Robotics Software Engineer Syllabus

Contact Info

While going through the program, if you have questions about anything, you can reach us at support@udacity.com. For help from Udacity Mentors and your peers visit the Udacity Classroom.

Nanodegree Program Info

Version: 2.0.0

Length of Program: 93 Days*

** This is a self-paced program and the length is an estimation of total hours the average student may take to complete all required coursework, including lecture and project time. Actual hours may vary.*

Part 1: Introduction to Robotics

Learn the essential elements of robotics, meet your instructors, and get familiar with the tools that will help you succeed in this program.

Part 2: Gazebo World

Learn how to simulate your first robotic environment with Gazebo, the most common simulation engine used by Roboticists around the world.

Project: Build My World

In this project, you will design a Gazebo World environment by including multiple models and use it as a base for all your upcoming projects.

Supporting Lessons

Lesson	Summary
Gazebo Basics	Learn how to simulate your first robot in Gazebo and interact with its world using a Plugin.

Part 3: ROS Essentials

Discover how ROS provides a flexible and unified software environment for developing robots in a modular and reusable manner. Learn how to manage existing ROS packages within a project, and how to write ROS Nodes of your own in C++.

Project: Go Chase It!

Design and build a mobile robot, and house it in your world. Then, program your robot with C++ nodes in ROS to chase white colored balls!

Supporting Lessons

Lesson	Summary
Introduction to ROS	Obtain an architectural overview of the Robot Operating System Framework and setup your own ROS environment in the Udacity Workspace.
Packages & Catkin Workspaces	Learn about ROS workspace structure, essential command line utilities, and how to manage software packages within a project. Harnessing these will be key to building shippable software using ROS.
Write ROS Nodes	ROS Nodes are a key abstraction that allows a robot system to be built modularly. In this lesson, you'll learn how to write them using C++.

Project: Optimize Your GitHub Profile

Other professionals are collaborating on GitHub and growing their network. Submit your profile to ensure your profile is on par with leaders in your field.

Part 4: Localization

Learn how Gaussian filters can be used to estimate noisy sensor readings, and how to estimate a robot's position relative to a known map of the environment with Monte Carlo Localization (MCL).

Project: Where Am I

Use the Adaptive Monte Carlo Localization algorithm in ROS to localize your robot!

Supporting Lessons

Lesson	Summary
Introduction to Localization	Introduction to the localization concept and the algorithms
Kalman Filters	Learn the Kalman Filter and Extended Kalman Filter Gaussian estimation algorithms.
Lab: Kalman Filters	Learn how to apply an EKF ROS package to a robot to estimate its pose.
Monte Carlo Localization	Learn the Monte Carlo Localization algorithm which uses particle filters to estimate a robot's pose.
Build MCL in C++	Learn how to code the Monte Carlo Localization algorithm in C++.

Part 5: Mapping and SLAM

Learn how to create a Simultaneous Localization and Mapping (SLAM) implementation with ROS packages and C++. You'll achieve this by combining mapping algorithms with what you learned in the localization lessons.

Project: Map My World

Deploy RTAB-Map on your simulated robot to create 2D and 3D maps of your environment!

Supporting Lessons

Lesson	Summary
Introduction to Mapping and SLAM	Introduction to the Mapping and SLAM concepts, as well as the algorithms.
Occupancy Grid Mapping	Learn how to map an environment with the Occupancy Grid Mapping algorithm.
Grid-based FastSLAM	Learn how to simultaneously map an environment and localize a robot relative to the map with the Grid-based FastSLAM algorithm.
GraphSLAM	Learn how to simultaneously map an environment and localize a robot relative to the map with the GraphSLAM algorithm.

Project: Improve Your LinkedIn Profile

Find your next job or connect with industry peers on LinkedIn. Ensure your profile attracts relevant leads that will grow your professional network.

Part 6: Path Planning and Navigation

Learn different Path Planning and Navigation algorithms. Then, combine SLAM and Navigation into a home service robot that can autonomously transport objects in your home!

Project: Home Service Robot

Program a home service robot that will autonomously map an environment and navigate to pickup and deliver objects!

Supporting Lessons

Lesson	Summary
Intro to Path Planning and Navigation	Learn what the lessons in Path Planning and Navigation will cover.
Classic Path Planning	Learn a number of classic path planning approaches that can be applied to low-dimensional robotic systems.
Lab: Path Planning	Learn to code the BFS and A* algorithms in C++.
Sample-Based and Probabilistic Path Planning	Learn about sample-based and probabilistic path planning and how they can improve on the classic approach.

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