

Vr Telepresence Robot Using Raspberry Pi

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Abstract: A telepresence robot is a remote-controlled, wheeled device with a display to enable video streaming which enable the participants to view remote locations, as if they were there. The project consist of a VR headset, with a smartphone in dual screen to experience virtual reality and 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. Video streamed is received by the smartphone using the IP address specified by the Raspberry Pi.

This robot with a camera is placed in a remote location to capture the environment in visual form using Raspberry Pi (R Pi). The captured visuals are displayed on the users virtual reality (VR) headset. An added feature allows the camera to move in the direction of the users head movements[3]. This gives the user a real-time experience as if he is present where the robot is located. The robot can also be moved in any direction through an app installed in the users smartphone.

Keywords - :Raspberry Pi, Vr Box, Raspberry Pi Camera Model, Wifi Dongle.

I. Introduction

Tele-presence refers to a set of technologies which allow a person to feel as if they were present, to give the appearance of being present, or to have an effect, via tele-robotics, at a place other than their true location. Tele-presence requires that the users' senses be provided with such stimuli as to give the feeling of being in that other location. Additionally, users may be given the ability to affect the remote location. In this case, the user's position, movements, actions, voice, etc. may be sensed[6], transmitted and duplicated in the remote location to bring about this effect. Therefore information may be travelling in both directions between the user and the remote location. A popular application is found in telepresence video conferencing, the highest possible level of videotelephony. Telepresence via video deploys greater technical sophistication and improved fidelity of both sight and sound than in traditional videoconferencing.

Technical advancements in mobile collaboration have also extended the capabilities of videoconferencing beyond the boardroom for use with hand-held mobile devices, enabling collaboration independent of location A telepresence robot is a remote-controlled, wheeled device with a display to enable video chat and video conferencing, among other purposes which enable the participants to see and talk to remote locations, as if they were there. They also enable much more interactivity than regular video conferencing. In a distance education class, for example, a telepresence robot can move around the room and interact face-to-face with individual students, just as an on-premises instructor might. Telepresence robots can enable remote tour guides, administrative assistants, home visitors, night watchmen and factory inspectors, among many other possibilities. To create the same-room illusion, telepresence solutions use a combination of technology elements like high quality audio, HD video, telemetry system and remote control all working in parallel to achieve the goal[4]. As organizations continue to become more international in their business practices, there is a rapidly growing demand for communication tools that support these activities while effectively combating the increasing costs of domestic and international travel. Although telepresence robots aren't inexpensive.

II. Hardware Design

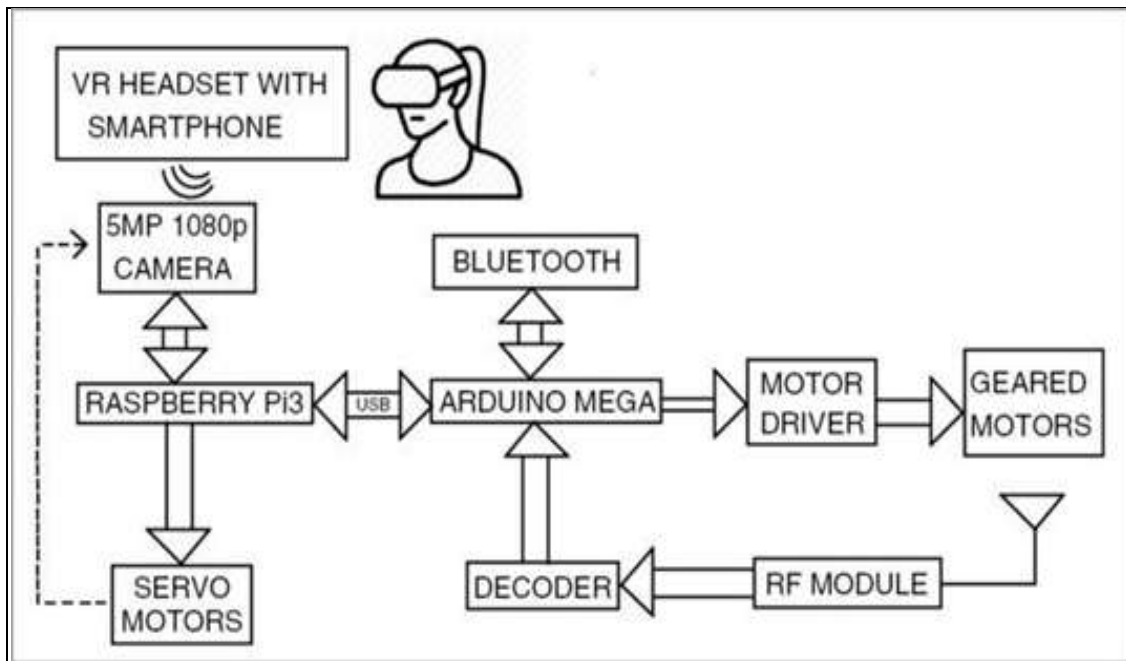


Fig.1 Block Diagram Of Vr Telepresence Robot Using Raspberry Pi

2.1.Working:

The 1st stage of project hardware is the power supply. Rechargeable batteries are used in the power supply in order to store the power. This is charged up by connecting to a 12V charger. The navigation circuit is the one which controls the movement of the robot. The directional data is sent to the navigation circuit. It is processed by the International Journal of Innovative and Emerging Research in Engineering Volume 4, Issue 2, 2017 56 Arduino and then provided to the driver IC which drives the gear motor in the required direction. This operation can be controlled by transfer of data = through Wi-Fi or Bluetooth or RF modules as transmitter and receiver. The casing to hold the gear motors, servo motors, camera and Raspberry Pi was made intact. The next main procedure is the setting up of the Raspberry Pi. The initial configurations are done. The board is connected to the Wi-Fi. An IP address is programmed and setup which links to the Raspberry Pi. The video that is captured by the camera is sent over to the Wi-Fi modem. The modem creates a LAN where in both the smartphone and the Raspberry Pi are connected. It is through this LAN that the data (head movement and video) is shared. This transmitted output can be viewed by connecting the smartphone or the laptop to the same Wi-Fi connection and IP address. This transmitted output is viewed in a smartphone placed in the VR headset. The smartphone is switched to dual screen mode for this purpose. The project also has the feature of letting the user experience virtual reality by swinging the VR headset. The smartphone reads the accelerometer and magnetometer data of the direction in which the user had turned. This data is sent to the modem over Wi-Fi and to the Raspberry Pi board which in turn provides these values as input to the servo motor. There are two servo motors which are used to move the camera. One for the vertical and other for the horizontal movement[1].

The raspberry Pi on the robot is configured to a Wi-Fi access point; we can connect to the robot with multiple devices. The PC is the remote controlling machine. It sends the connected keyboard command to the robot via sockets by a python program. Separate raspberry pi is used for the movement control from the PC keyboard, and for the head tracking. Another socket program for the head movement is developed. In this program socket from wireless IMU android app on raspberry pi is received and get and mapping this to servo positions. In the program user can limit the servo movement to the physical limits of the mechanic. For the video stream UV4L streamer solution is used. User can connect to the stream with browsers, so its really universal. In the current experimental setup 640x360 videos is streamed. User can connect to this stream via mobile[5].

III. Conclusion

With the successful integration of the hardware and software components, the Virtual telepresence robot moves almost simultaneously with the robot operator. Positions are successfully obtained by the Wireless IMU app and sent to the servo controller raspberry pi and the robot controller via the PC. This unilateral control method provides the human operator with visual telepresence and enables him/ her to remotely control the robot. Solves the lack of cost efficient telepresence robotic platform for complete and immersive remote operation, with stereoscopic machine vision and suggestive feedback and ready deployment in indoor environments such as hospitals, museums. Providing accessibility to stereoscopic stream in harsh environments such as war prone areas, debris and dust affected regions, nuclear armament or industrially radioactive zones using remote links. Addressing the major problem of lack of immersion in a Telepresence Robotic system by integrating Virtual Reality headsets (such as Google Cardboard) and online real-time head movement control and stereoscopic stream to traditional telepresence platform controlled remotely and wirelessly via the Internet.

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References

- [1]. Journal Papers: Telepresence Robot System for English Tutoring OhHun Kwon, Seong-Yong Koo, Young-Geun Kim, and Dong-Soo Kwon, Member, IEEE
- [2]. Books: Exploring Use Cases for Telepresence Robots.Katherine M. Tsui, Munjal Desai, and Holly A. Yanco University of Massachusetts Lowell 1 University Avenue, Lowell, MA 01854 ktsui, mdesai, holly@cs.uml.edu
- [3]. Chapters in Books: Essential Features of Telepresence Robots K. M. Tsui, M. Desai, H.A. Yanco, and C. Uhlik, Exploring Use Cases for Telepresence Robots, in Proceedings of the 6th ACM/IEEE International Conference on HumanRobot Interaction. ACM, 2011.
- [4]. Theses: Raspberry Pi as a Wireless Sensor Node: Performances and ConstraintsVladimir Vu-jovic and Mirjana Maksimovic.Nazmul Hossain, Mohammad Tanzir Kabir, A Real-time Surveillance Mini-rover Based on OpenCV-PythonJAVA Using Raspberry Pi 2, 2015 IEEE International Conference on Control System, Computing and Engineering, 27 - 29 November 2015, Penang, Malaysia.
- [5]. Electronic devices and circuits by A.P. Godse, U.A Bakshi
- [6]. Documentationby<https://www.raspberrypi.org/>