ROS COURSES

Tailor-Made Robot Operating System Courses For Universities

Robot Ignite Academy
The Construct

INDEX

ROS FOR BEGINNERS

ROS BASICS IN 5 DAYS

- 40.6 hours
- ROS Video Tutorials
- Programming 6 Robot Simulations: Parrot Drone, Kobuki, Husky, Sphero, BB-8, Warm Arm

A Brief Summary:

ROS In 5 Days is the ideal course if you are new to ROS. Here you will learn ROS fast!!!
The objective of this course is to give you the basic tools and knowledge to be able to understand and create any basic ROS related project. You will be able to move robots, read their sensor data, make the robots perform intelligent tasks, see visual representations of complex data such as Point Clouds and debug errors in the programs.

What You Will Learn:

At the end of this course, we will feel comfortable about the following subjects:

- ✓ ROS Basic Structure
- ✓ ROS Topics
- ✓ ROS Services
- ✓ ROS Actions
- ✓ ROS Debugging Tools

Learning Path:

Unit 0: Course Preview

- Interacting with a simulated robot (00:02 Hands on training)
- What you will need to learn to program a robot with ROS (00:08 Hands on training)

Unit 1: GUIDE FOR ROS IN A SINGLE WEEK

- It is possible to learn ROS fast if you have the proper method (00:03 Hands on training)
- Robots we are going to use along the course (00:02 Hands on training)
- Main Objective of this course (00:02 Hands on training)
- Learning ROS: attack in two ways (00:05 Hands on training)
- Apply what you learnt to a Robot Project (00:02 Hands on training)
- How to proceed with the whole course (00:05a Hands on training)

Unit 2 : ROS BASICS

- Basic Concepts (00:02 Hands on training)
- Move a Robot with ROS (00:05 Hands on training)
- What's a ROS Package (00:05 Hands on training)
- What is a launch file (00:05 Hands on training)
- Create a ROS Package (00:20 Hands on training)
- Your first ROS program (00:30 a Hands on training)
- ROS Nodes (00:10 a Hands on training)
- Compiling a ROS Package (00:10 a Hands on training)
- Parameter Server (00:10 a Hands on training)
- ROS Core (00:03 a Hands on training)
- Environment Variables (00:10 a Hands on training)

Unit 3 : ROS Topics - part 1

- Topic Publisher (00:30 Hands on training)
- ROS Messages (00:10 Hands on training)
- Exercises (01:50 Hands on training)

Unit 4 : ROS Topics - part 2

- Topic Subscriber (00:20 Hands on training)
- Custom Topic Message Compilation (00:10 Hands on training)
- ROS Topics Mini Project (01:40 Hands on training)

Unit 5 : ROS Services - part 1

- Topics - Services - Actions (00:05 Hands on training)
- Services Introduction (00:30 Hands on training)
- How to call a ROS Service (00:15 Hands on training)
- Exercises (01:40 Hands on training)

Unit 6 : ROS Services - part 2

- How to give a Service (01:00 Hands on training)
- How to create your own service message (01:00 Hands on training)
- Custom Service Compilation (01:00 Hands on training)

Unit 7 : ROS Actions - part 1

- Playing with the Quadrotor simulation (00:30 Hands on training)
- What are ROS Actions (00:30 Hands on training)
- Calling an Action Server (00:30 Hands on training)
- Performing other tasks while the Action is in progress (01:40 Hands on training)
- The axclient (00:20 Hands on training)

Unit 8 : ROS Actions - part 2

- Writing an Action Server (01:30 Hands on training)
- Creating your own Action Server Message (00:30 Hands on training)
- Custom Action Messages compilation (00:30 Hands on training)

Unit 9 : Debugging Tools

- ROS What The F*ck (00:15 Hands on training)
- ROS Debugging Messages and RQT-Console (00:15 Hands on training)
- Plot topic data and RQT Plot (00:15 Hands on training)
- Node Connections and RQT graph (00:15 Hands on training)
- Record experimental data and ROSBags (00:15 Hands on training)
- Visualize Complex data and RViz (00:15 Hands on training)

Course Project

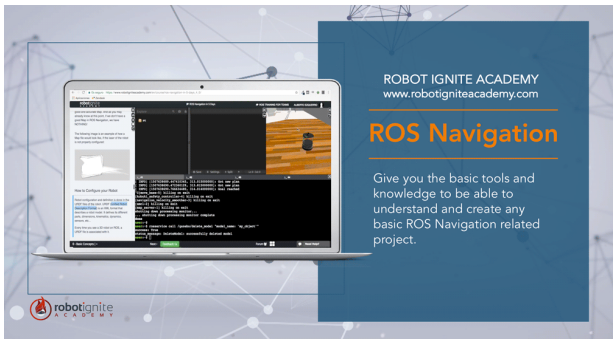
- Win the Sphero Race (00:30 Hands on training)
- What Sphero provides to program It (00:30 Hands on training)
- Ideas to start working on (00:30 Hands on training)
- Steps you should cover(08:30 Hands on training)

Turtlebot Project

- Win the TurtleBot Race! (00:30 Hands on training)
- What Turtlebot provides to program It (00:30 Hands on training)
- Ideas to start working on (00:30 Hands on training)
- Steps you should cover (08:30 Hands on training)

ROS MASTERING

ROS NAVIGATION



- 28 hours
- ROS Video Tutorials
- Programming 3 Robot Simulations: Kobuki, Husky, Summit XL

A Brief Summary:

The objective of this course is to give you the basic tools and knowledge to be able to understand and create any basic ROS Navigation related project.
You will be able to create maps of environments, localize the robot in the environment, make the robots perform path planning, visualize data of the different Navigation processes, debug errors using RViz and configure the different Navigation nodes.

What You Will Learn:

At the end of the course you will be comfortable with the following subjects:

✓ The ROS Navigation Stack
✓ What is needed to work with the Navigation Stack
✓ What is the move_base node and why it is so important
✓ Which parts take place in the move_base node

Learning Path:

Unit 0: Basic Concepts

- What is needed to perform robot navigation with ROS (01:00 Hands on training)
- How to configure your Robot (00:15 Hands on training)
- The Navigation Stack (00:05 Hands on training)
- Hardware Requirements (00:20 Hands on training)
- The move_base node (00:20 Hands on training)

Unit 1: Guide for ROS Navigation in 5 Days

- It is possible to learn ROS fast if you have the proper method (00:03 Hands on training)
- Robots we are going to use along the course (00:02 Hands on training)
- Main Objective of this course (00:02 Hands on training)
- Learning ROS Navigation: attack in two ways (00:05 Hands on training)
- Apply what you learnt to a Robot Project (00:02 Hands on training)
- How to proceed with the whole course (00:03 Hands on training)

Unit 2 : Mapping

- Visualize Mapping in RViz (00:10 Hands on training)
- Simultaneous Localization and Mapping (SLAM) (01:00 Hands on training)
- Hardware Requirements (00:10 Hands on training)
- Transforms (00:40 Hands on training)
- Creating a launch file for the slam_gmapping node (00:10 Hands on training)
- Build a Map Using Logged Data (00:10 a Hands on training)

Unit 3 : Localization

- Visualize Localization in RViz (00:25 Hands on training)
- Monte Carlo Localization (MCL) (00:05 Hands on training)
- The AMCL Package(MCL) (00:25 Hands on training)
- Hardware Requirements(MCL) (00:10 Hands on training)
- Creating a launch file for the AMCL node(MCL) (00:25 Hands on training)
- AMCL through Services (00:30 Hands on training)

Unit 4 : Path Planning 1

- Visualizing Path Planning in RViz (00:45 Hands on training)
- The move_base package (00:45 Hands on training)
- The Global Planner (01:00 Hands on training)
- Global Costmap (00:30 Hands on training)

Unit 5 : Path Planning 2

- The Local Planner (01:00 Hands on training)
- Local Costmap (01:00 Hands on training)
- Recovery Behaviors (00:15 Hands on training)
- Clear Costmap (00:15 Hands on training)
- Oscillation Suppression (00:15 Hands on training)
- Dynamic Reconfigure (00:15 Hands on training)

Unit 6 : Navigation Project

- How to give a Service (01:00 Hands on training)
- How to create your own service message (01:00 Hands on training)
- Custom Service Compilation (01:00 Hands on training)

Unit 7 : Debugging Tools

- ROS What The F*ck (00:15 Hands on training)
- ROS Debugging Messages and RQT-Console (00:15 Hands on training)
- Plot topic data and RQT Plot (00:15 Hands on training)
- Node Connections and RQT graph (00:15 Hands on training)
- Record experimental data and ROSBags (00:15 Hands on training)
- Visualize Complex data and RViz (00:15 Hands on training)

Turtlebot Project

- Win the TurtleBot Race! (00:30 Hands on training)
- What Turtlebot provides to program It (00:30 Hands on training)
- Ideas to start working on (00:30 Hands on training)
- Steps you should cover (08:30 Hands on training)

ROS PERCEPTION IN 5 DAYS

Learn OpenCV, FaceRecognition, Person tracking and object recognition

- 39 hours
- ROS Video Tutorials
- Programming 5 Robot Simulations: Mira Robot, Turtlebot, Fetch, Fetch2, Aibo

A Brief Summary:

Perception is probably one of the most important things when we talk about autonomy.

In this course you will learn how perception is performed by robots using the ROS Framework.

What You Will Learn:

At the end of this course you will fell comfortable about making robots do the following things:

- ✓ Track objects by its color blobs
- ✓ Navigate following floor lines with only RGB camera
- ✓ Detect human faces and track them
- ✓ Recognize different faces
- ✓ Track a person through a 3D environment
- ✓ Recognize flat surfaces like tables where object might be placed
- ✓ Recognize objects and track them in 3D space with PointCloudSensors

Learning Path:

Unit 1 : Perception with ROS Intro

- Working Example: Mira Robot Follows the Ball (00:30 Hands on training)
- Overview (00:10 Hands on training)

Unit 2 : Vision Basics Blob Tracking

- Roll , Pitch and Yaw (00:30 Hands on training)
- Blob tracking with OpenCV and python part 1: color encoding (01:00 Hands on training)
- Blob tracking with OpenCV and python part 2: start blob tracking with cmvision (01:00 Hands on training)
- Exercises (02:00 Hands on training)

Unit 3 : Vision Basics Follow Line

- Get Images from a ROS topic and show them with OpenCV (01:30 Hands on training)
- Apply Filters To the Image (01:30 Hands on training)
- Move the TurtleBot based on the position of the Centroid (01:30 Hands on training)
- Additional Step: Follow Multiple Centroids (01:30 Hands on training)
- PID controller with perception (01:30 Hands on training)

Unit 4 : Surface and Object Recognition

- Table Top Detector (01:30 Hands on training)
- 2D and 3D Object Finder (01:30 Hands on training)
- Move and spawn objects (01:30 Hands on training)
- 3D Object Detection (01:30 Hands on training)

Unit 5 : Face Detection and tracking

- Face Detector in ROS (01:30 Hands on training)
- Face Detector Client (01:00 Hands on training)
- Visualize the Face Detections (01:00 Hands on training)

Unit 6 : Face Recognition

- Starting the Face Recognition package (01:30 Hands on training)
- Multiple Face Detection at the same time (03:00 Hands on training)

Unit 7 : People Tracking

- ROS package for tracking people (00:30 Hands on training)
- Leg Detector (01:00 Hands on training)
- Detect UpperBody (01:00 Hands on training)
- Pedestrian detector (01:00 Hands on training)
- Combining all together (02:00 Hands on training)

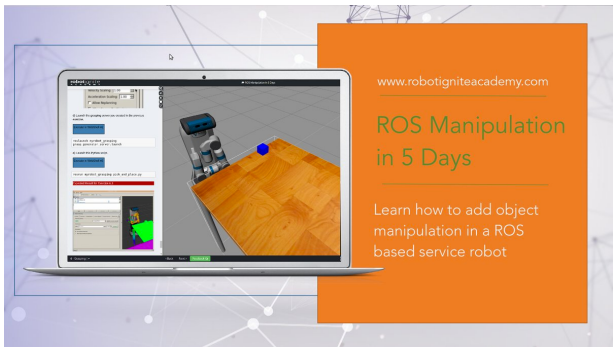
Aibo Perception Project

- Your Own Simplified Aibo ERS7 (01:00 Hands on training)

- RGB, Depth and Point Cloud (00:45 Hands on training)
- The Camera-Optic frame problem (00:15 Hands on training)
- Elements of the Simulated World (00:30 Hands on training)
- Project exercises (05:00 Hands on training)

ROS MANIPULATION IN 5 DAYS

Learn how to make your manipulator interact with the environment using ROS



- 12 hours
- ROS Video Tutorials
- Programming 3 Robot Simulations: Shadow Robot Simulation, Fetch Robot, RB-1 Simulation

A Brief Summary:

ROS Manipulation is the term used to refer to any robot that manipulates something in its environment.

The main goal of this Course is to teach you the basic tools you need to know in order to be able to understand how ROS Manipulation works, and teach you how to implement it for any manipulator robot.

What You Will Learn:

At the end of this Course you will feel comfortable about the following subjects:

✓ Basics of ROS Manipulation

✓ How to create and configure a MoveIt! package for a manipulator robot

✓ How to perform Motion Planning

✓ How to perform Grasping.

Learning Path:

Unit 1 : Introduction to the Course

- What is ROS Manipulation (00:02 Hands on training)
- Do you want to have a taste? (00:02 Hands on training)
- What you will learn with this Course (00:02 Hands on training)
- How you will learn it (00:02 Hands on training)
- Minimum requirements for the course (00:01 Hands on training)

Unit 2 : Basic Concepts

- What you need to perform ROS Manipulation (00:40 Hands on training)
- Structure of a Manipulator Robot (00:10 Hands on training)
- Basic Terminology (00:10 Hands on training)

Unit 3 : Creating a MoveIt package

- What is MoveIt! (00:02 Hands on training)
- Generating MoveIt! configuration package using Setup Assistant tool (01:00 Hands on training)
- The move_group node (00:02 Hands on training)
- Basic Motion Planning (00:15 Hands on training)
- MoveIt! planning scene (00:02 Hands on training)
- MoveIt! kinematics handling (00:02 Hands on training)
- MoveIt! collision checking (00:02 Hands on training)
- Moving the real robot (00:50 Hands on training)

Unit 4 : Perform Motion Planning programmatically

- Exercise (01:00 Hands on training)
- Planning a trajectory (00:15 Hands on training)
- Planning to a joint space goal (00:15 Hands on training)
- Getting some useful data (00:15 Hands on training)
- Executing a trajectory (00:15 Hands on training)

Unit 5 : Adding Perception

- Exercise (01:00 Hands on training)
- Adding Perception to MoveIt! (01:00 Hands on training)

Unit 6 : Grasping

- What is Grasping (00:02 Hands on training)
- Grasping using MoveIt! (00:30 Hands on training)
- Creating a pick and place task (01:00 Hands on training)
- Grasping in the Real Robot (00:30 Hands on training)

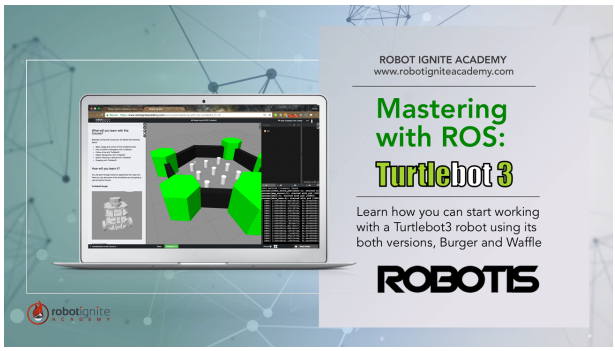
Project

- Build the MoveIt! package (00:25 Hands on training)
- Connect the MoveIt! package with the simulation (00:25 Hands on training)
- Python Script (00:25 Hands on training)
- Add Perception to the MoveIt! package (00:25 Hands on training)

- Grasping (00:25 Hands on training)

MASTERING WITH ROS: Turtlebot3

Learn how to work with a Turtlebot3 robot



- 8 hours
- Programming 5 Robot Simulations: Mira Robot, Turtlebot, Fetch, Fetch2, Aibo

A Brief Summary:

Within this Course, you are going to learn how you can start working with a Turtlebot3 robot using its both versions, Burger and Waffle

What You Will Learn:

✓ Basic Usage and control of the Turtlebot3 robot

✓ How to perform Navigation with Turtlebot3

✓ Follow a line with Turtlebot3

✓ Object Recognition with Turtlebot3

✓ Motion Planning in Moveit with Turtlebot3

Learning Path:

Unit 1 : Introduction to the Course

- What you will learn with this course? (00:10 Hands on training)

Unit 2 : Basic Usage

- Basic Usage (01:00 Hands on training)

Unit 3 : Navigation with Turtlebot3

- How to create a map of an environment (01:00 Hands on training)
- Localize the robot with the map (01:00 Hands on training)
- Path Planning with Obstacle Avoidance (01:00 Hands on training)

- Send a sequence of waypoints and execute those movements (01:00 Hands on training)

Unit 4 : Follow a line

- Follow a line (02:00 Hands on training)

Unit 5 : Blob Tracking

- Blob Tracking (02:00 Hands on training)

Unit 6 : Perception and Object Recognition

- Perception and Object Recognition (01:30 Hands on training)

Unit 7 : Motion Planning using Graphical Interfaces

- Motion Planning using Graphical Interfaces (02:00 Hands on training)

Project

- Consist on applying the Navigation concepts you learned during the Course (01:00 Hands on training)
- Consist on perform some Motion Planning using code, instead of MoveIt. (01:00 Hands on training)

MASTERING WITH ROS: SUMMIT XL

tMaster the robot SUMMIT XL from Robotnik. Learn all the basics to work with the real robot

- 6 hours
- Programming Robot Simulation: Summit XL

What You Will Learn:

✓ How to set up the navigation stack to make it navigate in an indoor environment, generating maps by its own

✓ How to create a program to navigate in outdoors environments through GPS data

✓ How to detect persons with the Hokuyo laser sensor

✓ How to detect person with its PTZ RGB camera

✓ How to recognise person with its PTZ RGB camera and tell if it has permission to be there or not

✓ How to Set WayPoints in a map to make it follow that path to patrole

✓ Create a reactive programs based on all previously mentioned and create a patroling program that reacts to person detections

Learning Path:

Unit 0 : Robotniks Summit XL platform

- Summit XL Intro (01:00 Hands on training)

Unit 1 : Set Indoor Navigation Stack

- Set Indoor Navigation Stack (01:00 Hands on training)

Unit 2 : Set Outdoors Navigation

- Set Outdoors Navigation (01:00 Hands on training)

Unit 3 : Detect and localise person

- Detect and localise person (01:00 Hands on training)

Unit 4 : Patrole with Summit XL Micro Project

- Patrole with Summit XL Micro Project (01:00 Hands on training)

MASTERING WITH ROS: JACKAL

Learn how to create real world applications for a real robot. In this case Jackal robot from ClearPathRobotics

- 6 hours
- Programming Robot Simulation: Jackal

A Brief Summary:

Learn how to create real world applications for a real robot. In this case Jackal robot from ClearPathRobotics.

What You Will Learn:

✓ How to set up the navigation stack to make it navigate in an indoor environment, generating maps by its own

✓ How to create a program to navigate in outdoors environments through GPS data

✓ How to detect persons with the laser sensor

✓ How to detect person with its RGB stereo camera

✓ How to generate waypoints and make jackal patrole

✓ Use the StereoCam to generate PointCloud Data

✓ Create a reactive programs based on all previously mentioned and create a patroling program that reacts to person detections

Learning Path:

Unit 0 : Introducing ClearPath Jackal Robot

- Introducing ClearPath Jackal Robot (01:00 Hands on training)

Unit 1 : Navitaion Indoor

- Navitaion Indoor (01:00 Hands on training)

Unit 2 : Set Outdoors Navigation

- Set Outdoors Navigation (01:00 Hands on training)

Unit 3 : Detect and localise a person

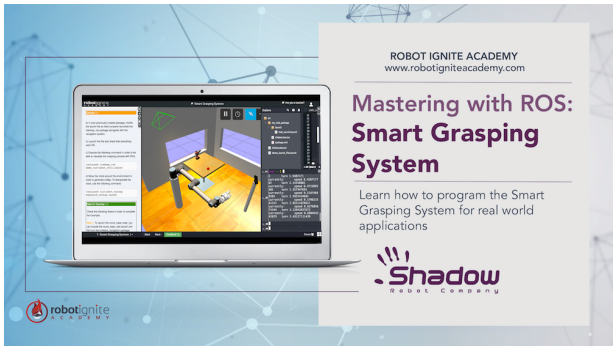
- Detect and localise person (01:00 Hands on training)

Unit 4 : Patrol with Jackal Micro Project

- Patrol with Jackal Micro Project (01:00 Hands on training)

MASTERING WITH ROS: Smart Grasping System

Learn how to work with a robotic hand from Shadow Robot, including their Smart Grasping System



- 8 hours
- Programming Robot Simulation: Robotics Hands (Smart Grasping System)

A Brief Summary:

Within this Course, you are going to learn how you can start working with one of the robotic hands developed by the Shadow Robot Company, as well as how to use their Smart Grasping System.

What You Will Learn:

✓ Basic Usage and control of a Shadow Hand.

✓ How to attach a robotic hand to a manipulated arm.

✓ How to create a MoveIt package for a manipulated robot.

✓ How to interact with the Smart Grasping System.

✓ How to integrate Perception with the Smart Grasping System.

Learning Path:

Unit 1 : Introduction to the Course

- Introducing ClearPath Jackal Robot (01:00 Hands on training)

Unit 2 : Basic Usage

- Basic Usage (01:00 Hands on training)

Unit 3 : Attach the hand to a robotic arm

- Attach the hand to a robotic arm (01:00 Hands on training)

Unit 4 : Motion Planning with MoveIt

- Motion Planning with MoveIt (01:00 Hands on training)

Unit 5 : Smart Grasping System

- Smart Grasping System (01:00 Hands on training)

Unit 6 : Perception and Object Recognition

- Perception and Object Recognition (01:00 Hands on training)

Project

- Project (01:00 Hands on training)

ROS ADVANCING

Robot Creation with URDF

Learn how to create the URDF files to control your robot with ROS

- 24 hours
- ROS Video Tutorials
- Programming 3 Robot Simulations: JIBO, Mira, Gurdy

A Brief Summary:

In this course you will learn how to go from a physical robot or even a robot drawing to a full fledged simulation with physics, actuators and sensors.

What You Will Learn:

During this course you will learn:

✓ How to create a URDF file that defines your robot in the Gazebo-ROS ecosystem

✓ Definition of weights, inertias, joints, links, sensor plugins and all that is needed to simulate a robot

✓ XACRO files

Learning Path:

Unit 1 : URDF Intro

- Introduction with demo (00:05 Hands on training)
- Why you need to simulate robots (00:02 Hands on training)
- How you will learn about URDF files (00:02 Hands on training)
- Requirements (00:02 Hands on training)

Unit 2 : Creating the Visual Robot Model with URDF

- Introduction (00:02 Hands on training)

- Learn how to use the URDF creation tools and the creation procedure (00:05 Hands on training)
- Links and Joints (00:05 Hands on training)
- See the URDF (01:00 Hands on training)
- Learn about the morphology of your robot (02:00 Hands on training)
- Learn how to import your 3D CAD models to Gazebo (02:00 Hands on training)

Unit 3 : Adapt URDF for Gazebo Simulator

- Add Collisions (00:10 Hands on training)
- Spawn a robot in Gazebo Through URDF Files (00:30 Hands on training)
- Add Inertias (01:00 Hands on training)
- Add controllers (02:30 Hands on training)
- Adding Sensors (00:10 Hands on training)

Unit 4 : GurdyRobot

- Create the Gurdy Robot (04:00 Hands on training)

Unit 5 : XACRO files

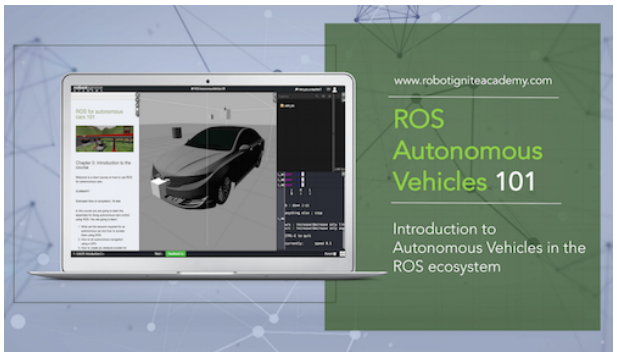
- Basics on using XACRO (00:10 Hands on training)
- Create your own XACRO (02:00 Hands on training)

Micro Project: Create your own Jibo

- Instructions and the Project itself (08:00 Hands on training)

ROS Autonomous Vehicles 101

Introduction to Self-Driving cars in the ROS ecosystem



- 7 hours
- ROS Video Tutorials
- Programming Robot Simulation: Simulated DBW MKZ

A Brief Summary:

The goal of this course is to show you the basic knowledge you need to master in order to program autonomous cars for a Level 3 of autonomy.
This means, it is expected that all task should be performed autonomously, but at the same time it is expected to intervene a human driver whenever required. This level is called conditional automation.

What You Will Learn:

In this course you are going to learn the essentials for doing autonomous cars control using ROS.

You are going to learn:

✓ What are the sensors required for an autonomous car and how to access them using ROS

✓ How to do autonomous navigation using a GPS

✓ How to create an obstacle avoider for an autonomous car

✓ How to interface ROS with a car that follows the DBW interface

Learning Path:

Unit 1 : Introduction to the Course

- Introduction (00:02 Hands on training)
- Sensors (00:02 Hands on training)
- Autonomous navigation (00:02 Hands on training)
- The DBW interface for autonomous cars and CAN-Bus (00:02 Hands on training)
- Minimum requirements for this course (00:01 Hands on training)
- Special thanks (00:01 Hands on training)

Unit 2 : Sensors

- Basic Sensors List (00:20 Hands on training)

Unit 3 : GPS Navigation

- Introduction (00:10 Hands on training)
- Creating a GPS Subscriber (00:20 Hands on training)
- Move To WayPoint GPS ACTION Server (00:20 Hands on training)
- Move To WayPoint GPS ACTION Client (00:20 Hands on training)

Unit 4 : Obstacles and Security

- Controle the Car movement Data Flow (00:05 Hands on training)
- System Failure Mesures and DeadMansSwitch (00:05 Hands on training)
- Obstacle Detection (01:50 Hands on training)

Unit 5 : CAN-Bus

- How Can-Bus messages look like (0:05 Hands on training)
- How we use CAN-Bus in the simulation (0:05 Hands on training)
- Exercises (1:50 Hands on training)

Microproject

- Instructions and the Project itself (08:00 Hands on training)

ROS-INDUSTRIAL 101

Introduction of some basic ROS tools to control industrial robots with ROS

- 6.5 hours
- ROS Video Tutorials
- Programming 2 Robot Simulations: Motoman Sia10f simulation and Mot

A Brief Summary:

ROS-Industrial is a project which main goal is to bring ROS closer to the robotics industrial world. It is a HUGE project, composed of many packages and tools.

This Course is not meant to make you learn all the things you can achieve with ROS-Industrial, but just to introduce you to some basic concepts you need to know if you want to begin exploring all the ROS-Industrial capabilities.

What You Will Learn:

During this Course you will address the following topics:

✓ Overview of how to create an URDF file for an industrial robot

✓ How to create a MoveIt! package for your industrial robot

✓ How to perform motion planning using Python

Learning Path:

Unit 1 : Introduction to the Course

- What is ROS-Industrial (00:02 Hands on training)
- What you will learn with this Course (00:02 Hands on training)
- How you will learn it (00:02 Hands on training)
- Minimum requirements for the Course (00:02 Hands on training)

Unit 2 : Creating the URDF

- Building the URDF (00:15 Hands on training)
- Building the Xacro (00:15 Hands on training)

Unit 3 : Building a MoveIt package

- Building a MoveIt! package (00:40 Hands on training)
- Basic Motion Planning (00:40 Hands on training)
- Moving the robot in the simulation (00:40 Hands on training)

Unit 4 : Motion Planning through code (Python)

- Planning a trajectory (00:20 Hands on training)
- Planning to a joint space goal (00:40 Hands on training)
- Getting some useful data (00:20 Hands on training)
- Executing a trajectory (00:20 Hands on training)

Final Project

- Build the URDF (00:30 Hands on training)
- Build the MoveIt! package (00:30 Hands on training)
- Connect the MoveIt! package with the simulation (00:30 Hands on training)
- Python Script (00:30 Hands on training)

OpenAI Gym for Robotics 101

Learn what is needed to be able to use OpenAI-Gym in your next project

- 6 hours
- ROS Video Tutorials
- Programa 2 Robot Simulations: Turtlebot, Parrot Drone

A Brief Summary:

The objective of this course is to teach how to use OpenAI-Gym through environments defined for Gazebo Simulator.

This means that although the examples in this course will be exclusively in Gazebo Simulator, the knowledge acquired will be applicable to any system. You will be able to define environments for Gazebo, but also for other simulators or even other systems.

What You Will Learn:

At the end of the course , the following topics will have been addressed:

✓ Basics of openai-gym

✓ Definition of environment files for openai-gym, centered in gazebo-ROS simulations.

✓ Importing of environments and communication with Gazebo Simulations through ROS

✓ Registering of learning results and data plot

✓ Create your own environment through a hands on example with a drone in Gazebo

Learning Path:

Unit 1 : Introduction OpenAI-gym

- What is OpenAI-Gym (00:05 Hands on training)
- What's in this OpenAI Gazebo-Gym Course (00:02 Hands on training)
- How you will learn all that (00:02 Hands on training)
- Minimum requirements for this course (00:02 Hands on training)

Unit 2 : Running an environment

- Make the robot learn how to move (00:15 Hands on training)
- Select the environment (00:05 Hands on training)
- Start up the monitoring (00:40 Hands on training)

Unit 3 : Environment file configuration

- Where to find the environment files (00:20 Hands on training)
- Exercises (00:40 Hands on training)

Unit 4 : Plot results

- Plot Results from Monitor (00:50 Hands on training)
- Exercises (01:00 Hands on training)
- Upload Results from Monitor (00:10 Hands on training)

Micro Project

- Know your environment (00:15 Hands on training)
- What you have to edit and create (00:45 Hands on training)
- Use the Environment just created to learn (01:00 Hands on training)

RTAB-MAP IN ROS 101

Learn how to use the rtabmap_ros package for performing RGB-D SLAM

START COURSE

- 1.5 hours
- ROS Video Tutorials
- Programming Robot Simulation: Turtlebot

A Brief Summary:

RTAB-Map (Real-Time Appearance-Based Mapping) is a RGB-D SLAM approach based on a loop closure detector.

The loop closure detector uses a bag-of-words approach in order to determinate if a new image detected by an RGB-D sensor it is from a new location or from a location that it has been already visited.

Of course, this is a very summarized explanation, you will get more details on how this loop closure detector works inside this Course.

What You Will Learn:

During this Course you will address the following topics:

✓ Basics of RTAB-Map

✓ How to use the rtabmap_ros package

✓ How does loop closure detection work internally

✓ How to create a 3D Map of an environment

✓ Autonomous Navigation using RGB-D SLAM

Learning Path:

Unit 1 : Introduction to the Course

- What is RTAB-Map (00:02 Hands on training)
- Demo (00:02 Hands on training)
- What you will learn with this Course (00:02 Hands on training)
- Minimum requirements for the Course (00:02 Hands on training)

Unit 2 : Basic Concepts

- System Requirements (00:08 Hands on training)
- Data Visualization - RViz (00:05 Hands on training)
- Launching RTAB-Map (00:05 Hands on training)
- Subscribed Topics (00:06 Hands on training)
- Arguments (00:06 Hands on training)

Unit 3 : Autonomous Navigation with rtabmap_ros

- Brief Introduction (00:04 Hands on training)
- Mapping Mode (00:12 Hands on training)
- Localization Mode (00:12 Hands on training)
- Autonomous Navigation (00:12 Hands on training)

ROS CONTROL 101

Learn how to ROSify the control of your robot

- 5 hours
- ROS Video Tutorials
- Programming 2 Robot Simulations: Pi Robot, RRBot

A Brief Summary:

ROS Control are a set of packages and tools that allow you to send commands and communicate with the joints of your robot in order to be able to control them.

The main goal of this Course is to teach you how to integrate this ros_control utility within a simulated environment, so you can apply the same concepts to use this tool to control the joints of your real robot.

What You Will Learn:

During this Course you will address the following topics:

✓ Basics of ROS Control

✓ How to configure ROS Control to work with your robot simulation

✓ How to create a custom controller

Learning Path:

Unit 1 : Introduction to the Course

- What is ROS Control (00:02 Hands on training)
- What you will learn with this Course (00:02 Hands on training)
- How you will learn it (00:02 Hands on training)
- Minimum requirements for the Course (00:02 Hands on training)

Unit 2 : Basic Concepts

- The ros_control packages (00:20 Hands on training)

Unit 3 : Configuring the controllers

- Configuring the URDF - Transmissions (00:30 Hands on training)
- Configuring the URDF - Plugin (00:30 Hands on training)
- Interacting with the joints in a graphical way (00:30 Hands on training)

Unit 4 : Create a controller

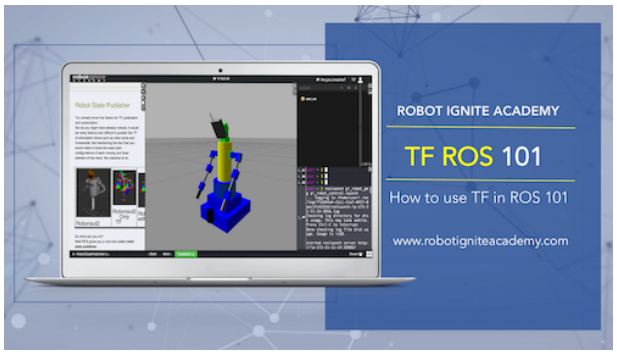
- Creating the package (00:05 Hands on training)
- Creating the source code (00:30 Hands on training)
- Updating the package.xml file (00:05 Hands on training)
- Updating the CMakeLists.txt file (00:05 Hands on training)
- Build the controller (00:05 Hands on training)
- Write the configuration file (00:05 Hands on training)
- Create a launch file (00:05 Hands on training)

Course Project

- Examine the simulation (00:30 Hands on training)
- Build the control package (00:30 Hands on training)
- Test your package (00:30 Hands on training)
- Create a controller (00:30 Hands on training)

TF ROS 101

To finally understand TF and Robot State Publisher in ROS



- 19 hours
- ROS Video Tutorials
- Programming 3 Robot Simulations: 3D Version of the Classical 2D TurtleSim, Fully articulated Pi Robot, Multiple KobukiRobot Simulation

A Brief Summary:

Any physical system, specially robotics systems, have many coordinate frames that change over time.

A robotic arm, for example, has many different physical parts, each one with its own coordinate frame, that can move at the same time.

With TF, you will know how a hand "knows" the position of an object based on the position of the camera, for example.

What You Will Learn:

This course will centre on hands on experience, making you able to:

✓ Publish and Subscribe to TF data topics

✓ Use the tools necessary to visualize TF data

✓ Publish fixed TF transforms

✓ Use RobotStatePublisher to generate TF data for robots to complex to publish it manually

✓ Understand the use of JointStatePublisher and how it relates to RobotMovement Controllers

Learning Path:

Unit 1 : Intro to TF

- What's in the ROS TF Course (00:03 Hands on training)
- How you will learn all that (00:03 Hands on training)

- Minimum requirements for this course (00:03 Hands on training)

Unit 2 : TF Basics
- What you will be able to do after this Unit (00:08 Hands on training)
- What this have to do with TF anyway (00:02 Hands on training)
- Get an idea of what is happening (01:20 Hands on training)

Unit 3 : TF Publish and Subscribe
- TF Publisher (01:00 Hands on training)
- TF Subscriber (01:00 Hands on training)
- Adding more frames (01:00 Hands on training)

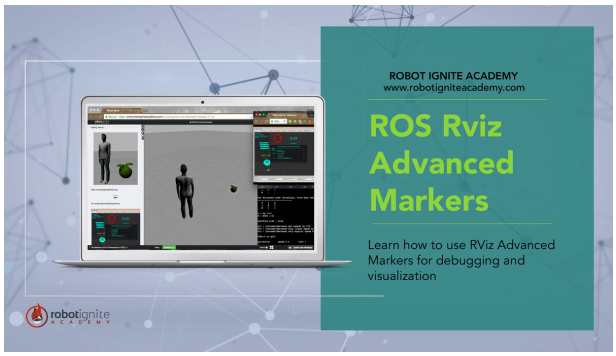
Unit 4 : RobotStatePublisher
- Know how Pi-Robot works (00:30 Hands on training)
- Create your own robot_state_publisher launch (01:00 Hands on training)
- Joint State Publisher (01:00 Hands on training)

Unit 5 : Static Transforms
- Introduction (00:10 Hands on training)
- How it's done in launch files and command line (00:20 Hands on training)
- Practical Application (01:30 Hands on training)

MicroProject
- Spawn a URDF model (00:10 Hands on training)
- Remove a model from Gazebo (00:10 Hands on training)
- Guidelines and the project itself (04:40 Hands on training)

ROS RViz Advanced Markers

Learn how to use RViz Advanced Markers for debugging and visualization



- 13 hours
- ROS Video Tutorials
- Programming Robot Simulation: Haro

A Brief Summary:

Visualizing data in the correct way is vital to extract meaningful conclusions. This is specially true in Robotics.

One of the problems you always tend to have in robotics is to know what the robot is actually seeing, what is the virtual representation of the world in his mind. Its also very important to represent visually complex data in one place only.

That's why RViz and all its markers and plugins have made robotics much user friendly and powerful than ever before!

What You Will Learn:

✓ How to use Basic RViz Markers

✓ How to Create BoundingBoxes Arrays that change dynamically

✓ How to add Overlay text, graphs and menus in RViz

✓ Draw TFTRajectories, RobotFootsteps and occupancy grids that change based on real robot data

✓ Draw pictograms from FontAwsome to represent detections and real object in the world

✓ Represent TwistStamped commands issued to the robot

✓ Create Interactive displays in RViz that allow to execute programs from RViz with custom icons

✓ Record videos of RViz

Learning Path:

Unit 1 : RvizMarkers Unit 0: Presentation in ROS

- Intro (00:02 Hands on training)
- Let's Play (00:10 Hands on training)
- What you will learn with this Course (00:02 Hands on training)
- How you will learn all this (00:02 Hands on training)
- Requirements (00:02 Hands on training)
- Special Thanks (00:02 Hands on training)

Unit 2 : RvizMarkers 1: Basic Markers

- First get the feeling of the simulation (00:10 Hands on training)
- Create your first basic Marker (01:30 Hands on training)
- Create a Custom Mesh Marker (01:00 Hands on training)

Unit 3 : RvizMarkers 2: BoundingBoxes, RobotFootsteps, PolygonArray ,Ocupancy grids, Pictograms

- Where to find all this elements in RViz (00:05 Hands on training)
- BoundingBoxes (01:00 Hands on training)
- RobotFootsteps (01:00 Hands on training)
- Polygon Array (00:30 Hands on training)
- Occupancy Grids (01:00 Hands on training)
- Pictograms (01:00 Hands on training)

Unit 4 : RvizMarkers Unit3: Add Overlays

- Adding plots, piecharts and menus (00:02 Hands on training)
- Plots and PieCharts (00:10 Hands on training)
- Menus and Text Overlay (00:15 Hands on training)
- Complete demo (02:00 Hands on training)

Unit 5 : RvizMarkers Unit 4: Add Custom Panels to RVIZ and Extras

- Add a YES or NO interactive panel (00:30 Hands on training)
- Add a custom GUI (02:00 Hands on training)
- Draw trajectories and TwistStaped in RViz (00:10 Hands on training)
- Record RViz Sessions (00:10 Hands on training)

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