

# CMPE 565 AUTONOMOUS ROBOTS

## Term Project: An Automation with Industrial Robots

**Deadline: ? ? 2018**

### 1 Introduction

As the final project of this course, you are expected to design and develop a group of industrial robots to operate in a packing service environment. The environment where the scenario will take place is the simulated version of a factory. According to this scenario, there will be two different robotic platforms: For arranging the packages on the shelf, the *UR10* robot will be used, for taking the objects from the conveyor belt and delivering these objects to *UR10*, *OmniPlatform* robot will be used.

The *OmniPlatform* robot is equipped with a Hokuyo range finder and a RGB camera to provide you additional information.

The project consists of the following parts:

1. Basic Scenario
2. Localization
3. Location Searching
4. Grasping Ability
5. Multi Agent Capability
6. Power Consumption
7. Obstacle Avoidance

### 2 Basic Scenario

In the basic scenario, firstly, the map of the environment should be achieved, you can store any other information in the mapping part. (You can manually explore the environment)

The objects which will be used on this project, have two different shape and two different color characteristics (Objects can be cylinder or cubic with blue and green colors) The objects will

emerge on the conveyor belt with (pseudo)random shape and color combinations. The conveyor belt always works and the object will be dropped. In order to drop object on the *OmniPlatform* robot platform. The robot should be located next to the red walls.

You can make order with */order* topic. This topic needs to get order number. For example, for the first order, you should send 1 to this topic and for the second order, 2 should be sent.

When the object is dropped and the robot should understand that the object is dropped. The *OmniPlatform* robot will move the room where the *UR10* is located and the *OmniPlatform* robot should go to the green walls. When the robot stops next to the green wall, it will communicate with the *UR10* and *UR10* will take the object and it will put the object on the shelf. The shelf locations for each object group is different. For example, the cubic objects will be placed on the third (top - first) shelf and the cylinder objects will be placed on the fourth shelf. Also the blue objects should be placed on the left side of the shelf and the green objects should be placed right side of the shelf.

In this basic scenario part, all the locations will be published and you can use them. If you complete this basic scenario with 5 object, you will get 50 points.

In basic scenario:

- Mapping : 15 points
- Dropping objects on the platform : 5 points
- Reaching UR10 : 10 points
- Grasping object : 10 points
- Positioning object on the self : 10 points

### **3 Localization**

In the simulation environment, we also published the robot position. If you do not use this information and use the output of a localization algorithm, you will get 5 points.

### **4 Location Searching**

The locations for the red and green walls also published for the basic scenario. If you searched these walls and goes next to the these walls with sensors, you will get 5 points.

### **5 Grasping Ability**

The locations for all the objects also published for the basic scenario. If you detect the objects and grasp them and then locate them on the shelf, you will get 10 points.

### **6 Multi Agent Capability**

In the environment, there will be two *OmniPlatform* robots. If you used them together to complete the tasks quickly. You will get 15 points.

## 7 Power Consumption

Every system should be turned off when they are not used. One of the main problems for mobile robots is power consumption. If you deactivate the motors when they are not used or sensors, it will reduce the current requirement and unnecessary power consumption. Also this factory tries to decrease the costs to gain more profit. Therefore, you should decrease the power consumption. You can disable the sensors of the robot, but when you disable a sensor, you will not get any data and when you disable motors, you will not give any angle value. You will get another 5 points, if you do this. (You should close the sensors when they are not used, and reopen when needed.)

## 8 Human Awareness

In one of the given scenes, there will be a person (Bill). If your robot does not harm Bill while doing its task, you will get an additional 10 points.

## 9 Deliverables

Before starting to implement your nodes, run the pull command to update your workspace and scene folders.

You need to submit:

- A video showing the operation of the entire system.
- Source codes of your nodes.
- A design document, explaining your work in detail.
- A term project page on our wiki.

We are going to have a preliminary demo on ? May, during lecture hours and an final demo on ? ?.