



VIRTUAL TELEPRESENCE ROBOT CONTROLLED WITH HAND GESTURES (VITEL)

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Abstract—ViTel is a robot which is developed in order to achieve virtual telepresence which makes the user feel as if being present in the desired location without physically being there. This robot is a wheeled device which is controlled with hand gestures for the movements, the robot enables the user to control it from a distance and succeed in achieving the view of the objects the robot aims at. ViTel consists of a smartphone in dual screen to experience virtual reality placed inside a VR headset and a two wheeled robotic vehicle. This is an immense aid to view remote locations and to view the places where mankind cannot sustain. By the impact of this, the pollution due to travel and the loss of life can be reduced. It can be used as an application in military and high security bases as well.

Keywords—Virtual Telepresence, Gesture Controlled Robot, Virtual Reality

I. INTRODUCTION

In order to make the life easier by reducing the need to travel to places and yet deal with their desires we introduce this robot. It is meant to be a combination of two different technologies and they are virtual reality and gesture-controlled robots. The actual goal to be attained is to reduce the hustle caused in our day to day lives. With just reducing the travel via the vehicles we use in our daily lives the pollution could be brought under control which would lead to the improvement of global warming eventually, here, and this robot can also be used in such places which has no guarantee for the sustainability for human lives. Virtual Reality has been known to most of them from several years, and there has been wide use of virtual reality in several fields as in cinema field, the field of graphics and video games. Virtual-Reality is a technology which imitates the surroundings and makes the user attain the emotion that the surrounding is real. Robots can be controlled using different mechanisms, in this we have used gesture-controlled robots, the gesture-controlled robots itself has been previously established and have been used widely. This brings both the aspects together to offer more emphasis and efficiency. As we all know that machines are invented only to the reduce the work-load of the human beings and to get the jobs done faster and accurately. Robots, as they are non-living things, the work they perform are based on the program which is initially stored into it or which has been communicated to it in some technological manner. In our paper we make use of Raspberry Pi and Arduino board into which we code and store the program based on which

the robot works. This paper provides the user with the benefit of virtual telepresence which makes the user as if being present in the desired location without physically being there and control the robot from a distance, the robot which is movable with the hand gestures will help the user to view even the surroundings.

- **Virtual Reality** – The user enjoys the benefit of experiencing the reality of being in a desired location without actually being there.
- **Gesture Controlled Robot** – The user uses the hand gestures to control the robot for its movements, the communication takes place between the rf-transmitter and rf-receiver.
- **Virtual Telepresence** – It is the combination of a robot which could move and virtual reality.

II. RELATED WORK

Had examined and reviewed various published papers related to robots controlled by hand gestures and virtual reality. This helped us to develop on virtual telepresence where the robot is controlled by the hand gestures. We used accelerometer and radio frequency module to attain the gesture-controlled robot and the data captured by the pi camera is shared upon a common server to be viewed on the smart phone in VR mode placed inside the VR box to attain the experience of virtual reality. In [2] in this robot they have made use of polysilicon surface sensor and signal controlling

circuit to quantify acceleration. The outcome of the accelerometer is analog in nature and corresponding to the acceleration. This gadget measures the static acceleration of gravity when we tilt it, and gives an outcome in type of movement or vibration. The gestures made by the hand are sensed and the coordinates are recorded and lies inside the framework, different gestures caused due to the hand movements causes changes to the coordinates and all these criteria eventually lead to the motion of the robot. It uses the technology of a robotic car which could be controlled using simple human gestures. This paper also discusses about how the resources are interfaced, the robot is controlled by the hand gestures and the communication is wireless and occurs with the help of radio waves, the gestures not only controls the movement of the car but also the controls the device controlling the flow of power or fuel into the engine. Movement of car is controlled by the differential mechanism. In [7], this paper defines Virtual Reality is a computer-based technology which regards the output with similarity with the input hence enabling the user to actually feel the presence of the surroundings as if to be real. Further the discussions are made on the need of virtual reality and the types of virtual reality. The paper states there are six types of virtual reality enhanced reality, immersive reality, quick time virtual reality, desktop virtual reality and hybrid virtual reality.

III. METHODOLOGY

To develop ViTel, made use of Arduino uno, raspberry pi, dc motors, servo motors accelerometer, motor drivers, batteries, bread board, metallic chassis and connecting wires. An Arduino uno with the required connections and a rf-transmitter are fitted onto a hand-glove and it is worn by the user, the hand movements are transferred to the radio frequency receiver placed on the bread board by the radio frequency transmitter and the signals to the dc motors are controlled by the motor drivers, the dc motor helps to turn the wheels to the desired direction. The horizontal movements of head are transmitted by the accelerometer of the respective phone via Wi-Fi to the receiver of the raspberry-pi and the vertical movements are transmitted from the gyroscope of the respective mobile device to the receiver of the raspberry-pi. The pi-camera and the mobile device are interfaced through a server which helps in transmitting the images captured by the camera to the mobile device. The mobile device is placed inside a vr-box which is a virtual environment visualization platform for smartphones, to immensely experience the vreffect. Figure 1 depicts the block diagram of ViTel.

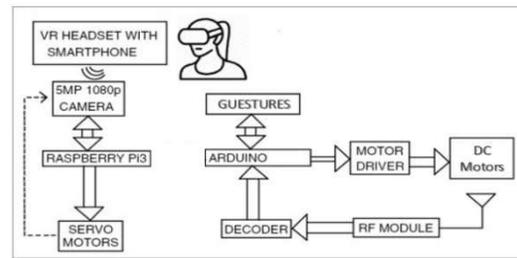


Figure 1: Block Diagram of ViTel

MATERIALS USED:

Metallic chasis:

The chassis is usually made from hard metallic material such as aluminum alloy and less frequently stainless steel or titanium alloy. It is the base used for placing the bread board and batteries. The wheels are attached to the chassis.

The bread board is to be placed on the metallic chassis. Figure 2 depicts Metallic chassis.



Figure 2: Metallic Chassis

Breadboard:

It comes with a bunch of tiny holes in it, these holes used to insert electronic wires or other components to an electronic circuit. Figure 3 shows the Breadboard.



Figure 3: Breadboard

Arduino Uno:

Arduino Uno is defined as a microcontroller. It is an open-source. It consists of digital input/output as well as analog input/output pins. Figure 4 shows Arduino Uno

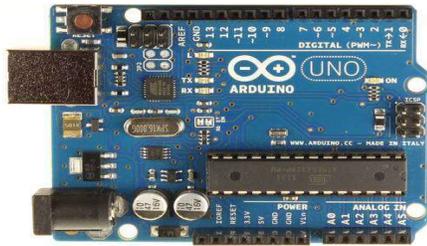


Figure4: Arduino Uno

Raspberry Pi:

Raspberry Pi can be defined as computer or processor small in size which can be connected to a television or to a monitor along with keyboard and mouse. Figure 5 shows Raspberry Pi.



Figure5: Raspberry Pi

RF-Transmitter and RF Receiver:

Figure 6 depicts Radio-Frequency Transmitter and Receiver. A radio frequency transmitter transmits the serially received data to the receiver through wireless transmission with the help of radio frequency and the receiver receives the data from the transmitter operating at the same frequency as that of the receiver. The rate at which the transmission occurs is of 1Kbps – 10Kbps.



Figure6: RF Transmitter and Receiver

VR Box:

VR Box is a virtual reality (VR) platform used with a head mount for a smartphone. Figure 7 depicts VR Box.



Figure7: VR BOX

IV. RESULTS

Figure 8 and 9 depicts the well assembled and designed ViTel (robot). Figure 10 depicts robot movement according to the gestures of the hand.

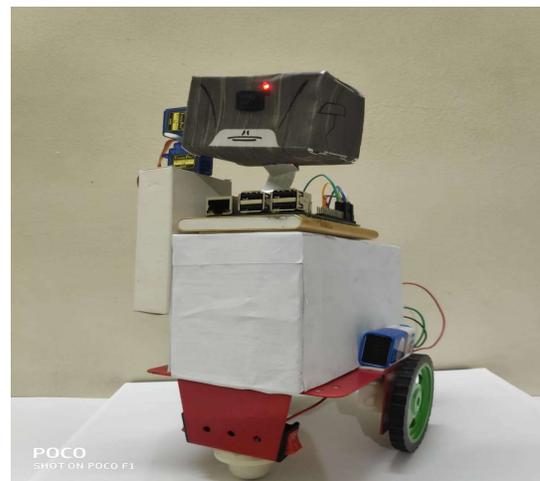


Figure8: ViTel (robot)

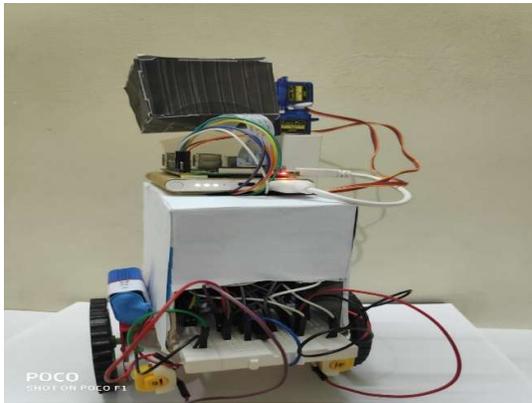


Figure9: ViTel (robot)

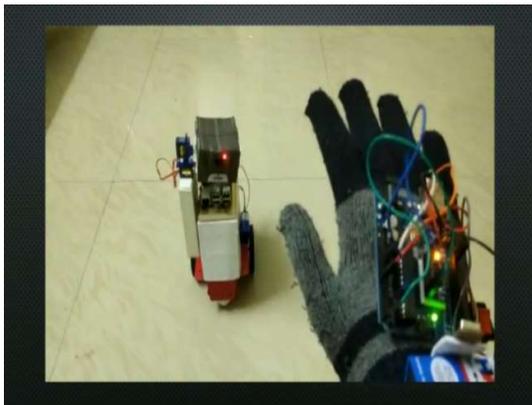


Figure10: Robot movement according to gestures of the hand.



Figure11: Video viewed on smartphone



Figure12: Live through Virtual Reality

In figure 11 and 12 depicts the video which is captured by Raspberry pi camera is transmitted and is viewed on the smartphone, which is then placed inside the VR-Box to experience virtual reality.

USES

- In order to reduce the pollution and save the time and cost by not travelling.
- To prevent the loss of lives, a person might not require to go to a dangerous place only to inspect instead he could send this robot which he could control from distance and view the place.
- For medical purpose, the task of doctors of going rounds to check their patients could be replaced with this robot.
- A crisis where humans are meant to be isolated from each other yet communications, meetings, college and school lectures should happen, during such scenarios the robot will be useful.

V. CONCLUSION

In this paper, we have developed a robot which could bring us the experience and satisfaction of being in a desired location without actually being present there. The robot is controlled by hand gestures and it has range of 15m to 20m, it works under radio frequency module. In order to enhance the distance coverage, we will have to establish the communication of the transmitter and the receiver for the movement of the robot over cloud, since this is only a prototype we considered to go with radio-frequency. This could be beneficial in various streams as in surveillance, hospitals, defense, education and work.

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