

Virtual Telepresence Robot Using Raspberry Pi

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Abstract: In today's world telepresence means it is less than a necessity as a person cannot be everywhere and it can be used for variety of other reasons including saving the lives of people. Robot can be controlled from a distant location that means it can be controlled from far location. This paper deals with a very new virtual telepresence robot with added feature that is head movement control that can be used in defence as well as for educational purposes, life threatening jobs like mining. Compared to humans, robots can easily survive the atmosphere which is developed in the field of mining and in defence. In this paper, we are discussing about controlling of robot from distant location. Here the robot is continuously controlled by head movement which in other terms is known as accelerometer and is captured by a camera which gives the user real time experience as if he/she present where virtual telepresence robot is located that is live stream video. The results of the experiments is we can control the robot via head movement. it is helpful in the field of defense and mining.

By the use of video streaming Telepresence technology enables users to be virtually present in another location at the same time. it is a kind of user interaction is further enhanced through mobility by driving remotely to form what is called a Telepresence robot. We can connect individuals with restricted mobility and increase social interaction, collaboration and active participation by using innovative machines. However, the individual who is having little knowledge and map of the remote environment about operating and navigating of these robot is challenging. Through the narrow camera view and manual remote operation avoiding obstacles is a cumbersome task. Through the real-time video feed and, thereby, decreasing their capability to handle different tasks, the users lack the sense of immersion while they are busy. This project demonstrates a simultaneous mapping and also autonomous driving virtual reality robot. By using the 2D Lidar sensor, we will generate two dimensional occupancy grid maps via SLAM and provide assisted navigation to reduce the involving the task of avoiding obstacles. Through head movement we can control thr robot and we will use virtual reality headset for 3D image. Remote users will be able to gain a visceral understanding of the environment while operating the robot.

A telepresence robot is nothing but it is a remote-controlled, fixed with wheeled device with a display which is used to enable the video streaming that enables the participants to view remote locations, as if they were there in the environment where the robot is placed. This project consists of a virtual reality headset, with a smartphone in dual screen used to experience the virtual reality fixed with 4 wheeled robotic vehicle. The movement of the Robot is controlled using a remote controller. The motion of the camera of the robot is controlled by the accelerometer and magnetometer

data processed by Arduino and Raspberry Pi.

Keywords: Raspberry Pi, Smartphone controlled, Telepresence, Video streaming, Video reality.

1. Introduction

Nowadays time is precious for all humans. In order to avoid to avoid the difficulties and make the life easiest way we introduce robots to the world. In our project we are planning to monitor a different place which is far away from the user so in order to save the time from travel from his origin place to desired monitoring place we are introducing the virtual telepresence robot. To meet our expectations, we can use both technologies and they are virtual reality and direction controlled robot. Virtual reality has been seen from past few years, they had been widely used in some different fields like chemical field and the field of graphics and video games. The virtual reality gives the person a special effect that makes the person attain the emotions that the user could feel it as real.

Basically robot can be controlled using different methods here we can control our robot using a remote or from our smart phone screen by providing the directions as input. As we already know robot are invented to reduce the work load of human and make the work in faster way. Robots are nonliving things; they work according to the data or program which is initially installed or stored in it. In our project we are using raspberry pi which we code and store program based on which the robot works. This project gives the user with advantages of virtual reality which makes user as if being present in the desired location without physically being there and control the robot from a far distance the robot can move by the commands of user on which direction he wants to move the robot. Here RPI camera will be placed on the robot for capture the image or video and send it back to the data to the user on his smart phone or display.

2. Background

A Telepresence is remote controlled wheeled device that has wireless internet connection. It will provide audio and video facility. In 1985 Palph Mosher, an engineer working for general elutric, developed a telepresence – called Handiman- that had

good dexterity and compensation. It had only two fingers but those two fingers had three joints that can wrap around any object to hold. These telepresence robots are strong enough to work in any environment and it can be convenient in other dangerous conditions to the lie of human beings. In this paper these robots will capture the images or videos will regularly be streaming the video to the users and the robot will be working according the commands given by the user through smartphone or remote system.

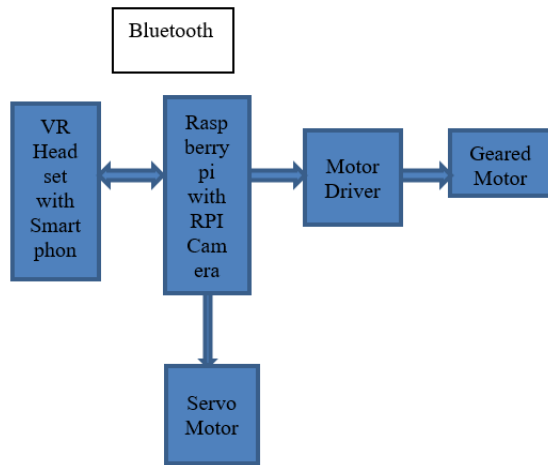


Fig. 1. Block diagram

3. Description

This Paper is framed as shown in block diagram. Here Raspberry pi is the brain of the system. Rpi mounted on the robot. It receives input from the smartphone via Bluetooth or Wi-Fi, Smartphone reads the accelerometer and magnetometer data of the direction in which user gives the command. This data is sent to the Raspberry pi Wi-Fi in which it turns, provides these values as input to the servomotor. Two servomotors are used to move the Rpi Camera in both horizontal and vertical direction. The video captured by Rpi camera can be viewed on a smartphone or the desktop.

4. Hardware

The hardware parts of the Virtual telepresence robot is affordable and easily available on online and in Electronics Shop. Here a little description is given.

A. Raspberry pi

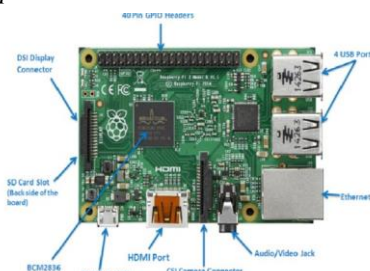


Fig. 2. Raspberry pi

What is the Raspberry Pi?

- The Raspberry Pi was created with the goal of education mind. This is very small and cheap ultra-tiny computer was designed for the purpose of schools could easily afford them in order to teach the students about computers in the classroom.
- The Raspberry pi model B consist of HDMI out, RCA video out, 2 USB ports, an SD card slot, a head phone jack, and an Ethernet port. The raspberry pi board itself has half a gigabyte of RAM and also an on-board ARM processor along with it.

B. L298N Motor driver

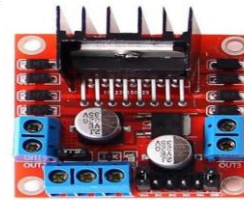


Fig. 3. Motor driver

- Motor Driver used is: L298N
- Motor Driver's power supply: +5V~+46V
- Motor Driver Io: 2A
- Motor driver's Logic power output Vss: +5~+7V (internal supply +5V)
- Its Logic current: 0~36mA
- Its Controlling level: Low -0.3V~1.5V, high: 2.3V~Vss
- It has Enable signal level: Low -0.3V~1.5V, high: 2.3V~Vss
- Its Max power: 25W (Temperature 75 cesus)
- Its Working temperature: -25C~+130C
- It has Dimension of: 60mm*54mm
- Motor Driver weight is: ~48g
- Other extensions are: controlling direction indicator, current probe, logic part power supply, pull-up resistor switch.

C. Geared motors



Fig. 4. Geared motor

A DC geared motor in the field of rotary motors is the device that converts the direct current electrical energy into the mechanical energy. The most common types of the geared motors are that they rely on the forces produced by the magnetic fields. All types of motors will be having some internal mechanisms, either electromechanical or electronic, their main

purpose is to periodically change the direction of current in part of the motor.

D. HDMI Cable



Fig. 5. HDMI Cable

HDMI stands for High definition multimedia interface. HDMI is mainly used for audio or video interface for transmission of compressed or uncompressed digital audio data, uncompressed video data from an HDMI compliant source device such as a display controller to a compatible video projector, computer monitor, digital audio device or digital television. Analog video standards are replaced by an HDMI.

E. Power source

A power source is a source of power. A power source is a device which is used to convert other forms of energy into electrical energy.

Power in physics is defined as the rate of doing work; equivalent to an amount of energy consumed per unit time.

Electric power is defined as the rate at which electrical energy is transferred by an electric circuit; usually produced by electric generators or batteries.

F. Ethernet cable



Fig. 6. Ethernet cable

An Ethernet cable is nothing but it is a common type of network cable that is used with wired networks. Ethernet cables connect devices such as routers, PCs and switches within a local area network. These physical cables have limited length and durability. Any network cable if it is too long or of poor quality, it will not carry a good network signal. These limits are one of the reason that there are different types of Ethernet cables which are optimized to perform certain number of tasks in specific situations.

G. VR Headset

A virtual reality (VR) headset is nothing but it is a head mounted device that is used to provide virtual reality for the wearer. Virtual reality (VR) headsets are widely used while playing video games but they are also used in other applications

which includes simulators and trainers. They are comprised of a process by which two photographs of the same object taken at slightly different angles are viewed together when head mounted like display which provides separate images for each eye, stereo sound, and head motion tracking sensors (which may include accelerometers, gyroscope, structured light systems, magnetometer etc.). Some VR headsets may also have eye tracking sensors and also gaming controllers.



Fig. 7. VR headset

H. Rpi Camera



Fig. 8. Rpi Camera

The Raspberry Pi Camera (RPi) Board v2 is nothing but it is a high quality 8 megapixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi with fixed focus lens feature. It is capable of 3280 x 2464 pixel static images and also supports 720p60, 1080p30 and 640x480p90 video.

I. Servo motor



Fig. 9. Servo motor

Servomotor is a rotatory actuator or linear actuator that allows for pulse control of angular or linear position. Hence servomotor works on the principle of pulse width modulation. Its angles of rotation can be controlled by timing of pulse applied to the control PIN. Servomotor are small in size servomotors contain 3wires those are power, ground and control. And the servomotor rotational is just 180 degrees it can't operate beyond it. We can note it down as a disadvantage of servomotor.

5. Software

The important programming language and software are used.

- Debian OS
- Python



Fig. 10. Debian OS

Debian OS – It is flashed on to memory card 3GB. Then memory card is inserted in the slot of Raspberry pi. Power supply is connected to the Rpi board to supply power to turn on. The Raspberry pi kernel can be accessed by typing Username and Password in the remote desktop

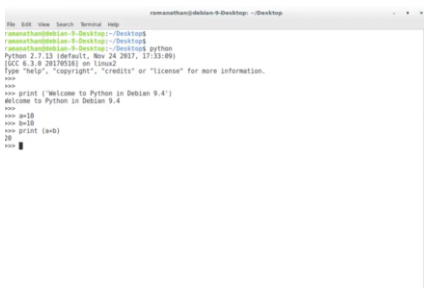


Fig. 10. Python on Debian OS

Python is an interpreted, high-level, general-purpose programming language with dynamic semantics. Its high-level built in data structures, contained with dynamic typing and dynamic bending, makes it very attractive for rapid application development, as well as for use as a scripting.

6. Result

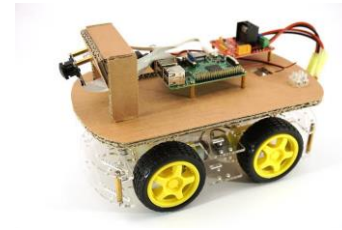


Fig. 11. Hardware setup

After assembling the hardware and installing and running the software we successfully demonstrated that the telepresence robot provides us the video streaming in the direction of our requirement.

7. Conclusion

This paper presented an overview on virtual telepresence robot using raspberry pi.

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