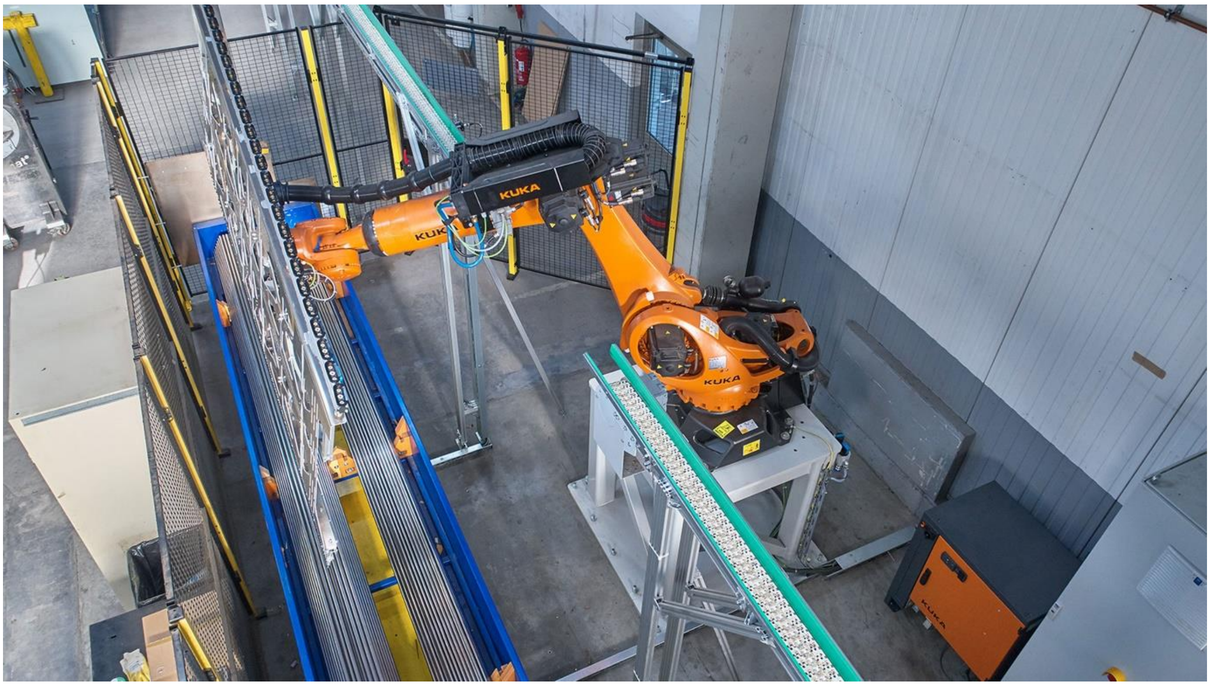
Egyptian Russian University
Faculty of Engineering
Mechatronics & Robotics Dep.

Robotics and material handling project

Project Code: ME446

Pick and Place Robots simulation using Coppeliasim

Technical Report



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Introduction

Pick and place is probably the most common application in robotics these days. It's certainly extremely popular. Whether you're moving boxes, bottles, bricks, blocks, or bags, there is almost certainly a pick and place robot to suit your needs.

There are so many options when it comes to pick and place robotics. Many robot models are suitable and it's not always obvious which robot is the best one for you.

A pick and place robot is any robot that can pick up an object from one location and drop it in another. They are used for a wide variety of tasks in manufacturing and other industries, including sorting, stacking, moving, and packaging products.

This wide definition applies to most robot models so there is no specific "pick and place robot" that is always used for this type of task. However, some types (such as Delta robots) are more commonly used for pick and place than others.

Benefits of Using a Robot for Pick and Place

Using a robot for pick and place has some significant benefits when compared to manual pick and place:

1. **Throughput —** The most obvious benefit is increased throughput. A robot will be able to consistently pick and place more objects than a human operator and can operate round the clock to increase throughput further.
2. **Safety —** Less obvious is that using a robot is safer than having humans move the objects. Repetitive motions such as those required by pick and place can cause musculoskeletal problems over time.
3. **Speed —** Most robots will be much faster than humans at pick and place tasks, some significantly faster. Even those robots that are slower than humans (e.g. many collaborative robots) will be able to keep up their speed consistently.
4. **Consistency —** The most impactive benefit of all robots is that they are more consistent than humans. A robot will always pick and place items in the same way.
5. **Return on Investment —** The return on a pick and place task can come very quickly as such tasks can usually be calculated by the amount it would have cost to hire a human to perform the same task.

Programming a Pick and Place Robot

Whatever type of robot you use, you want to be able to program it as easily as possible. This is easier with some types of robots than others. However, whatever robot you are using, the robot programming can become easy if you choose the right programming system.

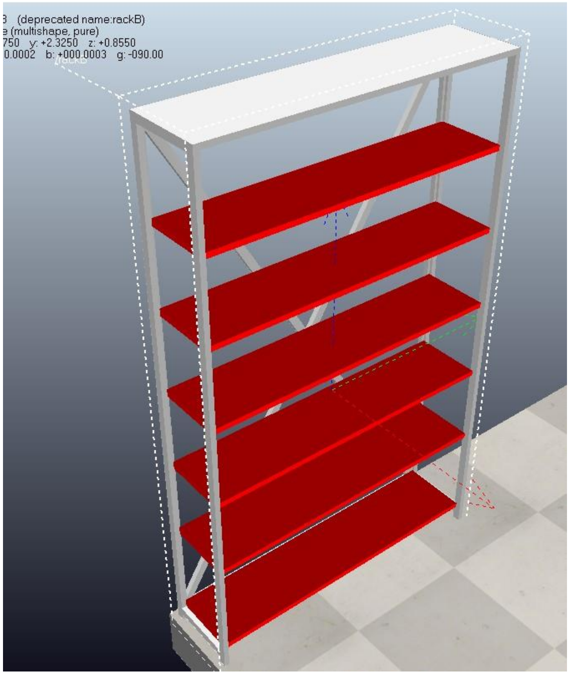
Here I'm using the Coppeliasim Version 4.3.0 (rev. 3) 64 bit

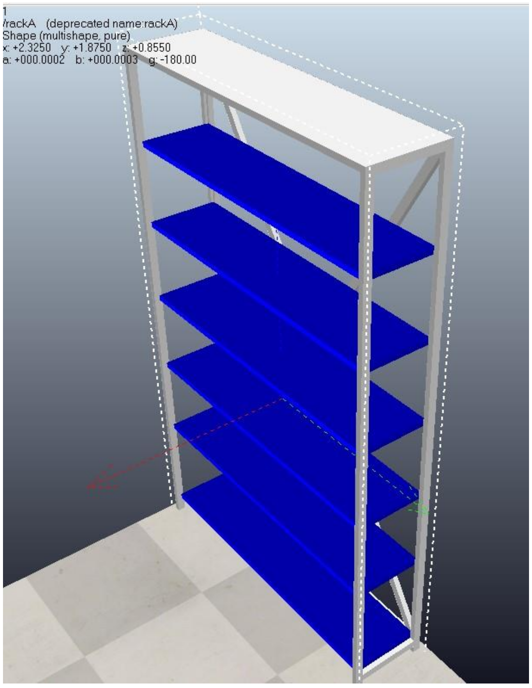
Scene items properties

Racks

Firstly, I started by adding two different racks, one with red shelves for red cuboids.

The other one is with blue shelves for blue cuboids.





Conveyor tables

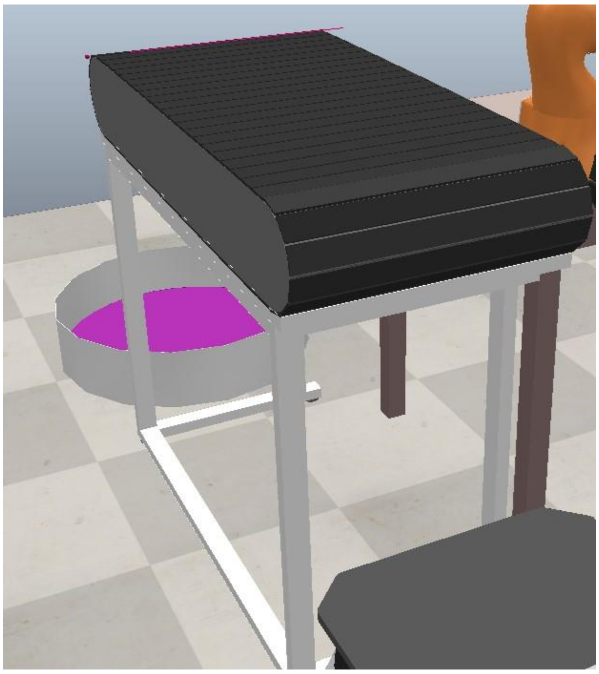
Since there’s no conveyor table in coppeliasim, I tried create something similar to it by combing a generic conveyor belt to a high table to give a closer look to what conveyor tables in real life looks.

I used 3 identical shapes to this:

Height: 1.3 m

Width: 0.6 m

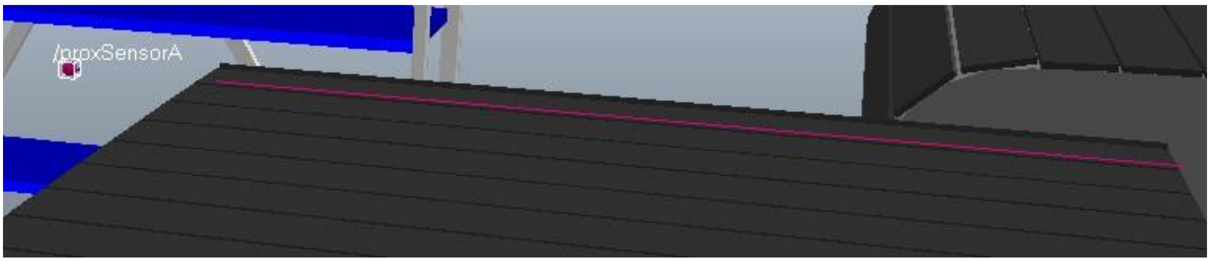
Length: 1.1 m



I also added a ray tube proximity sensor to detect objects.

Offset: 0.1 m

Range: 0.55 m



Customizable table

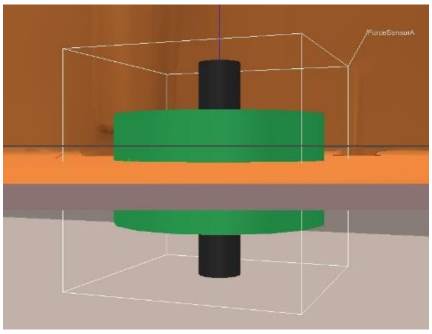
I used a customizable table and placed the robot arms on it.

Height: 0.9 m

Length: 1.4 m

Width: 0.8 m

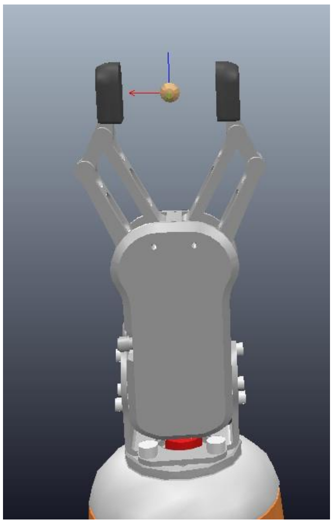
I also used a force sensor to join between arm robot and customizable table in order for them not to fall instantly just after starting simulation.

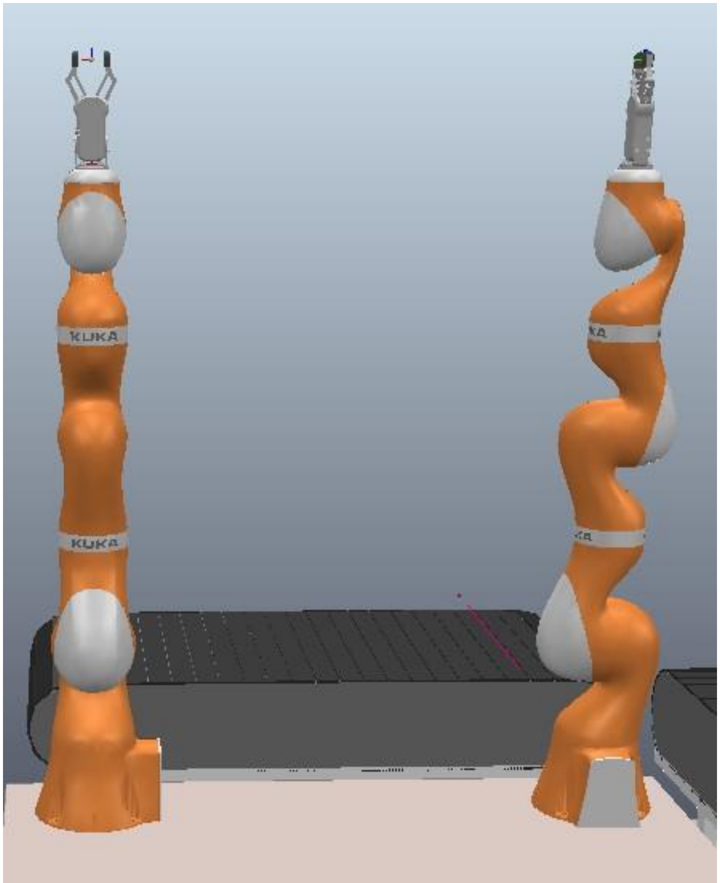


Robot arms

In my scene I used two robot arms of KUKA 6 Degree of freedom model on coppeliasim.

As you can see, I attached an RG2 gripper for each robot to grasp cuboids easily.



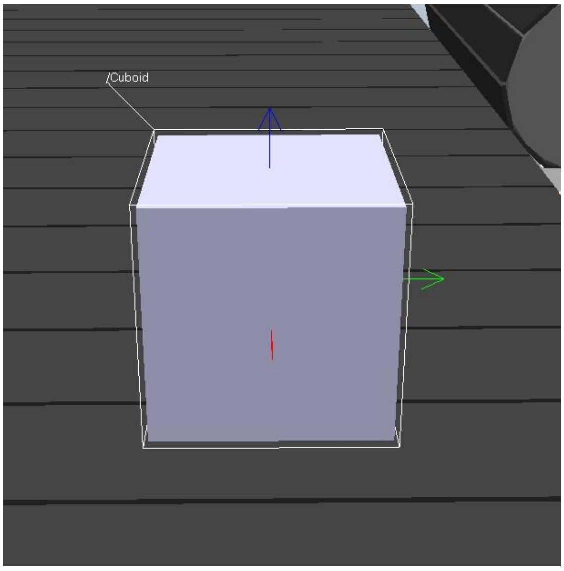


Cube

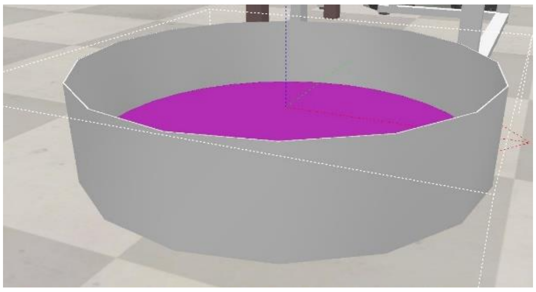
Here I used primitive shape (Cube).

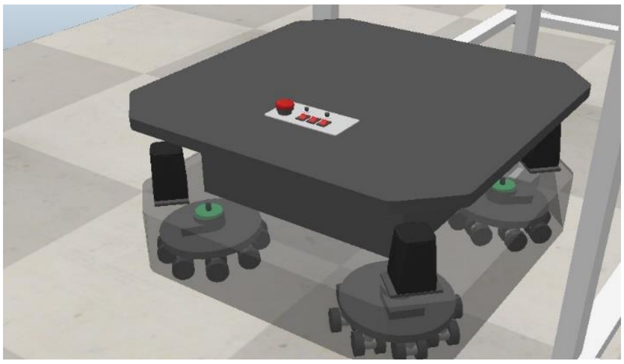
Length: 0.6 m

The code is supposed to insert a cue every 3 seconds of a random color between red, green and blue.

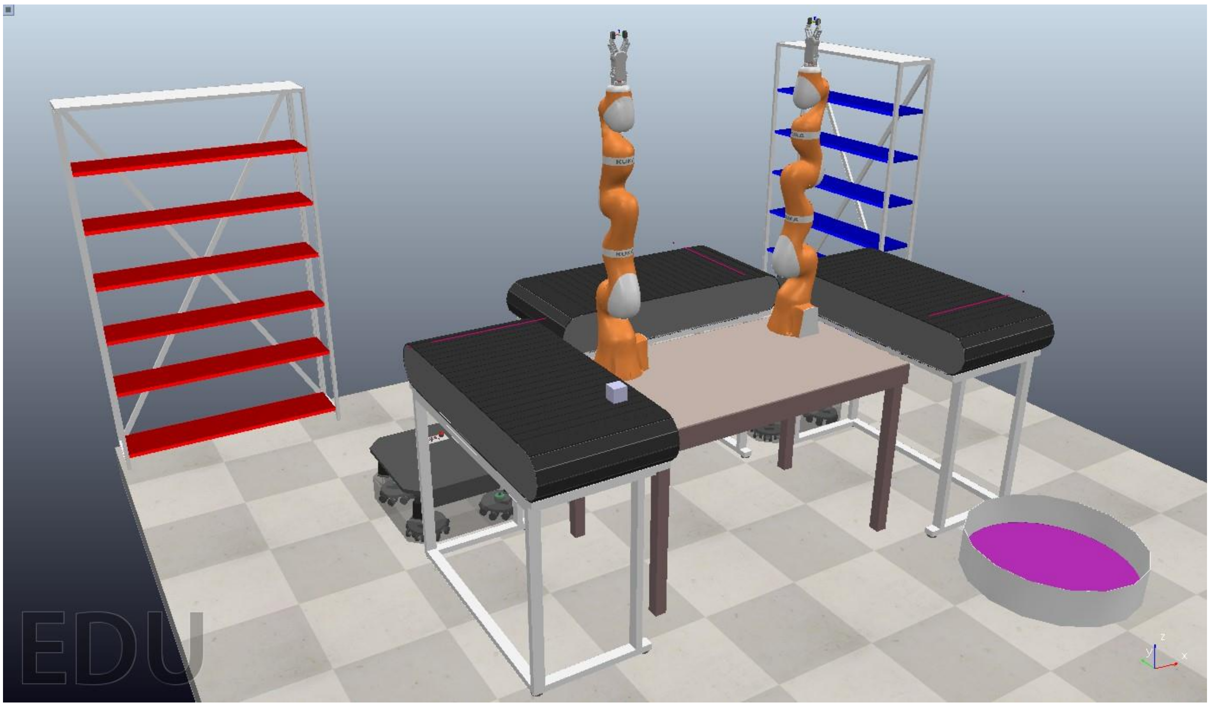


For red and blue cubes, they are made to fall on an omni wheels mobile robot at the end of each conveyor their supposed to be on while green cubes are supposed to fall in the trash which in this simulation is purple round bucket.





Complete scene sequence



As you can see the full scene sequence is as follow

1. A cube of a random color between green, blue and red will be inserted every 3 seconds to the first conveyor
2. If it's a red cube the first proximity sensor will not detect it.
3. If it's a green or blue the proximity sensor will detect it and stop the conveyor.
4. The first arm robot will start locating the cube and position the gripper on it.
5. The gripper will grasp the cube and move it to second conveyor
6. Process will repeat itself but with the second proximity sensor detecting green cubes only in order for the second robot arm to move it to the third and final conveyor.
7. If any of the three sensors detected any false color (example. A red cube on the second conveyor. A blue cube on the third conveyor) the entire system will shut down printing (SYSTEM SHUTDOWN,UNEXPECTED CUBE).