Faculty of Engineering
Summer Research Program 2023-2024

Project Title: Remote Control of Robotic Arms using Virtual Reality

Supervisor(s): Dr Pamela Carreno-Medrano, Dr Akansel Cosgun

Department: ECSE

Email: akansel.cosgun@monash.edu

Website profile of project supervisor:

https://scholar.google.com/citations?user=HPPx6F8AAAAJ&hl=en

https://www.linkedin.com/in/akan-cosgun-02608847/

Objective

In factories and warehouses, there are often several robots under operation at all times. Often, problems occur such as if the robot fails to detect an object or drops an object it is carrying. It is costly for on-site personnel to fix these issues. This project will explore the idea of remote operators connecting to robots, diagnosing and fixing the problem.

In our previous work, we developed a new paradigm to program robots, by selecting the robot's waypoints in Virtual Reality. In this project, we will explore this project further. We will explore developing a "shadow mode", allowing remote user to watch the process, as well as creating new control methods such as selecting and moving a virtual object in which the real robot would watch.

Project Details

The hardware that will be used for this project is a robotic manipulator (Franka Panda) and a Virtual Reality Headset (Meta Oculus Quest 2). The project would consist of the following stages:
1) Visualize the robot's raw sensor (from RGB-D cameras) in VR
2) Detect objects in real-world using RGB-D cameras, and create virtual replicas of them in VR
3) Creating the user interface that will let users move the objects freely in VR.
4) From the virtual object's movements, solve how the robot arm should move. If the actions are infeasible, show to user which trajectories are feasible (staying as close to the user's movements as possible)
5) Executing the programmed trajectory on the real robot
6) Conduct user studies to evaluate the effectiveness of the user interface.

Prerequisites
● Strong programming skills in Python, C++, C# or another programming language