so that we can use robot in different field i.e. Temperature Sensor, Pressure Sensor, Heat Sensor, Position Sensor, Proximity Sensor. A multipurpose robot can be made by wireless network, ranging from surveillance and home security to industrial applications where the user need not be present at the work place in person but can do it from his home itself.

8. CONCLUSION

In this project we 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 thus we can monitor any remote areas. One can easily monitor as well as control the activity of the robotic unit.

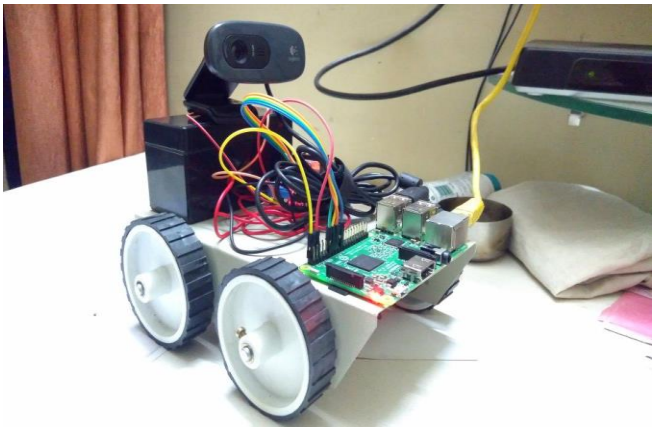


Fig.: Robot Setup

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