MASTERING ROS 2020 SPRING

START DATE:
FEB 24th, 2020

Mastering ROS Robot MANIPULATORS

From Zero ROS Knowledge to Building Mobile Robot Manipulator Apps

- Real & Simulated Robot Manipulators Practices
- 1 week course in Barcelona
- Limited spot: 18 students

MORE INFORMATION:
WWW.MASTERINGROS.COM

Course created by:
The Construct
For ROS Developers

In cooperation with:
Robotnik

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Course Overview

Become a ROS Developer for Mobile Robot Manipulators

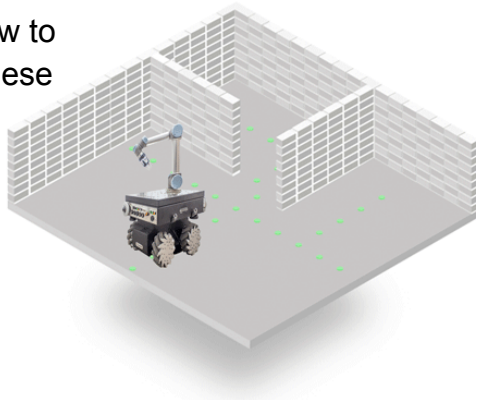
Why attend this course?

Robot manipulators are mobile robots equipped with mobility, one or several robotics arms, and a gripper. They have the ability to autonomously move within an environment, detect objects to grasp, and grasp them to bring them to the proper location. They are widely used in warehouses to locate and bring stuff, in malls and airports to clean, in nuclear areas to access dangerous zones, and even underwater to get to difficult locations. Robot manipulators will be used even more in the near future as their skills improve.

This course is a one-week program where you will learn from the beginning how to create ROS applications for mobile manipulators, including the navigation system, object detection, and grasping and delivering.

Our program includes an additional lesson to create a web interface for the robot app that allows people to manage the whole robot easily.

In this course, we will learn how to build a ROS application that makes a mobile manipulator fill a box with the proper objects obtained from another location. You will start learning the basics of ROS, then move on to robot navigation in known environments. Then, you will learn how to use perception to detect the objects to grasp in the background. Next, you will learn how to move a robotic arm with a gripper to grasp an object. Then, you will learn how to create a complete application that integrates all these behaviors into a single ROS app based on State Machines. Finally, you will learn how to create a web interface that allows people without ROS knowledge to control the robot's operation.



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How will you benefit?

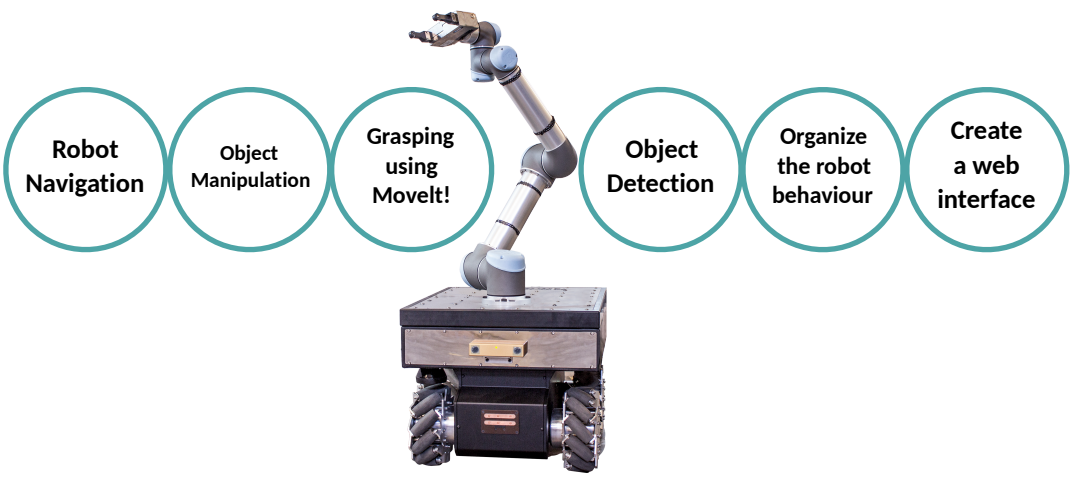
Grow Your ROS Skills

After participating in the *Mastering ROS Robot Manipulators* course, you will grow your ROS skills and be able to:

- Understand how to **make a robot navigate on a known environment** using the `ROS Navigation Stack`
- Understand how to **make a robot grasp an object using** `MoveIt`.
- Understand how to **define the behavior of a robot** using `FlexBe`.
- Understand how to **build a web interface to control the manipulator** using `Javascript`.
- Understand how to **create a full app for a mobile robot manipulator** to work as a warehouse robot for pick & package.

During attendance (5 days)

You will be using the real robot mobile manipulator RB-Kairos from Robotnik company, equipped with a UR arm and a GR Gripper, as well as an additional point cloud camera on the wrist. You will be learning:



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What you will learn & practice?

Before You Go Week - Get ROS Basics Ready (*OPTIONAL)

If you don't know ROS yet, the week prior to the course we will give you access to the ROS BASICS IN 5 DAYS Online Course, to learn how to create ROS programs. During this week, you will have 2 additional sessions of 30 minutes of personal tutoring by Skype.

Day 1: Introduction to ROS

- **Basic ROS Concepts** (ros packages, launch files, nodes, parameter server, ros core, environment variables, etc.)
- **Create your first ROS program**

Day 2: ROS Topics

- How to create a **Topic_Publisher**
- Introduction to **Topic Messages**
- How to create a **Topic_Subscriber**
- **Hands-on Exercises:** Make a robot obstacle-avoiding system

Day 3: Understanding ROS Services

- How to create a **Service_Client**
- Introduction to **Service Messages**
- How to create a **Service_Server**
- **Hands-on Exercises**: Control a Robot Arm using ROS Services

Day 4: Understanding ROS Actions

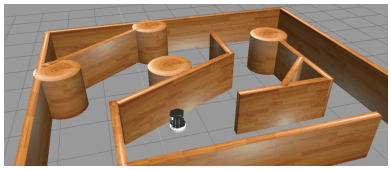
- How to create an **Action_Client**
- Introduction to **Action Messages**
- Interact with Actions in a graphical way - **Axclient**
- How to create an **Action_Server**
- **Hands-on Exercises:** Control a Drone Robot using ROS Actions

Day 5: Understanding ROS TF

- Publish and Subscribe to **TF data**
- Understand **Robot State Publisher** and **Joint state Publisher**
- Understand **Static Transforms**
- **Hands-on Exercises**: Publish TF for Your Robot

Project of the week: Make a Robot Get Out of the Maze

You will use all the knowledge you acquired to make a TurtleBot move out of a maze using its sensors and actuators.



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What you will learn & practice?

Course Week - Learn & Practice with robot manipulators in Barcelona (*MANDATORY)

You will learn all the ROS skills necessary to program a mobile manipulator for manipulation tasks in human environments. You will practice with a simulation and real robot RB-Kairos from Robotnik.

Day 6: ROS Navigation Stack

- How to **create a map of an environment**
- How to **make a robot localize on a map**
- How to configure the move_base for **path planning** and **obstacle avoidance**
- **Hands-on Challenge**: Make an RB-Kairos autonomously navigate in an indoor environment.

Day 7: Moving the arm

- How to **configure MoveIt for your robot**
- How to program the **moveit_commander** to **send trajectories to the robot arm**
- **Hands-on Challenge**: Program the Arm to reach any location in its action space.

Day 8: Grasping the object

- How to **detect the object to grasp**
- How to **grasp an object**
- How to **add perception to avoid obstacles**
- **Hands-on Challenge**: Make the Arm grasp objects from the shelf while avoiding obstacles.

Day 9: Using FlexBe to Program the Robot Behavior

- How to **create FlexBe states**
- How to **create a full State Machine** that **communicates with the robot**
- **Hands-on Challenge**: Define the behavior of the warehouse robot for a pick & place application.

Day 10: Designing Web Interfaces for ROS robots

- How to **set up the server in the robot**
- How to **create a web page that shows relevant robot information**
- How to **add commands for the robot**
- **Hands-on Challenge**: Create a web interface for non-experts to command the robot, and know its status.

Project of the week: Make a Full Manipulator Application to Autonomously Clean a Space

Throughout the week, you will be building a complete robot app for mobile manipulators that looks and serves objects from shelves in a warehouse environment. The robot has to go to the shelves' locations, look for the objects, grasp them, and bring them to the operator boxes.

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Register Now

Booking Details

Date	24 February - 28 February, 2020
Duration	30 hours *over the course of 1 week*
Price	1250 €
Registration Deadline	February 10, 2020

Register Now

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