Overview

Virtual Reality is a hot topic on immersive multimedia or computer simulation. Users of the headset can be in the virtual world. For example if the user turn his head to the right, he can see the things on his right in the 3D virtual world. In the past, virtual reality equipment was usually for Military and training use, with high price and high requirement on the computer that operate.

In 2012, a company called Oculus VR posted an idea onto the Kickstarter about a visual, commercial, entertaining virtual reality headset: Oculus Rift.

By Oculus VR’s introduction to the developers, Oculus Rift is a virtual reality headset designed for gaming and entertaining, aim to give a new experience for the users on gaming.

Objective

The objective of our project is to build a prototype of an immersive robot which can be controlled wirelessly. Our immersive robot combined the virtual reality and robotic system.

Our robot has two cameras inserted as the eyes of the robot, 3 shafts are implemented to simulate the head movement and a tank with continuous tracks as the base. To control the robot effectively, a head set, Oculus Rift and an Xbox game controller are connected to the PC; then transmit and receive data through a wireless network. Two Raspberry Pis are act as a control unit of the robot.

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Software Design
We chose C++ as the programming language for our project.
1. Create a network connection between 2 Raspberry Pi and the PC.
2. Grab the control data input by the user via Xbox controller, and the head movement of the user via Oculus Rift.
3. Send those Data from PC to the Raspberry Pi.
4. Raspberry Pi use the data to calculate the output of the servo and the motor.
5. Send signal to the PCA9685 in order to drive the servo and motor.
6. Capture video using Raspberry Pi Camera Module
7. Encode to right format and stream the video to the PC.
8. Receive video and decode it.
9. Render the frame onto the Oculus Rift head-mounted display.

Result
1. The servos can easily follow the movement of the head set along the yaw, pitch and roll shafts with negligible latency; and it cause no effects to the whole robotic system.
2. The power supply system can be operated efficiently and provide a stable power supply to all the electronic devices and components on the robot.
3. Multiple sockets can be created within one program.
4. Multiple sockets can be created on both Raspberry Pis and the PC.
5. Data can be sent by both TCP and UDP.
6. Images can be sent and received successfully, although the target is not sending the image, but the skill can be used in video sending.

Immersive Robot (WKT4-15)

Supervisor’s Name:
Professor Woo Kam Tim

Methodology

Hardware Design
The robot is designed as a tank with multiple layers for growth of complex structure. The robot is mainly divided into 3 layers with different functions. Top layer is for Raspberry Pis, cameras, servos and electronic circuit implementation. A router for wireless communication between the PC and the two Raspberry Pis is installed in the middle layer, while the batteries and other electronic circuits are implemented at the bottom layer.