RC Surveillance car using raspberry pi 3 along with smartphone controller by Wi-Fi and Bluetooth technologies

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ABSTRACT:

This paper represents the implementation and development of a remote-control car for surveillance purpose and the whole system is controlled by the smart phone. In this RC car, the video streaming work is done by the WIFI communication between the RC car and smart phone. The surveillance of RC car in a given area can be done by the communication between the RC car and Bluedot application that is installed in the smart phone. After the successful communication established between the RC car and smart phone. For the surveillance or to navigate the car while controlling the RC car remotely, we have used the pi camera that is attached to the vehicle in the front. The test was carried out so that the RC car can be navigate in the four directions i.e., Right, Left, Forward, backward.

KEYWORDS:

Bluedot, RC car, smart phone, surveillance, WIFI, Bluetooth.

1) INTRODUCTION:

Research on robotics has continued for several years. There is unique presence, robots offer a typical mechanical and movable structure. Nowadays robots use sensors to detect the nature. Microcontrollers Plays a most important role in the making of robots to restrict the power supply and to measure the utilized memory. The Sensors required for the robots are additionally very expensive. To deal with the expansion of robots the microcontroller assets have to deal with the attached sensors. In modern days Smartphone innovation plays a major role in day-to-day life, many useful sensors are officially implanted in a Smart phone [1]. The more importantly the standpoint that is related to this project is the smart phone allows user to drive their vehicle away without driving himself. Now a days many articles concentrating on these types of advancements of related models between the smart phone and a machine. A Smartphone has numerous advantages (example: accelerometer, sound, microphone and camera) and several useful communication interfaces (for example WIFI, Bluetooth, etc.). There is no uncertainty that the smart phones have high processing processors have high power and large RAM than the basic microcontrollers. This helps us to get an idea to include a smart phone into a remote-control car which can handle the complicated tasks and progress for further execution. This model finalized a different agenda with smart phone touch control. This implementation of the proposed model is assessed by activities that was have planned. This project work can be utilized in Surveillance purpose in several places. In order to provide such services for the above situations, provide with a surveillance system that runs on the raspberry pi. The Raspberry pi drive the vehicle that is connected to the android application called Bluedot in a smart phone. A control board is additionally given through the remote Bluedot application introduced in the Smartphone that uses touch gestures to drive the car wirelessly by just swiping the touch screen on the mobile to which ever direction the operator want can turn the car in the desired direction. There is a blue circle that is present in the application that is where the operator has to use the touch gestures in the two-dimensional space. The above figure shows how the interface of the bluedot application in the smart phone. The car

moves forward when swipe the screen to the upward direction. For turning left and right need to swipe the screen to the left and right respectively. Same goes to every direction for the car to be moved.

This paper illustrates a prototype of remote-controlled car which receives the commands from the smartphone with precise controlling of the car, while navigate the car remotely. Controlling the car using web interface key is not able to provide proper control of car, especially in case want to control the speed of the car or slightly turn of the car. So, the aim is to provide proper solution for it. The rest of the paper mainly focus on work, design and development of the remote-controlled car and describes the architecture of proposed work. Other part of the paper describes the working mechanism of the proposed work. Further the paper shows about the result and presents the summary of this work.

2) LITERATURE SURVEY:

There are some various works has been committed related to the remote-controlled car for different purposes. Paper developed a remote-controlled car that is controlled by computer through parallel port and by controlling car with the voice command and facial expressions [1].

The computer receives the voice command and convert this command /face images into the digital signal and the signal is then converted into the radio signal and the car took the decision accordingly to the movement of the car. Some work has been done by using Arduino and using the smart phone to give the directions to the movement of the car. That system requires Arduino board and motor driver for the rc unit and the bi directional motors is used for the movement in four directions [2].

A vision-based obstacle avoidance algorithm is used for a low cost with very low-resolution image. Ultrasonic sensors have been used in mobile applications that helps in finding obstacle by measuring distances. A system was implemented using ultrasonic sensor and infrared sensor intended to help the elderly and people with vision impairment [3].

Another system proposed by R. Manduchi is a system based on stereo range measurements, for obstacle avoidance [4-6].

Varsha Vishwa Kiran and S Santhanalakshmi has proposed Raspberry Pi based Remote Controlled Car using Smartphone Accelerometer and controlling by an android app called IMU [7].

In this project we are using both Bluetooth and WIFI for controlling and surveillance purpose.

3) PROJECT MODEL DESIGNING:

This part consists of the basic block diagram of the project as shown in figure below. The things that need to connect to each other to make the work possible are raspberry pi, pi camera, smart phone, L293D H-bridge motor driver IC and simple structure of a car made of cardboard. The block diagram of our project is shown in figure 1.

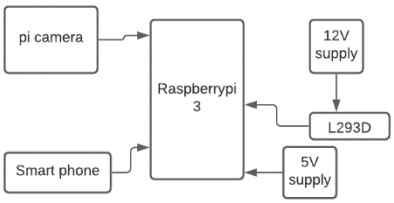


Figure 1

A) Raspberry pi 3 model B:

This is a micro controller device in small size which can be held in our hands and can be portable. This device is of low cost and can be easily programmable using python. This device has inbuilt WIFI, Bluetooth as well as internal memory and works at 1.2 GHz 64bit processor [8]. It can be used as a mini computer. The sample picture is shown below in figure 2

Figure 2

B) Gear motor driver:

In this project L298N H-bridge motor driver IC is used as our component to control the movement of our motors. The motors can be controlled in

two directions those are clock wise and in anti-clock wise directions [9]. This device acts as a bridge between our micro controller and motors of the car. The connections are shown in figure 3 [10]. This device is used to control motors which work with high voltage. L293D is recommended for low power supply devises.

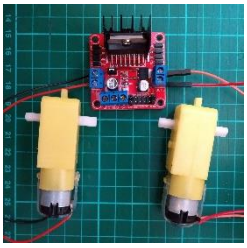
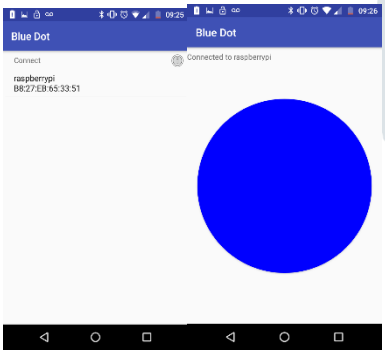


Figure 3

C) Working theory:

Our RC car gets the direction movement form the smart phone signal using an application called blue dot. The direction of the car is decided by the position of the finger on the blue dot application after pairing the Bluetooth with our phone to raspberry pi [11].

The picture shows the appearance of blue dot application:



WORKING MECHANISM:

This section consists of the assembly and working of our project.

A) Hardware connections:

Two motors are connected to OUT1, OUT2 and the other two motors to OUT3, OUT4 which are labeled on L293D IC then given 5V power supply to L293D labeled as VCC and GND to drive the motors [5]. On the board L293D used here there are pins labeled In1, In2, In3, and In4 connect these to GPIO pins of raspberry pi 7,8,9,10. Connect the GND of Raspberry pi to GND of L293D.

Connections are below:

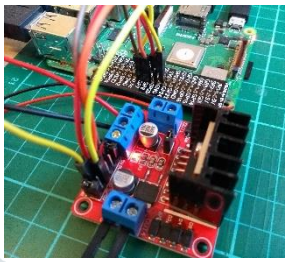
GPIO7 – IN1

GPIO8 – IN2

GPIO9 – IN3

GPIO10 - IN4

GND Raspberry Pi – GND L293D



To make the car move forward pin 7 and pin 9 must be ON and other two pins should be OFF, similarly to move backward pin 8 and pin 10 must be ON and other two should be OFF. Now to move the car in left direction pin 9 must be ON and other should be OFF. Similarly, to move the motor in right direction pin 7 must be ON and other pins should be OFF.

B) Setting up the Raspberry pi:

To setup the raspberry pi, need some things for the installment of raspberry pi.

- Any standard keyboard and mouse for operating.
- A HDMI input is required for display input.
- Any monitor or TV for display.
- A power supply of at least 2Amp at 5V input through USB

First, insert an SD card with Raspbian (via NOOBS) into the micro-SD card slot of the Raspberry Pi. Now plugin the keyboard and mouse into the USB ports, and then connect the Raspberry pi to a monitor or TV using HDMI cable plugin the HDMI wire to the monitor/TV, and then hook the other end of the cable into the Raspberry Pi. Now the power supply to is given to the Raspberry pi through an adapter of micro-USB. A power indicator light now began to glow. Now download and install the “Raspbian operating system” on the raspberry pi. Then a warning window pops up, click yes to confirm. Once the installation process is completed, Raspbian automatically began to reboot itself. Now under the menu bar which is

on the top left corner of screen, pick the preferences in the below menu, then select the raspberry pi configuration and in the configuration-tab set your location, time zone and keyboard language. Finally reboot the raspberry pi [12].

C) WIFI and Bluetooth connectivity:

Raspberry Pi was configured to communicate automatically with the chosen network. After booting up the raspberry pi at the task bar click on Wi-Fi icon visible to you and select the preferred network and so the Wi-Fi is connected. For connecting Bluetooth on your Raspberry Pi, open a terminal window and install the dbus and bluedot python modules.

- We use "sudo pip3 install bluedot" code to install bluedot [11].
- Download bluedot application on android phone.

On our android phone open Settings and select Bluetooth and turn it on to make our device discoverable. Similarly, in raspberry pi we connect the Bluetooth discoverable. Check for our device and click pair both on our phone and raspberry pi.

D) Remote controlling:

Here our remote is a smart phone with bluedot application installed in it. The application sends the output signals from the smart phone to raspberry pi to operate the car accordingly [11].

- If position of our finger is on top of the blue dot motors move in clock wise direction
- Similarly, if position at bottom, then anti-clock wise direction
- If the position is on right the one motor will be clock wise and the other will be anti-clock wise.
- Similarly, if on left side then one motor will be anti-clock wise and the other will be clock wise.

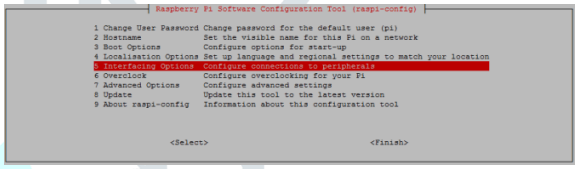
The Python program written will wait for input from android app and process the data for movement of RC car [11]. After pairing this bluedot app with mobile and raspberry pi this app starts to send output according to the position of touch on the bluedot and accordingly RC car starts to move.

E) Video live streaming:

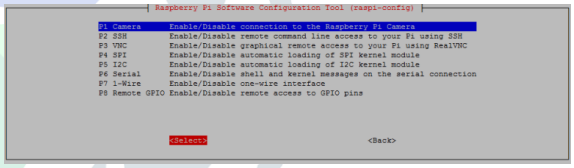
A 5Mp pi camera is included to get visual data of surroundings so that any obstacles found in front of the RC car can be avoided. This can also be used to find things that are present where we human beings cannot visit like small holes. For configuring the camera first, connect the pi camera to **Pi CSI port** and then execute the following instructions on the command line of raspberry pi [13].

Using "sudo raspi-config" command.

After using this command, see the Raspberry Pi software configuration tool then select the **Interfacing Options**:

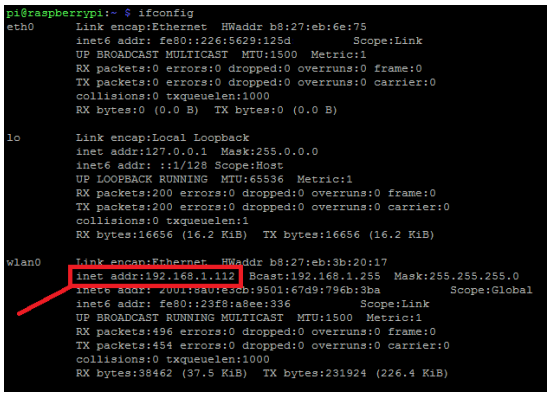


After selecting the interfacing option enable the camera and reboot your Pi:



In order to access video streaming web server, know the IP address of our raspberry pi after connecting to the Wi-Fi for that use the command "$ ifconfig".

Here displays a bunch of information, including our Raspberry Pi IP address. As shown in figure:



Here the python3 as well as HTML script is for video publishing. For this a new file is created and named it as "rpi_camera_surveillance_system.py"

and saved it. Then write the code which is available in official Pi camera package documentation [14]. After we write this code, we have to run it using thorny python in raspberry pi OS "**python3 rpi_camera_surveillance_system.py**".Then go to the web page and type http://<your Pi IP Address>:8000. Therefore, can access the video streaming through any device that has a browser and is connected to the same network that our Pi. Now It's ready to access the video streaming.

The output of our streaming is shown figure 4:

Figure 4

RESULT AND DISCUSSION:

This project work has been made to run an RC car, and it receives the direction of movement according to the output signal received from the Smartphone using bluedot pointing position and broadcasting network has been built for video live streaming that helps to scout the area and control the car movement remotely. Raspberry pi will drive the RC car and it has a Wi-Fi connection to communicate with Smartphone. For power supply pi is connected to 5v power supply and RC car is powered by 12v rechargeable battery for the speed.

CONCLUSION:

This work proposes the Remote-controlled car with the help of a Smartphone. This completely well-designed prototype vehicle can be used for surveillance purpose in dangerous locations, industrial buildings, borders and many more. Several updates can be made possible like we can add solar panel to car so that charging problem of batteries will be solved.

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