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Virtual Telepresence Robot

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Abstract:
In general, robot functions of tele-presence robots are limited, and the visual angle of the camera on robots is narrow, so they are unsuitable to use navigation services. The proposed system overcomes the difficulty by adopting system architecture in which robots are controlled via a server with the help of the Internet, by using well-designed virtual reality techniques for robot control as well as its efficiency and by implementing almost all robot navigation functions into the server. The Virtual Telepresence Robot is remote-controlled robot to capture the surrounding view through a camera attached to the robot. The robot consists of a camera, 3 wheeled robot vehicle, WiFi Module and smartphone. This robot attached with a camera placed in a remote location to capture the environment in visual form using Raspberry Pi.

Keywords*: Raspberry Pi, NodeMCU. WiFi Module, Remote-controlled.*

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I. INTRODUCTION

A telepresence robot is a remote-controlled, wheeled device that has wireless internet connectivity(wifi technology). Typically, the robot uses a smartphone to provide video and audio capabilities. Gives information about surrounding. Virtual presence can be considered as a special case of telepresence where the remote environment is artificially created. Camera is interfaced with Raspberry Pi which allows it to live stream and record the video. Also NodeMcu plays the role of driving a robot through a motor driver. Robot is also controlled using a mobile application which allows us to send any direction command to the robot. However, operating and navigating these robots by individuals who have little knowledge and map of the remote environment is challenging.. Typically, the robot uses a smartphone to provide video and audio capabilities. Gives information about surrounding. Virtual presence can be considered as a special case of telepresence where the remote environment is artificially created. Camera is interfaced with Raspberry Pi which allows it to live stream and record the video. Also NodeMcu plays the role of driving a robot through a motor driver. Robot is also controlled using a mobile application which allows us to send any direction command to the robot.

II. BLOCK DIAGRAM

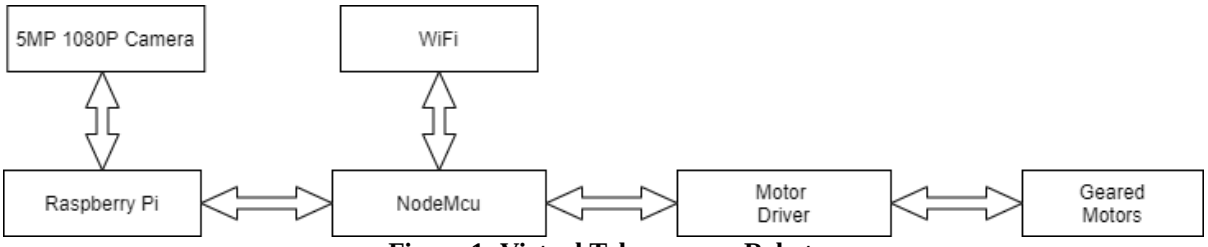

Figure 1: Virtual Telepresence Robot

The project is framed as shown in the block diagram. The Raspberry Pi and Nodemcu are the main controller of system. Raspberry Pi gives output to the smartphone via wifi. Nodemcu is used for navigation purpose, Smartphone which contain proper application gives commond to the nodemcu and nodemcu gives output to the motor driver which can drive robot. The commonds to run the robot given via wifi.

III. COMPONENTS

3.1. Raspberry Pi

In fig.2 Raspberry Pi is a small-sized computer with an ARM processor that can run Linux. This component is the Raspberry Pi 3 Model B+**,** which has 1 GB of RAM, dual-band WiFi, Bluetooth 4.2, Bluetooth Low Energy (BLE), an Ethernet port, HDMI output, audio output, RCA composite video output four USB ports, and 0.1″-spaced pins that provide access to general purpose inputs and outputs (GPIO). The Raspberry Pi requires a microSD card with an operating system on it.

The Raspberry Pi is a low cost and small sized computer which can be plugged into a computer monitor or TV. It is faster and able to decode 4K video benefiting from large/ faster storage and faster network connections. This helps us to make streams available to any browser or vlc also.

Figure 2: Raspberry Pi

3.2. Camera

In fig.3 Raspberry Pi camera module can be used to take high definition video, as well as stills photographs. It is very easy to use and still offers plenty of features to play with. The Raspberry Pi camera board transfers data through an extremely fast camera serial interface.

As a Telepresence robot application is to capture live video with high definition this camera offers the best feature we wanted to have for this application. The Raspberry Pi camera module can be used to take high-definition videos as well as still photographs. The module has a five megapixel fixed-focus camera that supports 1080p30, 720p60 and VGA90 video models as well as stills capture. It attaches via a 15cm ribbon cable to the CSI port on the Raspberry Pi. n.

Figure 3: Raspberry Pi Camera

3.3. Motor Driver

In fig.4 L298N Motor Driver module consists of an L298 Motor Driver IC, 78M05 Voltage Regulator, resistors, capacitor, Power LED, 5V jumper in an integrated circuit.L289 Motor Driver module is a high power motor driver module for driving DC and Stepper motors. To drive the robot we used 2 DC motors. L289 is interfaced with NodeMcu and output from NodeMcu drives robot.

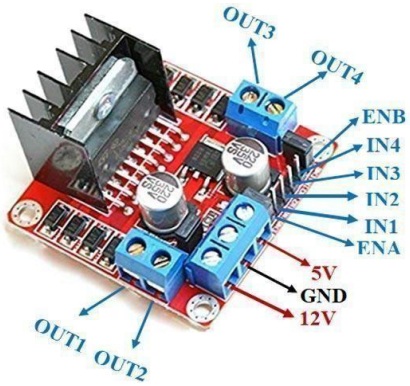

Figure 4: Motor Driver

3.4. Nodemcu

In fig.5 The ESP8266 is the low cost WiFi microchip this small module allows a microcontroller to connect to the WiFi network. NodeMcu is an open source firmware for which we can program it using Arduino IDE so we have uploaded a program for motion control of our robot. NodeMCU can be powered using Micro USB jack and VIN pin External Supply Pin. It supports UART, SPI, and I2C interface.
NodeMCU Development Board can programmed with an Arduino IDE since it is easy to use.

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Programming NodeMCU with the Arduino IDE is much easier. All you need is the Arduino IDE, a USB cable and the NodeMCU board . You can check this onTutorial for NodeMCU to prepare your Arduino IDE for NodeMCU.

Figure 5: Nodemcu

3.5. Geared Motor

In fig.6 Geared motors are a specific type of electrical motors that produce a high torque while maintaining a low- horsepower or low-speed motor output. These can be either AC (alternating current) or DC (direct current). They also have two different speed specifications—normal speed and stall-speed torque.DC geared motors are primarily used to reduce speed in a series of gears, which, in turn, creates more torque.

This is accomplished by series of gears or a gear box attached to the main motor rotor and shaft with the help of a second reduction shaft. The second shaft is then connected to the series of gears or gearbox to create what is known as a series of reduction gears.Two DC geared motors are used in this project

Figure 6: Geared Motor

3.6. Blynk Server

In fig.7 Blynk server is used to communicate with our smartphone with a smartphone via application(apk).Blynk application is available on playstore . Once you download an application you can follow the steps shown in the figures below.

As shown in Fig.7 create a new project and give the name whatever you want. And make sure that you have chosen ESP8266 device and connection type to wifi. Then the second step is as shown in Fig.8 selecting

joystick fromwidget box, adjust size of joystick as per your need . It will show you the page as shown in Fig.9 .After this click on the joystick button then it will show you Fig.10. Ensure that you have selected the merge button and select virtual pin V1 or V2 whatever you have used in your program.

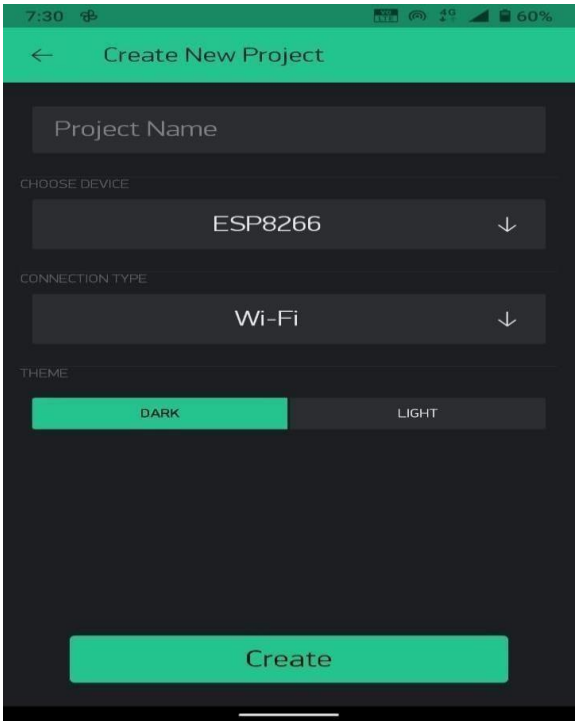

Figure 7: Create Project

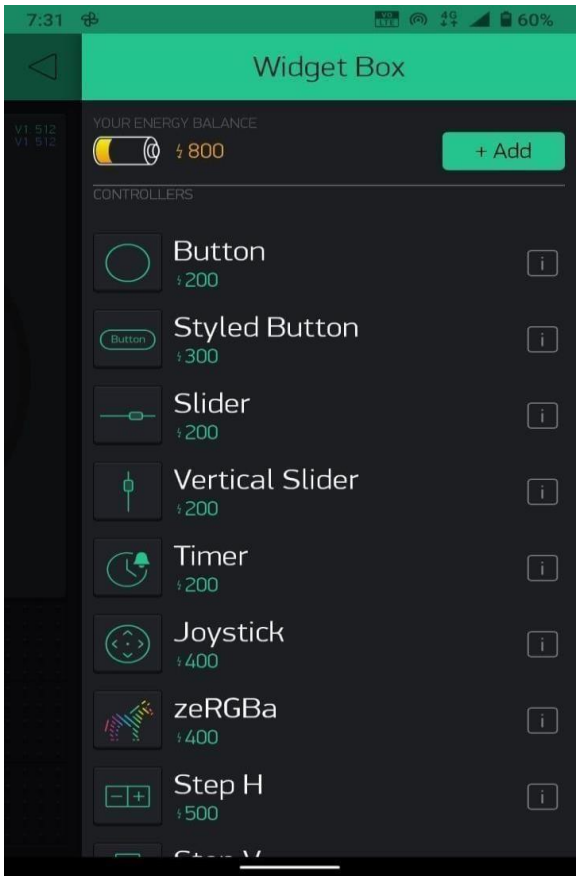

Figure 8: Widget Box

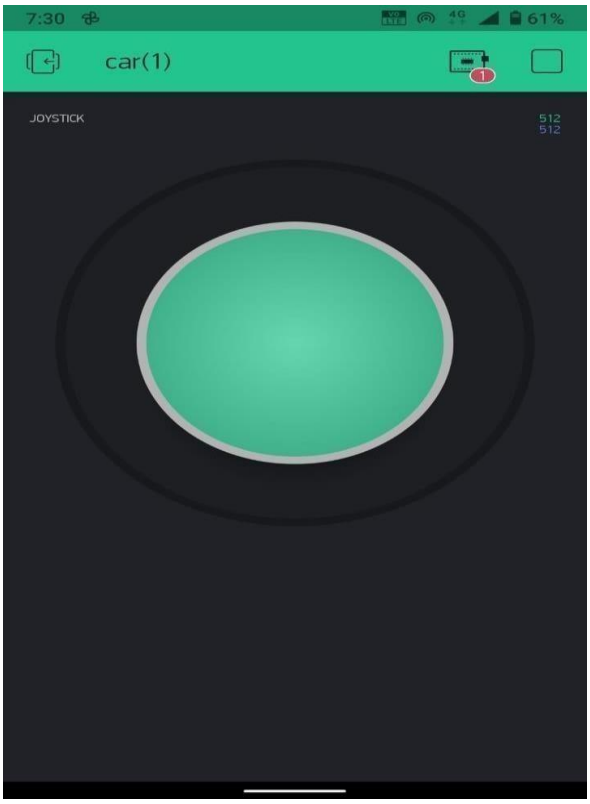

Figure 9: Car1 Project

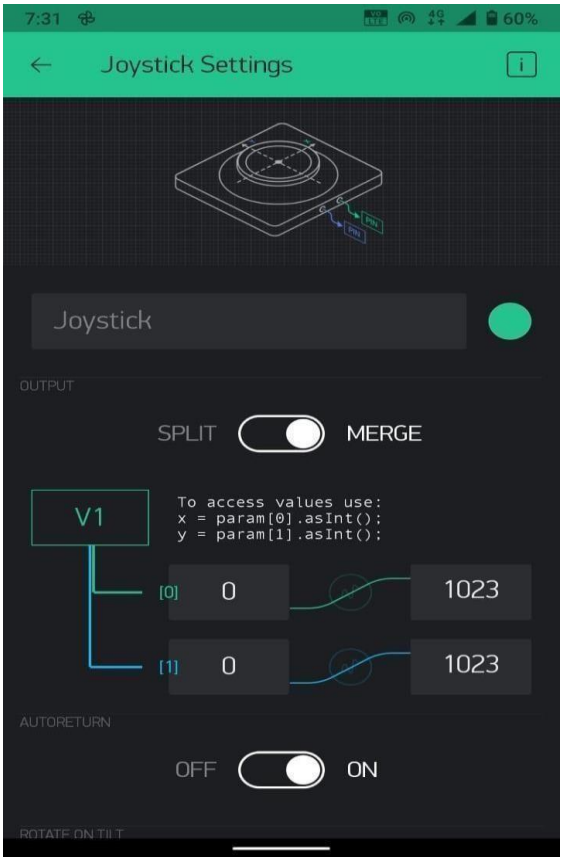

Figure 10: Joystick Setting

IV. WORKING

A Telepresence robot consists of Raspberry Pi fig.2, Camera fig.3, NodeMcu fig.4, Motor Driver fig.5 and Geared Motors fig.6. Robot movement is controlled through a Smartphone via blynk application fig.7 . Once downloaded application settings in application are shown above in Fig.7, Fig.8, Fig.9, Fig.10. By writing proper code for motion control of the robot and uploading it into NodeMcu board using Arduino IDE .Blynk server and its application to interface with NodeMcu board is used to control the motion and direction of the robot. NodeMcu is programmed to work with a Smartphone so that robot movement can happen based on the Smartphone application control.

Once the OS is written on RaspberryPi, install some important packages like Python , php5 etc .Live streaming is captured through a camera attached to the robot. Raspberry pi OS is installed on computer and board is interfaced and programmed to capture the live video streaming. Install the Raspberry Pi Camera module which is used for streaming by inserting the cable into the Raspberry Pi camera port. The cable slots into the connector is between the USB and micro-HDMI ports, with the silver connectors facing the micro-HDMI ports. Now boot Raspberry Pi (plug the power in and turn it on).Once booted, update your Raspberry Pi by running the following commands in a terminal window: sudo apt-get-update && sudo apt-get upgrade
Now run the following command to go into the Raspberry Pi configuration tool, sudo raspi-config
It will show a page as shown in Fig.11

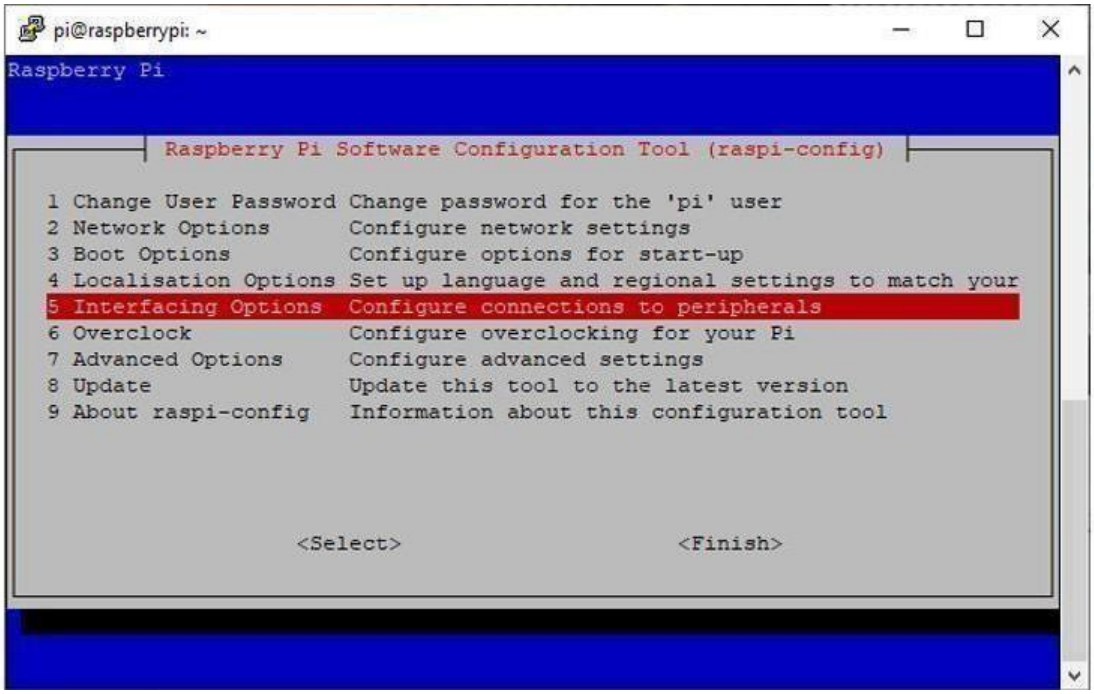

Figure 11: Interfacing Option

Navigate to Interfacing Options and hit Enter. Now select the 'Camera' option, and then hit Enter key to enable it. Select ―Finish‖ and select to reboot Raspberry Pi. As shown in Fig.12

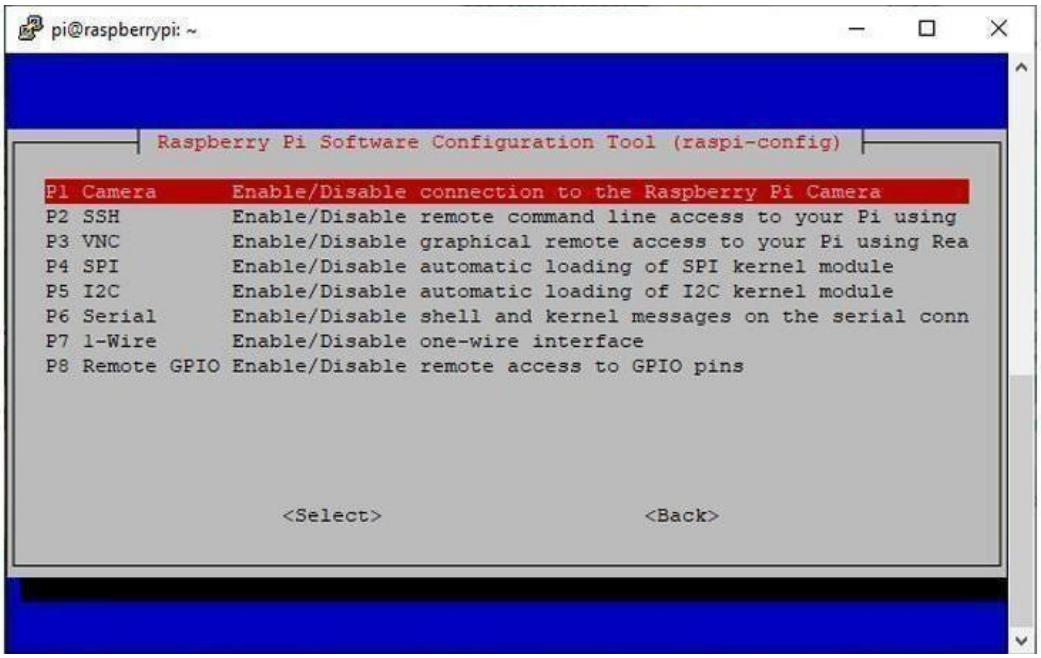

Figure 12: Enable/Disable Connection

Now download VLC player on another computer or install on smartphone. And use following command on RaspberryPi command prompt,

—raspivid -o - -t 0 -hf -w 800 -h 400 -fps 24 |cvlc -vvv stream:///dev/stdin --sout '#standard{access=http,mux=ts,dst=:8160}':demux=h264‖

Once run above command successfully , Then in application goto open network stream and write proper ip http://yourip:8160. It will show live streaming on your smartphone via VLC player. So with the help of a WiFi module it will able to cover a wide range and have our Robot to be placed into a remote location and streaming video captured by robot directly into any video player or using an android phone.

V. CONCLUSION

Virtual telepresence robots can be used in Health care. Knowledge and skill of the physical surgeon can be projected over long distances.This technology allows to establish a sense of shared presence or shared space among geographically separated members of a group.Education system can also be benefited by this technology. Professors can teach students in different campuses at the same time.

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