UNMANNED VEHICLE CONTROL AND LIVE VIDEO WEBCAST FOR SURVEILLANCE THROUGH WIRELESS LAN

AJAY CHANDRAN.R[1], BALAJI.V[2], KEVIN LOUIS.J[3], ELANGOVAN.S[4]

[1,2,3]Student, Department of Electronics and Communication Engineering, Meenakshi Sundararajan Engineering College, Chennai, India
[4]Assistant Professor, Department of Electronics and Communication Engineering, Meenakshi Sundararajan Engineering College, Chennai, India

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Abstract – *In the present scenario, surveillance is a key issue in the defense as well as the domestic field. Surveillance operations are carried out mainly using manpower. The main drawbacks of the system are dis-operation or loop hole in the process of surveillance due to human negligence. Even strict surveillance could lead to loss of human life in case of combat. In order to provide a solution, this project aims to design a wirelessly controlled surveillance vehicle equipped with a wireless camera to obtain real-time visual feedback. Human life is very valuable and hence machines can be used as a shield for human life. Here Raspberry Pi B+ Microcontroller is used as a web host and the vehicle is connected to it through the concept of WLAN. The structure of this vehicle is designed in a manner to overcome various obstacles which might lie in the path of operation. Additional guidance is provided by the live video feedback. The motion of the vehicle and camera can be controlled by a human operator from a distance within the range of WLAN.*

Key Words: Surveillance, Wireless Camera, Raspberry Pi B+, WLAN, Video Feedback.

1. INTRODUCTION:

Surveillance is defined as a process in which a surrounding or an individual is monitored usually with the aim of providing a secure habitat. It also plays a significant role in monitoring sensitive areas, warehouses, hazardous or inaccessible areas without putting human life in jeopardy. Surveillance can be categorized as outdoor or indoor. Properties or areas affected by natural calamities can be categorized as outdoor surveillance while factories, warehouses, garages, etc. can be categorized as Indoor Surveillance.

Obtaining information from inaccessible or hazardous areas is difficult for human beings as they have their own limitations as well as human life is precious to put it in such a risk. This is where the surveillance vehicle comes into picture. A surveillance vehicle with a camera mounted on it can get the job done. It can monitor any outdoor suspicious activity or as H. T. Lee, W. C. Lin, C. H. Huang and Y. J. Huang [2] have mentioned, it can be sent to inaccessible areas or areas of interest for indoor surveillance and hence can reduce the efforts and cost of putting up cameras throughout the vicinity. Surveillance vehicles definitely reduces the risk to human life as an operation can be carried out without actually sending any human out.

While designing a surveillance vehicle, there are two important aspects that need to be considered. Firstly, what technology will be used to transmit the live video and second being the method used to control the vehicle. The user should be able to monitor the video and simultaneously control the vehicle. We made use of Raspberry Pi as a web host to control and monitor the surroundings.

After digging into the work done previously in this field, it is seen that different technologies are used to achieve live video streaming [4] and to control the vehicle. As mentioned above, most of the previous work involves use of Bluetooth, ZigBee, GPRS or GSM technology to control the vehicle which are all very well-established technologies. But using these technologies, we need expensive IP cameras or wireless cameras are used to transmit video signal which increases the cost of the project. Also, the size of these cameras is huge. Thus, they are not feasible while scouting areas with constrained space. The proposed technology overcomes all the problems mentioned in previous works. In this project, Raspberry pi is used as a web host to achieve connectivity between the vehicle and the controller.

2. PROPOSED SYSTEM:

In this system we propose an automated wireless Video surveillance solution using microcontroller, which sends back a live video feedback. Due to its rigid framework and structure it will be able to deal with any kind of obstacles that lie along the path. The power source is upgraded into a more stable one instead of using solar panels [3]. The proposed idea can be applied in to the border surveillance and various security systems. The streamed video can be clearly visualized on webpage through a microcontroller, which is having picture quality configurations. By the above mentioned features the proposed idea is able to overcome the previously present drawbacks. The block diagram of the system is shown in fig-1 as follows

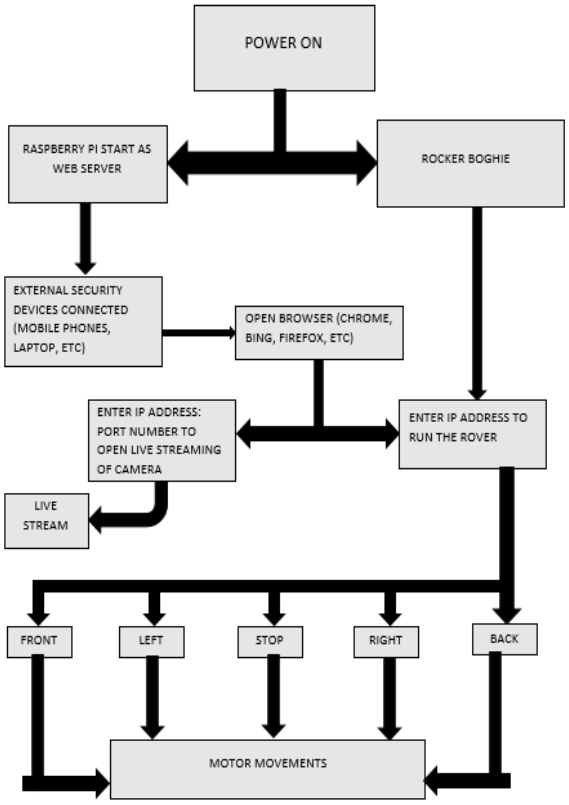

Fig -1: BLOCK DIAGRAM OF PROPOSED SYSTEM

3. CONSTRUCTION:

Here the working model of the proposed system is shown in Fig -2 below

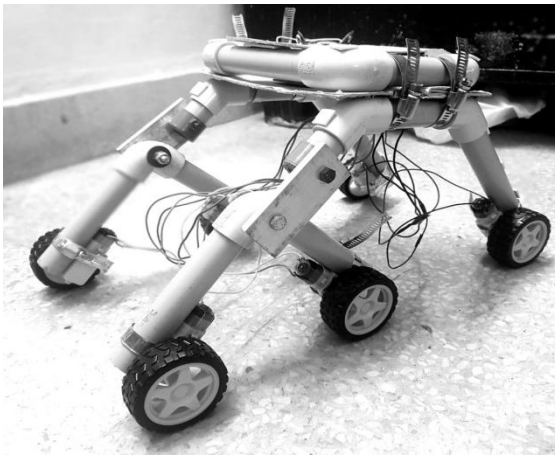

Fig -2: WORKING MODEL OF PROPOSED SYSTEM

The security through a surveillance camera must be dynamic and must move from one location to another. To accomplish this, a simple four wheeler can be used. But a four wheeler is not capable of crossing ridges without damages. To avoid such problems, a rocker bogie mechanism is used.

The construction is simple as shown in Fig-2. It is a six-wheel vehicle with a rotatable forward motion. The flexibility of rotation of the first four wheels make the vehicle to raise up or go down without any damages. The motors that run the vehicle must be based on the weight and size of the vehicle. Above the vehicle, a platform is made where the microcontroller and the camera is placed for surveillance purposes.

Based on the design size, the rotation angle of the forward wheels is calculated. The motors are connected together to two different motor drivers for effective movement. The drivers are given enough supply to run all the motors. The motor pins, camera and the supply is connected to the microcontroller.

This rocker bogie is made of pipes connected with V-joints and reducers. The platform is made of cardboard which holds the microcontroller and the supply. The motors used are DC motors with 100 revolutions per minute. The motors are connected to drivers which has about four batteries, 9V each, which are connected in parallel. The microcontroller is supplied with a normal power bank. The microcontroller is the heart of the design which connects all the hardware and software mechanisms together to act as a perfect surveillance vehicle.

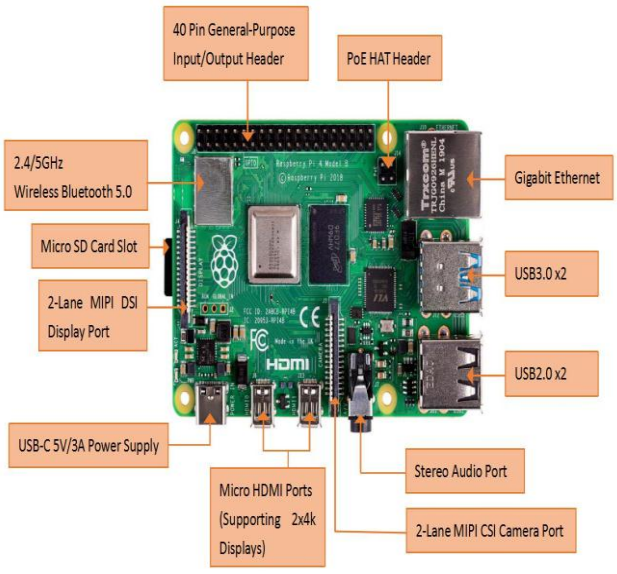

Fig -3: RASPBERRY PI 3 B+ MODULE

The Raspberry Pi 3 B+ module is the micro controller used in this system. It is a dual band wireless LAN with a 64-bit quad core processor running at 1.4GHz, Bluetooth 4.2/BLE, faster Ethernet and PoE capability via a separate PoE HAT [1]. The basic components of the module are illustrated in the Fig-3

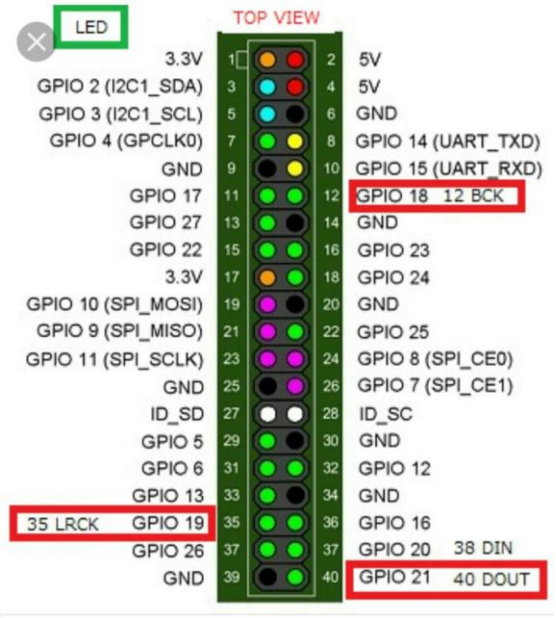

Fig -4: PIN CONFIGURATION

Fig -4 shows the pin diagram of the Raspberry Pi micro controller. Here we have used GPIO for input and output purpose. Pins 4,17,24,27 are used in our system.

4. SOFTWARE AND DESCRIPTION:

4.1 RASPBERRY PI INSTALLATION

After the construction of the entire hardware structure the Raspbian OS must be installed in the micro controller. The required software is downloaded and installed. After installation the Raspberry PI is switched on. Go to terminal and type the following command to update **sudo apt get update, sudo apt get upgrade.**

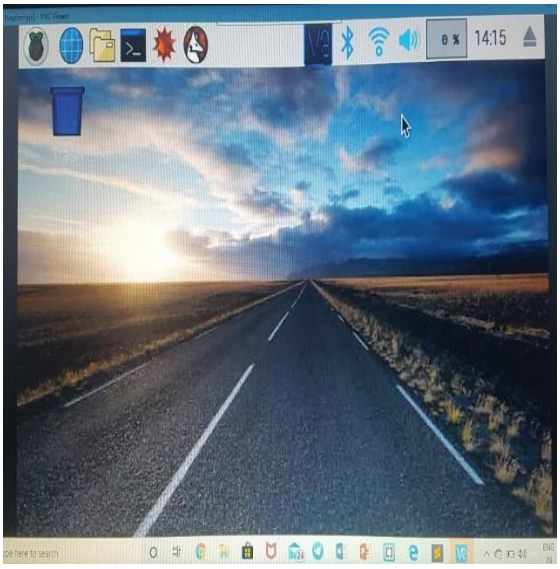

Fig -5: RASPBERRY PI DESKTOP VIEW AFTER INSTALLATION

For first time installation, you have to connect a monitor, mouse and keyboard to work with. After turning on, connect to your respective Wi-Fi. For further use, VNC viewer can be used. After installing VNC viewer, the respective IP address is entered to open the screen view of Raspberry Pi. Fig 5 shows the desktop view of the Raspberry Pi after the installation is completed.

4.2 APACHE INSTALLATION

By default, Apache puts a test HTML doc in the web folder. This default web page is served when you browse to **http://localhost/** on the pi itself or **http://192.168.43.34** from another computer on the network. To find the pi's IP address, type Hostname –I at the command line to view the IP address. The default web page is shown in Fig-6

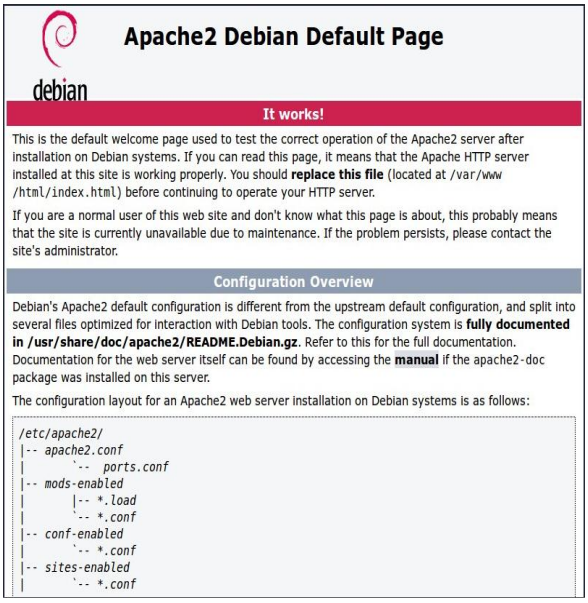

Fig -6: APACHE2 DEBIAN DEFAULT PAGE

4.3 PHP INSTALLATION

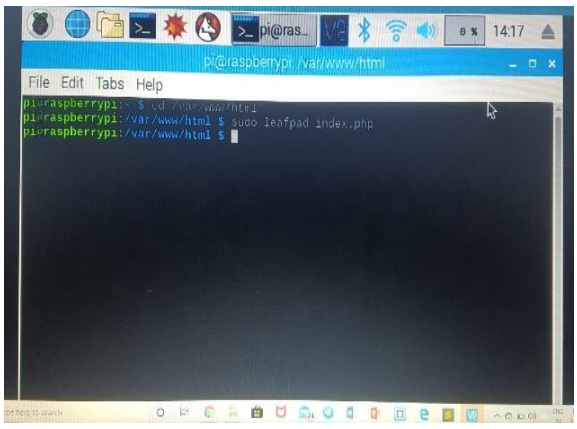

Fig -7: TERMINAL VIEW AFTER PHP INSTALLATION

To allow your Apache server to process PHP files you need to install the latest version of PHP and the PHP module for Apache. Type the following command to install these: **sudo apt install php libapache2-mod-php –y.** Now remove the index.html file: **sudo rm index.html** and create the file index.php: **sudo nano index.php.** The terminal view after PHP installation is shown in Fig-7

4.4 MOTION SOFTWARE

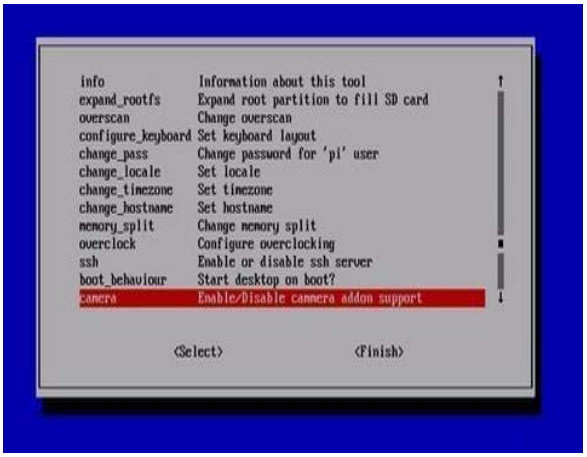

Fig -8: **MODULE ENABLING SCREEN**

The camera installation on the Raspberry Pi is simple once you find the Port location. Start the raspi-config tool by the command **sudo raspi-config** and click enter. Then go to the Interfacing **Options->Camera->Enable** the camera support. After that exit raspi-config and accept the reboot.

Fig -9: **CAMERA MODULE**

The camera comprises of a little (25mm by 20mm by 9mm) circuit board, which associates with the Raspberry Pi's Camera Serial Interface (CSI) transport connector by means of an adaptable strip link. The camera's picture sensor has a resolution of five megapixels and has a fixed center focal point. The product for the camera bolsters full resolution despite everything pictures up to 2592x1944 and video resolution of 1080p30.

4.5 WIRELESS LAN

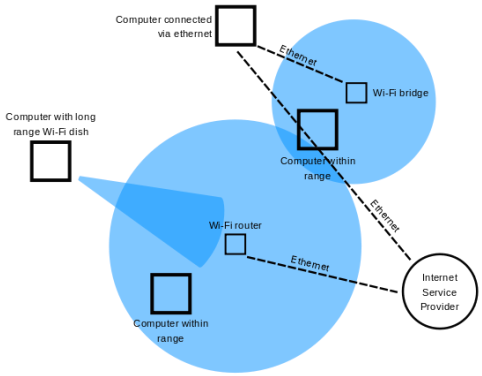

Fig -10: **BASIC STRUCTURE OF WLAN**

A wireless LAN (WLAN) is a wireless computer network that connects two or more devices using wireless communication to form a local area network (LAN) within a limited area. Fig-10 shows the basic structure of WLAN. After connecting the micro controller to a network it acts as the host.

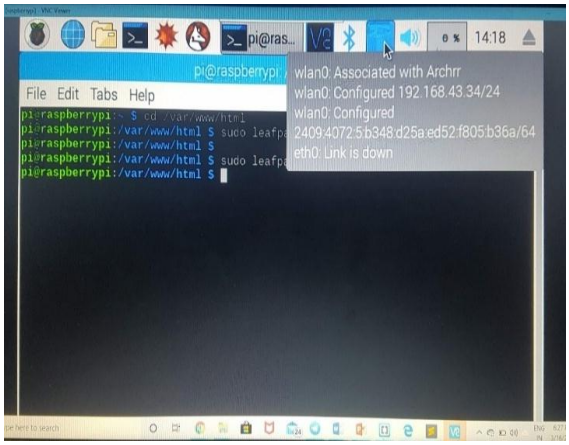

Fig -11: **WLAN CONNECTIVITY**

Fig-11 shows the connectivity status of the Raspberry Pi. Once the local network is set up the surveillance operation can be carried out from the command center or any location within the range of the network.

5. RESULT:

Surveillance is carried out by setting the rocker bogie in motion. Fig-12 below shows the micro controller after interfacing the camera module.

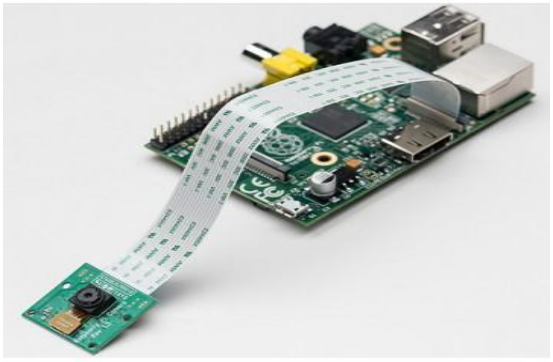

Fig -12: **INTERFACING**

Fig-13 shows the website through which the vehicle is controlled. There are four directions available. This helps in navigating through the various obstacles present in the path to be monitored.

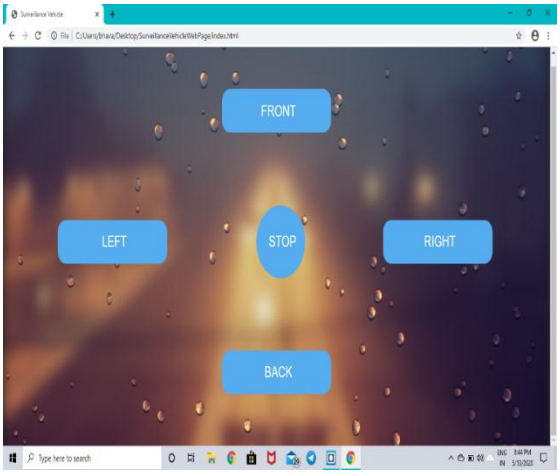

Fig -13: **SURVEILLANCE WEBSITE**

The live video feed back is obtained by the command **sudo service motion start.** This prompts the controller to activate the camera module. The video stream can be viewed by using the IP **http://192.168.43.34/8081.** Fig-14 shows the live video webcast**.**

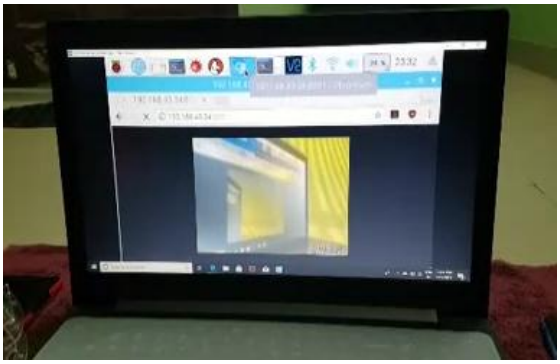

Fig -14: **LIVE VIDEO STREAMING**

Thus the surveillance is carried out and the data is obtained.

6. CONCLUSION:

This paper proposes, an unmanned vehicle which is controlled from a command center through a wireless LAN, which sends back live video stream of the place under surveillance. This can be largely implemented in various government as well as domestic sectors where security is an important criterion, taking into consideration various factors such as reduction in manpower and increase speed of video transfer. The interfacing of all the modules has been done using Raspberry pi. The automation provides safety to all the humans who are involved in the operation. From here the data required can be transferred through a wireless LAN or through video streaming. Additional stability is provided by the structure of the vehicle which enables it to overcome the various obstacles that lie in its path. This project serves to reduce the risk and burden of the human personnel involved in the surveillance and security field, more specifically in army sector. If implemented, it can automate the manual process which is currently followed and reduce the risk occurring to humans.

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