TWIN REALITY

CONTROL SYSTEMS AND INSTRUMENTATION ENGINEERING PROGRAM

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Introduction

Virtual Reality has played an increasingly important role in our world. Be it attending online meetings, playing games, medical professions. The most common use of Virtual Reality is to work with robots. Therefore, helping to promote robots to effectively respond to human needs is a very important factor. In addition, today's industrial plants There are many areas that are related to remote areas or areas with limitations Therefore, if we can control robots to work remotely It can help reduce working time. The organizing team therefore saw that we could solve the problem by using a Virtual Reality system to control the robot from a distance. To bring to work in various areas without humans having to go into the area themselves.

Methods

For the hardware part, it consists of two computers. The first computer is responsible for creating the virtual world and connecting to the VR Valve Index headset. The headset sends data through Steam VR to display the virtual world and receives input from the VR hand controller. Afterward, the computer processes the data before sending the robot's position data to another computer running Linux via an IP address. Once the position data is received successfully, it is converted into joint values and transmitted to the robot via an IP address. When the real-world robot receives the joint values, it moves accordingly. Then, the robot sends the data back to ROS for comparison with the virtual world to ensure alignment. In designing software for the virtual world, the team will utilize Unity, a software capable of creating 3D virtual environments. Windows will serve as the intermediary between the hardware and the application. To create the virtual world, it's crucial to accurately capture and detail the objects as the robot's movements depend on it. Therefore, precise and detailed object representations to ensure the robot's accurate navigation when deployed in real-world scenarios

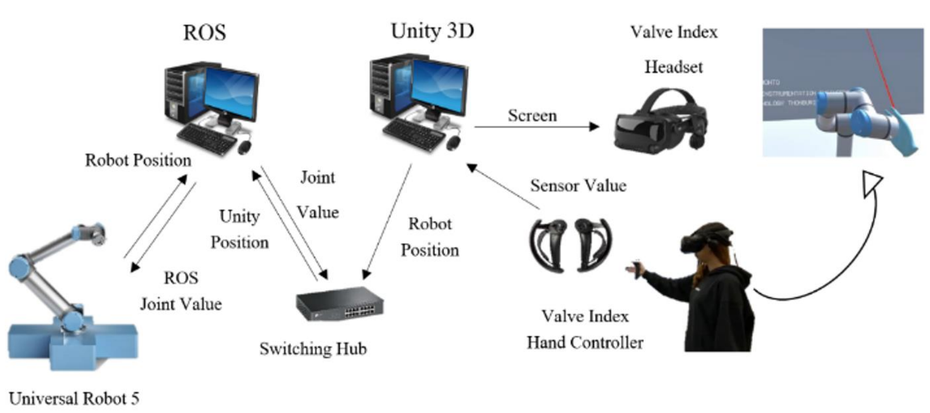

Figure 1. Concept

Conclusion

Twin Reality, Robot in the real world can mimic movements for corresponding to virtual robots. But it is possible to manipulate them to grasp and move objects from one position to another. However, discrepancies in distance between objects and the virtual or real-world robots could lead to errors in grasping and moving objects. As this project is merely a prototype model for further development, it only utilizes VR. In future developments, it should transition to AR to incorporate real-world environments instead of relying solely on simulated environments, thus eliminating the need for distance calculations as in the current setup.

Results

When the user moves their hand in any direction, the robot will move or adjust its position to reach the user's hand, considering the Wrist3 axis. Test results demonstrate that the robot can effectively move in alignment with direction of the user's hand.

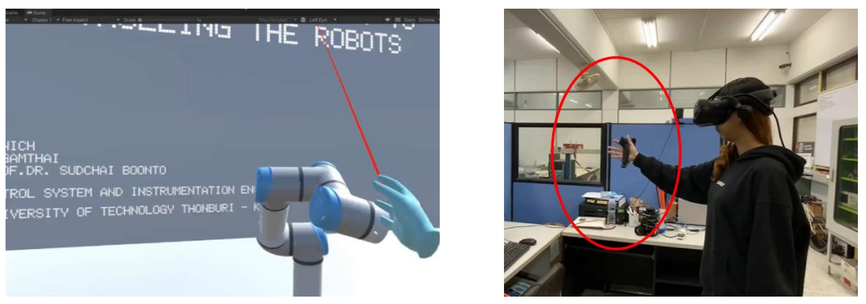

Figure 2. Control UR5 by using VR hand controller

When the user brings their hand close to an object and makes a grasping gesture, indicating the intention to pick up the object, the robot responds accordingly by grasping the object within its hand. Subsequently, when the user performs an open-hand gesture, signifying the intention to release the object, the robot responds by placing the object onto the floor. The objects in the virtual world can effectively respond to control inputs via the hand controller.

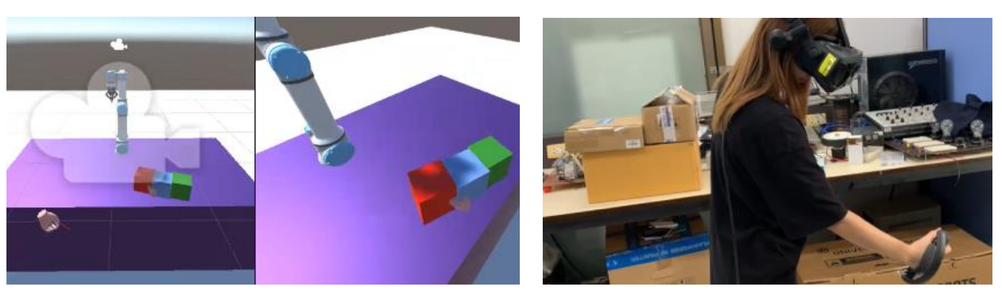

Figure 3. Objects interaction with each other

When users control the robot within the virtual world, they will observe that the real-world robot moves accurately in alignment with the movements of the virtual robot. However, we have the flexibility to adjust the time delay according to our requirements through settings in the Robot Operating System

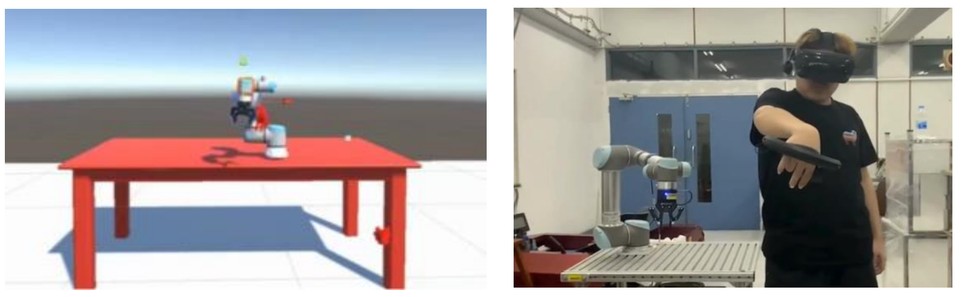

Figure 4. Final stage

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