

Pick & Place UR5 Robotic Arm

1. Introduction

In today's world, robotics plays a central role in improving speed, consistency, and efficiency in manufacturing processes. One of the most widespread robotic applications is the pick and place task, where a robotic arm picks up an object and moves it to a different location. This function is essential in industries such as packaging, sorting, and assembly where fast and repetitive operations are required. For our robotics project, we decided to simulate a robotic arm performing a pick and place task inside a controlled industrial environment.

2. Why This Selection

We chose this specific task because it offers a practical use case that is widely implemented across various industries yet remains within the scope of our coursework. The pick-and-place operation is relatively straightforward in terms of motion, but it still allows us to apply important concepts from the course, such as forward and inverse kinematics, trajectory planning, and system control. It also enables us to build and visualize a realistic robotic environment, which will be useful when developing our simulator and GUI later in the project.

This task also aligns well with the tools we are using. Since we are working with ROS2 and Webots, simulating a robot picking and placing objects provides a hands-on opportunity to practice integrating these systems while working on a realistic industrial application.

3. Real World Uses

Pick and place examples are: Amazon warehouses where robotic arms sort packages into delivery containers, ABB and KUKA industrial systems where robots package things such as medical supplies, and Universal Robots UR5 systems used in factories to automate repetitive tasks, reduce labor cost, and improve throughput. The UR5 robotic arm, in particular, is designed to work safely alongside humans and is known for its 6 degrees of freedom, lightweight structure, and versatile programming interface. It is widely used for packaging, assembly, material handling, and testing applications.

4. Simulated Environment and Approach

For this project, we will be simulating the UR5 robotic arm in Webots, which supports ROS2 integration and real-time control. Our environment will include a simple industrial setup where the UR5 will perform pick and place operations. Objects will be picked from one position and placed into a designated area such as a container or conveyor. This setup provides a strong foundation for testing motion planning, control logic, and eventually building a functional graphical user interface.

5. References

Universal Robots. (n.d.). UR5 Collaborative Robot Arm. <https://www.universal-robots.com/products/ur5-robot/>

KUKA Robotics. (n.d.). Packaging Automation Solutions. <https://www.kuka.com>