

[EPUB] Programming Robots With Ros By Morgan Quigley Brian Gerkey

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Programming Robots with ROS-Morgan Quigley 2015-11-16 Want to develop novel robot applications, but don't know how to write a mapping or object-recognition system? You're not alone, but you're certainly not without help. By combining real-world examples with valuable knowledge from the Robot Operating System (ROS) community, this practical book provides a set of motivating recipes for solving specific robotics use cases. Ideal for enthusiasts, from students in robotics clubs to professional robotics scientists and engineers, each recipe describes a complete solution using ROS open source libraries and tools. You'll learn how to complete tasks described in the recipes, as well as how to configure and recombine components for other tasks. If you're familiar with Python, you're ready to go. Learn fundamentals, including key ROS concepts, tools, and patterns Program robots that perform an increasingly complex set of behaviors, using the powerful packages in ROS See how to easily add perception and navigation abilities to your robots Integrate your own sensors, actuators, software libraries, and even a whole robot into the ROS ecosystem Learn tips and tricks for using ROS tools and community resources, debugging robot behavior, and using C++ in ROS

Programming Robots with ROS-Morgan Quigley 2015-11-16 Want to develop novel robot applications, but don't know how to write a mapping or object-recognition system? You're not alone, but you're certainly not without help. By combining real-world examples with valuable knowledge from the Robot Operating System (ROS) community, this practical book provides a set of motivating recipes for solving specific robotics use cases. Ideal for enthusiasts, from students in robotics clubs to professional robotics scientists and engineers, each recipe describes a complete solution using ROS open source libraries and tools. You'll learn how to complete tasks described in the recipes, as well as how to configure and recombine components for other tasks. If you're familiar with Python, you're ready to go. Learn fundamentals, including key ROS concepts, tools, and patterns Program robots that perform an increasingly complex set of behaviors, using the powerful packages in ROS See how to easily add perception and navigation abilities to your robots Integrate your own sensors, actuators, software libraries, and even a whole robot into the ROS ecosystem Learn tips and tricks for using ROS tools and community resources, debugging robot behavior, and using C++ in ROS

Mastering ROS for Robotics Programming-Lentin Joseph 2018-02-26 Discover best practices and troubleshooting solutions when working on ROS Key Features Develop complex robotic applications using ROS to interface robot manipulators and mobile robots Gain insight into autonomous navigation in mobile robots and motion planning in robot manipulators Discover best practices and troubleshooting solutions Book Description In this day and age, robotics has been gaining a lot of traction in various industries where consistency and perfection matter. Automation is achieved via robotic applications and various platforms that support robotics. The Robot Operating System (ROS) is a modular software platform to develop generic robotic applications. This book focuses on the most stable release of ROS (Kinetic Kame), discusses advanced concepts, and effectively teaches you programming using ROS. We begin with aninformative overview of the ROS framework, which will give you a clear idea of how ROS works. During the course of this book, you'll learn to build models of complex robots, and simulate and interface the robot using the ROS MoveIt! motion planning library and ROS navigation stacks. Learn to leverage several ROS packages to embrace your robot models. After covering robot manipulation and navigation, you'll get to grips with the interfacing I/O boards, sensors, and actuators of ROS. Vision sensors are a key component of robots, and an entire chapter is dedicated to the vision sensor and image elaboration, its interface in ROS and programming. You'll also understand the hardware interface and simulation of complex robots to ROS and ROS Industrial. At the end of this book, you'll discover the best practices to follow when programming using ROS. What you will learn Create a robot model with a seven-DOF robotic arm and a differential wheeled mobile robot Work with Gazebo and V-REP robotic simulator Implement autonomous navigation in differential drive robots using SLAM and AMCL packages Explore the ROS Pluginlib, ROS nodelets, and Gazebo plugins Interface I/O boards such as Arduino, robot sensors, and high-end actuators Simulate and motion plan an ABB and universal arm using ROS Industrial Explore the latest version of the ROS framework Work with the motion planning of a seven-DOF arm using MoveIt! Who this book is for If you are a robotics enthusiast or researcher who want to learn more about building robot applications using ROS, this book is for you. In order to learn from this book, you should have a basic knowledge of ROS, GNU/Linux, and C++ programming concepts. The book is also excellent for programmers who want to explore the advanced features of ROS.

A Systematic Approach to Learning Robot Programming with ROS-Wyatt Newman 2017-09-15 A Systematic Approach to Learning Robot Programming with ROS provides a comprehensive, introduction to the essential components of ROS through detailed explanations of simple code examples along with the corresponding theory of operation. The book explores the organization of ROS, how to understand ROS packages, how to use ROS tools, how to incorporate existing ROS packages into new applications, and how to develop new packages for robotics and automation. It also facilitates continuing education by preparing the reader to better understand the existing on-line documentation. The book is organized into six parts. It begins with an introduction to ROS foundations, including writing ROS nodes and ROS tools. Messages, Classes, and Servers are also covered. The second part of the book features simulation and visualization with ROS, including coordinate transforms. The next part of the book discusses perceptual processing in ROS. It includes coverage of using cameras in ROS, depth imaging and point clouds, and point cloud processing. Mobile robot control and navigation in ROS is featured in the fourth part of the book The fifth section of the book contains coverage of robot arms in ROS. This section explores robot arm kinematics, arm motion planning, arm control with the Baxter Simulator, and an object-grabber package. The last part of the book focuses on system integration and higher-level control, including perception-based and mobile manipulation. This accessible text includes examples throughout and C++ code examples are also provided at https://github.com/wsnewman/learning_ros

Robot Operating System (ROS) for Absolute Beginners-Lentin Joseph 2018-05-24 Learn how to get started with robotics programming using Robot Operation System (ROS). Targeted for absolute beginners in ROS, Linux, and Python, this short guide shows you how to build your own robotics projects. ROS is an open-source and flexible framework for writing robotics software. With a hands-on approach and sample projects, Robot Operating System for Absolute Beginners will enable you to begin your first robot project. You will learn the basic concepts of working with ROS and begin coding with ROS APIs in both C++ and Python. What You'll Learn Install ROS Review fundamental ROS concepts Work with frequently used commands in ROS Build a mobile robot from scratch using ROS Who This Book Is For Absolute beginners with little to no programming experience looking to learn robotics programming.

Learning ROS for Robotics Programming-Enrique Fernández 2015-08-18 Your one-stop guide to the Robot Operating System About This Book Model your robot on a virtual world and learn how to simulate it Create, visualize, and process Point Cloud information Easy-to-follow, practical tutorials to program your own robots Who This Book Is For If you are a robotic enthusiast who wants to learn how to build and program your own robots in an easy-to-develop, maintainable, and shareable way, this book is for you. In order to make the most of the book, you should have a C++ programming background, knowledge of GNU/Linux systems, and general skill in computer science. No previous background on ROS is required, as this book takes you from the ground up. It is also advisable to have some knowledge of version control systems, such as svn or git, which are often used by the community to share code. What You Will Learn Install a complete ROS Hydro system Create ROS packages and metapackages, using and debugging them in real time Build, handle, and debug ROS nodes Design your 3D robot model and simulate it in a virtual environment within Gazebo Give your robots the power of sight using cameras and calibrate and perform computer vision tasks with them Generate and adapt the navigation stack to work with your robot Integrate different sensors like Range Laser, Arduino, and Kinect with your robot Visualize and process Point Cloud information from different sensors Control and plan motion of robotic arms with multiple joints using MoveIt! In Detail If you have ever tried building a robot, then you know how cumbersome programming everything from scratch can be. This is where ROS comes into the picture. It is a collection of tools, libraries, and conventions that simplifies the robot building process. What's more, ROS encourages collaborative robotics software development, allowing you to connect with experts in various fields to collaborate and build upon each other's work. Packed full of examples, this book will help you understand the ROS framework to help you build your own robot applications in a simulated environment and share your knowledge with the large community supporting ROS. Starting at an introductory level, this book is a comprehensive guide to the fascinating world of robotics, covering sensor integration, modeling, simulation, computer vision, navigation algorithms, and more. You will then go on to explore concepts like topics, messages, and nodes. Next, you will learn how to make your robot see with HD cameras, or navigate obstacles with range sensors. Furthermore, thanks to the contributions of the vast ROS community, your robot will be able to navigate autonomously, and even recognize and interact with you in a matter of minutes. What's new in this updated edition? First and foremost, we are going to work with ROS Hydro this time around. You will learn how to create, visualize, and process Point Cloud information from different sensors. This edition will also show you how to control and plan motion of robotic arms with multiple joints using MoveIt! By the end of this book, you will have all the background you need to build your own robot and get started with ROS. Style and approach This book is an easy-to-follow guide that will help you find your way through the ROS framework. This book is packed with hands-on examples that will help you program your robot and give you complete solutions using ROS open source libraries and tools.

Hands-On ROS for Robotics Programming-Bernardo Ronquillo Japón 2020-02-26 Take your ROS skills to the next level by implementing complex robot structures in a ROS simulation Key Features Learn fundamental ROS concepts and apply them to solve navigation tasks Work with single board computers to program smart behavior in mobile robots Understand how specific characteristics of the physical environment influence your robot's performance Book Description Connecting a physical robot to a robot simulation using the Robot Operating System (ROS) infrastructure is one of the most common challenges faced by ROS engineers. With this book, you'll learn how to simulate a robot in a virtual environment and achieve desired behavior in equivalent real-world scenarios. This book starts with an introduction to GoPiGo3 and the sensors and actuators with which it is equipped. You'll then work with GoPiGo3's digital twin by creating a 3D model from scratch and running a simulation in ROS using Gazebo. Next, the book will show you how to use GoPiGo3 to build and run an autonomous mobile robot that is aware of its surroundings. Finally, you'll find out how a robot can learn tasks that have not been programmed in the code but are acquired by observing its environment. You'll even cover topics such as deep learning and reinforcement learning. By the end of this robot programming book, you'll be well-versed with the basics of building specific-purpose applications in robotics and developing highly intelligent autonomous robots from scratch. What you will learn Get to grips with developing environment-aware robots Gain insights into how your robots will react in physical environments Break down a desired behavior into a chain of robot actions Relate data from sensors with context to produce adaptive responses Apply reinforcement learning to allow your robot to learn by trial and error Implement deep learning to enable your robot to recognize its surroundings Who this book is for If you are an engineer looking to build AI-powered robots using the ROS framework, this book is for you. Robotics enthusiasts and hobbyists who want to develop their own ROS robotics projects will also find this book useful. Knowledge of Python and/or C++ programming and familiarity with single board computers such as Raspberry Pi is necessary to get the most out of this book.

Effective Robotics Programming with ROS-Anil Mahtani 2016-12-27 Find out everything you need to know to build powerful robots with the most up-to-date ROS About This Book This comprehensive, yet easy-to-follow guide will help you find your way through the ROS framework Successfully design and simulate your 3D robot model and use powerful robotics algorithms and tools to program and set up your robots with an unparalleled experience by using the exciting new features from Robot Kinetic Use the latest version of gazebo simulator, OpenCV 3.0, and C++11 standard for your own algorithms Who This Book Is For This book is suitable for an ROS beginner as well as an experienced ROS roboticist or ROS user or developer who is curious to learn ROS Kinetic and its features to make an autonomous Robot. The book is also suitable for those who want to integrate sensors and embedded systems with other software and tools using ROS as a framework. What You Will Learn Understand the concepts of ROS, the command-line tools, visualization GUIs, and how to debug ROS Connect robot sensors and actuators to ROS Obtain and analyze data from cameras and 3D sensors Use Gazebo for robot/sensor and environment simulation Design a robot and see how to make it map the environment, navigate autonomously, and manipulate objects in the environment using MoveIt! Add vision capabilities to the robot using OpenCV 3.0 Add 3D perception capabilities to the robot using the latest version of PCL In Detail Building and programming a robot can be cumbersome and time-consuming, but not when you have the right collection of tools, libraries, and more importantly expert collaboration. ROS enables collaborative software development and offers an unmatched simulated environment that simplifies the entire robot building process. This book is packed with hands-on examples that will help you program your robot and give you complete solutions using open source ROS libraries and tools. It also shows you how to use virtual machines and Docker containers to simplify the installation of Ubuntu and the ROS framework, so you can start working in an isolated and control environment without changing your regular computer setup. It starts with the installation and basic concepts, then continues with more complex modules available in ROS such as sensors and actuators integration (drivers), navigation and mapping (so you can create an autonomous mobile robot), manipulation, Computer Vision, perception in 3D with PCL, and more. By the end of the book, you'll be able to leverage all the ROS Kinetic features to build a fully fledged robot for all your needs. Style and approach This book is packed with hands-on examples that will help you program your robot and give you complete solutions using ROS open source libraries and tools. All the robotics concepts and modules are explained and multiple examples are provided so that you can understand them easily.

ROS Robotics Projects-Lentin Joseph 2017-03-31 Build a variety of awesome robots that can see, sense, move, and do a lot more using the powerful Robot Operating System About This Book Create and program cool robotic projects using powerful ROS libraries Work through concrete examples that will help you build your own robotic systems of varying complexity levels This book provides relevant and fun-filled examples so you can make your own robots that can run and work Who This Book Is For This book is for robotic enthusiasts and researchers who would like to build robot applications using ROS. If you are looking to explore advanced ROS features in your projects, then this book is for you. Basic knowledge of ROS, GNU/Linux, and programming concepts is assumed. What You Will Learn Create your own self-driving car using ROS Build an intelligent robotic application using deep learning and ROS Master 3D object recognition Control a robot using virtual reality and ROS Build your own AI chatter-bot using ROS Get to know all about the autonomous navigation of robots using ROS Understand face detection and tracking using ROS Get to grips with teleoperating robots using hand gestures Build ROS-based applications using Matlab and Android Build interactive applications using TurtleBot In Detail Robot Operating System is one of the most widely used software frameworks for robotic research and for companies to model, simulate, and prototype robots. Applying your knowledge of ROS to actual robotics is much more difficult than people realize, but this title will give you what you need to create your own robotics in no time! This book is packed with over 14 ROS robotics projects that can be prototyped without requiring a lot of hardware. The book starts with an introduction of ROS and its installation procedure. After discussing the basics, you'll be taken through great projects, such as building a self-driving car, an autonomous mobile robot, and image recognition using deep learning and ROS. You can find ROS robotics applications for beginner, intermediate, and expert levels inside! This book will be the perfect companion for a robotics enthusiast who really wants to do something big in the field. Style and approach This book is packed with fun-filled, end-to-end projects on mobile, armed, and flying robots, and describes the ROS implementation and execution of these models.

Learning Robotics Using Python-Lentin Joseph 2015-05-27 If you are an engineer, a researcher, or a hobbyist, and you are interested in robotics and want to build your own robot, this book is for you. Readers are assumed to be new to robotics but should have experience with Python.

Exam Prep for: Programming Robots With Ros-ROS Robotics By Example-Carol Fairchild 2016-06-30 Bring life to your robot using ROS robotic applications About This Book This book will help you boost your knowledge of ROS and give you advanced practical experience you can apply to your ROS robot platforms This is the only book that offers you step-by-step instructions to solidify your ROS understanding and gain experience using ROS tools From eminent authors, this book offers you a plethora of fun-filled examples to make your own quadcopter, turtlebot, and two-armed robots Who This Book Is For If you are a robotics developer, whether a hobbyist, researchers or professional, and are interested in learning about ROS through a hands-on approach, then this book is for you. You are encouraged to have a working knowledge of GNU/Linux systems and Python. What You Will Learn Get to know the fundamentals of ROS and apply its concepts to real robot examples Control a mobile robot to navigate autonomously in an environment Model your robot designs using URDF and Xacro, and operate them in a ROS Gazebo simulation Control a 7 degree-of-freedom robot arm for visual servoing Fly a quadcopter to autonomous waypoints Gain working knowledge of ROS tools such as Gazebo, rviz, rqt, and Move-It Control robots with mobile devices and controller boards In Detail The visionaries who created ROS developed a framework for robotics centered on the commonality of robotic systems and exploited this commonality in ROS to expedite the development of future robotic systems. From the fundamental concepts to advanced practical experience, this book will provide you with an incremental knowledge of the ROS framework, the backbone of the robotics evolution. ROS standardizes many layers of robotics functionality from low-level device drivers to process control to message passing to software package management. This book provides step-by-step examples of mobile, armed, and flying robots, describing the ROS implementation as the basic model for other robots of these types. By controlling these robots, whether in simulation or in reality, you will use ROS to drive, move, and fly robots using ROS control. Style and approach This is an easy-to-follow guide with hands-on examples of ROS robots, both real and in simulation.

ROS Robotics Projects-Ramkumar Gandhinathan 2019-12-18 Build exciting robotics projects such as mobile manipulators, self-driving cars, and industrial robots powered by ROS, machine learning, and virtual reality Key Features Create and program cool robotic projects using powerful ROS libraries Build industrial robots like mobile manipulators to handle complex tasks Learn how reinforcement learning and deep learning are used with ROS Book Description Nowadays, heavy industrial robots placed in workcells are being replaced by new age robots called cobots, which don't need workcells. They are used in manufacturing, retail, banks, energy, and healthcare, among

other domains. One of the major reasons for this rapid growth in the robotics market is the introduction of an open source robotics framework called the Robot Operating System (ROS). This book covers projects in the latest ROS distribution, ROS Melodic Morenia with Ubuntu Bionic (18.04). Starting with the fundamentals, this updated edition of ROS Robotics Projects introduces you to ROS-2 and helps you understand how it is different from ROS-1. You'll be able to model and build an industrial mobile manipulator in ROS and simulate it in Gazebo 9. You'll then gain insights into handling complex robot applications using state machines and working with multiple robots at a time. This ROS book also introduces you to new and popular hardware such as Nvidia's Jetson Nano, Asus Tinker Board, and Beaglebone Black, and allows you to explore interfacing with ROS. You'll learn as you build interesting ROS projects such as self-driving cars, making use of deep learning, reinforcement learning, and other key AI concepts. By the end of the book, you'll have gained the confidence to build interesting and intricate projects with ROS. What you will learn Grasp the basics of ROS and understand ROS applications Uncover how ROS-2 is different from ROS-1 Handle complex robot tasks using state machines Communicate with multiple robots and collaborate to build apps with them Explore ROS capabilities with the latest embedded boards such as Tinker Board S and Jetson Nano Discover how machine learning and deep learning techniques are used with ROS Build a self-driving car powered by ROS Teleoperate your robot using Leap Motion and a VR headset Who this book is for If you're a student, hobbyist, professional, or anyone with a passion for learning robotics and interested in learning about algorithms, motion control, and perception capabilities from scratch, this book is for you. This book is also ideal for anyone who wants to build a new product and for researchers to make the most of what's already available to create something new and innovative in the field of robotics.

Robot Operating System (ROS)-Anis Koubaa 2018-07-05 Building on the successful first and second volumes, this book is the third volume of the Springer book on the Robot Operating System (ROS): The Complete Reference. The Robot Operating System is evolving from year to year with a wealth of new contributed packages and enhanced capabilities. Further, the ROS is being integrated into various robots and systems and is becoming an embedded technology in emerging robotics platforms. The objective of this third volume is to provide readers with additional and comprehensive coverage of the ROS and an overview of the latest achievements, trends and packages developed with and for it. Combining tutorials, case studies, and research papers, the book consists of sixteen chapters and is divided into five parts. Part 1 presents multi-robot systems with the ROS. In Part 2, four chapters deal with the development of unmanned aerial systems and their applications. In turn, Part 3 highlights recent work related to navigation, motion planning and control. Part 4 discusses recently contributed ROS packages for security, ROS2, GPU usage, and real-time processing. Lastly, Part 5 deals with new interfaces allowing users to interact with robots. Taken together, the three volumes of this book offer a valuable reference guide for ROS users, researchers, learners and developers alike. Its breadth of coverage makes it a unique resource.

A Gentle Introduction to ROS-Jason M. O'Kane 2013 ROS (Robot Operating System) is rapidly becoming a de facto standard for writing interoperable and reusable robot software. This book supplements ROS's own documentation, explaining how to interact with existing ROS systems and how to create new ROS programs using C++, with special attention to common mistakes and misunderstandings. The intended audience includes new or potential ROS users.

Robot Programming-Cameron Hughes 2016-05-02 Start programming robots NOW! Learn hands-on, through easy examples, visuals, and code This is a unique introduction to programming robots to execute tasks autonomously. Drawing on years of experience in artificial intelligence and robot programming, Cameron and Tracey Hughes introduce the reader to basic concepts of programming robots to execute tasks without the use of remote controls. Robot Programming: A Guide to Controlling Autonomous Robots takes the reader on an adventure through the eyes of Midamba, a lad who has been stranded on a desert island and must find a way to program robots to help him escape. In this guide, you are presented with practical approaches and techniques to program robot sensors, motors, and translate your ideas into tasks a robot can execute autonomously. These techniques can be used on today's leading robot microcontrollers (ARM9 and ARM7) and robot platforms (including the wildly popular low-cost Arduino platforms, LEGO® Mindstorms EV3, NXT, and Wowee RS Media Robot) for your hardware/Maker/DIY projects. Along the way the reader will learn how to: Program robot sensors and motors Program a robot arm to perform a task Describe the robot's tasks and environments in a way that a robot can process using robot S.T.O.R.I.E.S. Develop a R.S.V.P. (Robot Scenario Visual Planning) used for designing the robot's tasks in an environment Program a robot to deal with the "unexpected" using robot S.P.A.C.E.S. Program robots safely using S.A.R.A.A. (Safe Autonomous Robot Application Architecture) Approach Program robots using Arduino C/C++ and Java languages Use robot programming techniques with LEGO® Mindstorms EV3, Arduino, and other ARM7 and ARM9-based robots.

Learning ROS robot programming with Raspberry Pi-□□□□ 2018-06-04

Robot Operating System (ROS)-Anis Koubaa 2017-06-29 This second volume is a continuation of the successful first volume of this Springer book, and as well as addressing broader topics it puts a particular focus on unmanned aerial vehicles (UAVs) with Robot Operating System (ROS). Consisting of three types of chapters: tutorials, cases studies, and research papers, it provides comprehensive additional material on ROS and the aspects of developing robotics systems, algorithms, frameworks, and applications with ROS. ROS is being increasingly integrated in almost all kinds of robots and is becoming the de-facto standard for developing applications and systems for robotics. Although the research community is actively developing applications with ROS and extending its features, amount of literature references is not representative of the huge amount of work being done. The book includes 19 chapters organized into six parts: Part 1 presents the control of UAVs with ROS, while in Part 2, three chapters deal with control of mobile robots. Part 3 provides recent work toward integrating ROS with Internet, cloud and distributed systems. Part 4 offers five case studies of service robots and field experiments. Part 5 presents signal-processing tools for perception and sensing, and lastly, Part 6 introduces advanced simulation frameworks. The diversity of topics in the book makes it a unique and valuable reference resource for ROS users, researchers, learners and developers.

Hands-On Robotics Programming with C++-Dinesh Tavaskar 2019-03-30 Enhance your programming skills to build exciting robotic projects Key Features Build an intelligent robot that can detect and avoid obstacles and respond to voice commands Detect and track objects and faces using OpenCV Control your robot with a GUI button designed using Qt5 Book Description C++ is one of the most popular legacy programming languages for robotics, and a combination of C++ and robotics hardware is used in many leading industries. This book will bridge the gap between Raspberry Pi and C/C++ programming and enable you to develop applications for Raspberry Pi. To follow along with the projects covered in the book, you can implement C programs in Raspberry Pi with the wiringPi library. With this book, you'll develop a fully functional car robot and write programs to move it in different directions. You'll then create an obstacle - avoiding robot using an ultrasonic sensor. Furthermore, you'll find out how to control the robot wirelessly using your PC/Mac. This book will also help you work with object detection and tracking using OpenCV, and guide you through exploring face detection techniques. Finally, you will create an Android app and control the robot wirelessly with an Android smartphone. By the end of this book, you will have gained experience in developing a robot using Raspberry Pi and C/C++ programming. What you will learn Install software in Raspberry Pi compatible with C++ programming Program the Raspberry Pi in C++ to run a motor Control RPi-powered robot wirelessly with your laptop or PC Program an RPi camera using OpenCV Control a Raspberry Pi robot with voice commands Implement face and object detection with Raspberry Pi Who this book is for This book is for developers, programmers, and robotics enthusiasts interested in leveraging C++ to build exciting robotics applications. Prior knowledge of C++ is necessary to understand the projects covered in this book.

Learn Robotics Programming-Danny Staple 2018-11-29 Gain experience of building a next-generation collaboration robot Key Features Get up and running with the fundamentals of robotic programming Program a robot using Python and the Raspberry Pi 3 Learn to build a smart robot with interactive and AI-enabled behaviors Book Description We live in an age where the most difficult human tasks are now automated. Smart and intelligent robots, which will perform different tasks precisely and efficiently, are the requirement of the hour. A combination of Raspberry Pi and Python works perfectly when making these kinds of robots. Learn Robotics Programming starts by introducing you to the basic structure of a robot, along with how to plan, build, and program it. As you make your way through the book, you will gradually progress to adding different outputs and sensors, learning new building skills, and writing code for interesting behaviors with sensors. You'll also be able to update your robot, and set up web, phone, and Wi-Fi connectivity in order to control it. By the end of the book, you will have built a clever robot that can perform basic artificial intelligence (AI) operations. What you will learn Configure a Raspberry Pi for use in a robot Interface motors and sensors with a Raspberry Pi Implement code to make interesting and intelligent robot behaviors Understand the first steps in AI behavior such as speech recognition visual processing Control AI robots using Wi-Fi Plan the budget for requirements of robots while choosing parts Who this book is for Learn Robotics Programming is for programmers, developers, and enthusiasts interested in robotics and developing a fully functional robot. No major experience required just some programming knowledge would be sufficient.

Mastering ROS for Robotics Programming-Lentin Joseph 2015-12-21 Design, build and simulate complex robots using Robot Operating System and master its out-of-the-box functionalities About This Book Develop complex robotic applications using ROS for interfacing robot manipulators and mobile robots with the help of high end robotic sensors Gain insights into autonomous navigation in mobile robot and motion planning in robot manipulators Discover the best practices and troubleshooting solutions everyone needs when working on ROS Who This Book Is For If you are a robotics enthusiast or researcher who wants to learn more about building robot applications using ROS, this book is for you. In order to learn from this book, you should have a basic knowledge of ROS, GNU/Linux, and C++ programming concepts. The book will also be good for programmers who want to explore the advanced features of ROS. What You Will Learn Create a robot model of a Seven-DOF robotic arm and a differential wheeled mobile robot Work with motion planning of a Seven-DOF arm using MoveIt! Implement autonomous navigation in differential drive robots using SLAM and AMCL packages in ROS Dig deep into the ROS Pluginlib, ROS nodelets, and Gazebo plugins Interface I/O boards such as Arduino, Robot sensors, and High end actuators with ROS Simulation and motion planning of ABB and Universal arm using ROS Industrial Explore the ROS framework using its latest version In Detail The area of robotics is gaining huge momentum among corporate people, researchers, hobbyists, and students. The major challenge in robotics is its controlling software. The Robot Operating System (ROS) is a modular software platform to develop generic robotic applications. This book discusses the advanced concepts in robotics and how to program using ROS. It starts with deep overview of the ROS framework, which will give you a clear idea of how ROS really works. During the course of the book, you will learn how to build models of complex robots, and simulate and interface the robot using the ROS MoveIt motion planning library and ROS navigation stacks. After discussing robot manipulation and navigation in robots, you will get to grips with the interfacing I/O boards, sensors, and actuators of ROS. One of the essential ingredients of robots are vision sensors, and an entire chapter is dedicated to the vision sensor, its interfacing in ROS, and its programming. You will discuss the hardware interfacing and simulation of complex robot to ROS and ROS Industrial (Package used for interfacing industrial robots). Finally, you will get to know the best practices to follow when programming using ROS. Style and approach This is a simplified guide to help you learn and master advanced topics in ROS using hands-on examples.

Robot Operating System Cookbook-Kumar Bipin 2018-06-29 Leverage the power of ROS to build exciting collaborative robots. Key Features Delve into an open source, meta-operating system for your robot Get acquainted with tools and libraries for building and running code on multiple platforms Use Gazebo to model your robot and create a virtual environment Book Description This book will leverage the power of ROS with an introduction to its core and advanced concepts through exciting recipes. You will get acquainted with the use of different synchronous and asynchronous communication methods, including messages, services, and actions. You will learn how to use the various debugging and visualization tools used in development and how to interface sensors and actuators with the ROS framework. Firstly, you will get to grips with ROS simulation frameworks, such as Gazebo and RotorS for modeling and simulating any physical robot and virtual environment. You will also cover mobile robotics, micro-aerial vehicles, and robotic arms, which are the leading branches of robotic applications. Robot Operating System Cookbook will also guide you in the development of an autonomous navigation framework for both mobile robots and micro-aerial vehicles. Finally, you will explore ROS-Industrial, an open source project that extends the advanced capabilities of ROS software to manufacturing industries. What you will learn Explore advanced concepts, such as ROS pluginlib, nodelets, and actionlib Work with ROS visualization, profiling, and debugging tools Gain experience in robot modeling and simulation using Gazebo Understand the ROS Navigation Stack for mobile robots Configure a MoveIt! package for a manipulator robot Develop an autonomous navigation framework for MAV using ORB SLAM and MoveIt Integrate sensors, actuators, and robots into the ROS ecosystem Get acquainted with the ROS-Industrial package with hardware support, capabilities, and applications Who this book is for If you're a researcher or engineer with an interest in the problems, solutions, and future research issues that you may encounter in the development of robotic applications, this book is for you. Basic knowledge of C++ and Python programming with the GNU/Linux environment is strongly recommended to assist with understanding the key concepts covered in the book.

Ros 2 in 5 Days-Ricardo Téllez 2019-03-14 Since ROS started back in 2007, a lot has changed in the robotics world and, with it, in the ROS community. What started as a "small" project has become the main tool for robot developers all around the world. This means that ROS is being pushed to its limits every day. With all this in mind, and in order to accomplish all the new challenges that robotics evolution is presenting, ROS is now ready to evolve. And this evolution is none other than ROS2.The goal of ROS2 is to bring ROS to a whole new level, maintaining all the awesome features that ROS already provides, and adding many new functionalities that will make sure that ROS2 can fulfill all the new challenges that robotics will bring in the years to come.So, the goal of this course will be to introduce you to the basic concepts that you need to know in order to start working with ROS2. During the course, we will try to bypass all the unnecessary noise and focus on the main things you need to know in order to learn to use ROS2. And in particular, we will focus on practice. So... what do you say? Are you in?

Modern Robotics-Kevin M. Lynch 2017-05-25 A modern and unified treatment of the mechanics, planning, and control of robots, suitable for a first course in robotics.

Software Engineering at Google-Titus Winters 2020-02-28 Today, software engineers need to know not only how to program effectively but also how to develop proper engineering practices to make their codebase sustainable and healthy. This book emphasizes this difference between programming and software engineering. How can software engineers manage a living codebase that evolves and responds to changing requirements and demands over the length of its life? Based on their experience at Google, software engineers Titus Winters and Hyrum Wright, along with technical writer Tom Manshreck, present a candid and insightful look at how some of the world's leading practitioners construct and maintain software. This book covers Google's unique engineering culture, processes, and tools and how these aspects contribute to the effectiveness of an engineering organization. You'll explore three fundamental principles that software organizations should keep in mind when designing, architecting, writing, and maintaining code: How time affects the sustainability of software and how to make your code resilient over time How scale affects the viability of software practices within an engineering organization What trade-offs a typical engineer needs to make when evaluating design and development decisions

ROS Robotics By Example-Carol Fairchild 2017-11-30 Learning how to build and program your own robots with the most popular open source robotics programming framework About This Book Get to know the fundamentals of ROS and apply its concepts to real examples Learn how to write robotics applications without getting bogged down in hardware problems Learn to implement best practices in ROS development Who This Book Is For This book is for robotic enthusiasts, researchers and professional robotics engineers who would like to build robot applications using ROS. It gives the robotics beginner and the ROS newbie an immensely practical introduction to robot building and robotics application coding. Basic knowledge of GNU/Linux and the ability to write simple applications is assumed, but no robotics knowledge, practical or theoretical, is needed. What You Will Learn Control a robot without requiring a PhD in robotics Simulate and control a robot arm Control a flying robot Send your robot on an independent mission Learning how to control your own robots with external devices Program applications running on your robot Extend ROS itself Extend ROS with the MATLAB Robotics System Toolbox In Detail ROS is a robust robotics framework that works regardless of hardware architecture or hardware origin. It standardizes most layers of robotics functionality from device drivers to process control and message passing to software package management. But apart from just plain functionality, ROS is a great platform to learn about robotics itself and to simulate, as well as actually build, your first robots. This does not mean that ROS is a platform for students and other beginners; on the contrary, ROS is used all over the robotics industry to implement flying, walking and diving robots, yet implementation is always straightforward, and never dependent on the hardware itself. ROS Robotics has been the standard introduction to ROS for potential professionals and hobbyists alike since the original edition came out; the second edition adds a gradual introduction to all the goodness available with the Kinetic Kame release. By providing you with step-by-step examples including manipulator arms and flying robots, the authors introduce you to the new features. The book is intensely practical, with space given to theory only when absolutely necessary. By the end of this book, you will have hands-on experience on controlling robots with the best possible framework. Style and approach ROS Robotics By Example, Second Edition gives the robotics beginner as well as the ROS newbie an immensely practical introduction to robot building and robotics application coding. ROS translates as "robot operating system"; you will learn how to control a robot via devices and configuration files, but you will also learn how to write robot applications on the foundation of this operating system.

A Systematic Approach to Learning Robot Programming with ROS-Wyatt Newman 2017-09-15 A Systematic Approach to Learning Robot Programming with ROS provides a comprehensive, introduction to the essential components of ROS through detailed explanations of simple code examples along with the corresponding theory of operation. The book explores the organization of ROS, how to understand ROS packages, how to use ROS tools, how to incorporate existing ROS packages into new applications, and how to develop new packages for robotics and automation. It also facilitates continuing education by preparing the reader to better understand the existing on-line documentation. The book is organized into six parts. It begins with an introduction to ROS foundations, including writing ROS nodes and ROS tools. Messages, Classes, and Servers are also covered. The second part of the book features simulation and visualization with ROS, including coordinate transforms. The next part of the book discusses perceptual processing in ROS. It includes coverage of using cameras in ROS, depth imaging and point clouds, and point cloud processing. Mobile robot control and navigation in ROS is featured in the fourth part of the book The fifth section of the book contains coverage of robot arms in ROS. This section explores robot arm kinematics, arm motion planning, arm control with the Baxter Simulator, and an object-grabber package. The last part of the book focuses on system integration and higher-level control, including perception-based and mobile manipulation. This accessible text includes examples throughout and C++ code examples are also provided at https://github.com/wsnewman/learning_ros

Grokking Algorithms-Aditya Y. Bhargava 2016-05-25 Summary Grokking Algorithms is a fully illustrated, friendly guide that teaches you how to apply common algorithms to the practical problems you face every day as a programmer. You'll start with sorting and searching and, as you build up your skills in thinking algorithmically, you'll tackle more complex concerns such as data compression and artificial intelligence. Each carefully presented example includes helpful diagrams and fully annotated code samples in Python. Learning about algorithms doesn't have to be boring! Get a sneak peek at the fun, illustrated, and friendly examples you'll find in Grokking Algorithms on Manning Publications' YouTube channel. Purchase of the print book includes a free eBook in PDF, Kindle, and ePub formats from Manning Publications. About the Technology An algorithm is nothing more than a step-by-step procedure for solving a problem. The algorithms you'll use most often as a programmer have already been discovered,

tested, and proven. If you want to understand them but refuse to slog through dense multipage proofs, this is the book for you. This fully illustrated and engaging guide makes it easy to learn how to use the most important algorithms effectively in your own programs. About the Book Grokking Algorithms is a friendly take on this core computer science topic. In it, you'll learn how to apply common algorithms to the practical programming problems you face every day. You'll start with tasks like sorting and searching. As you build up your skills, you'll tackle more complex problems like data compression and artificial intelligence. Each carefully presented example includes helpful diagrams and fully annotated code samples in Python. By the end of this book, you will have mastered widely applicable algorithms as well as how and when to use them. What's Inside Covers search, sort, and graph algorithms Over 400 pictures with detailed walkthroughs Performance trade-offs between algorithms Python-based code samples About the Reader This easy-to-read, picture-heavy introduction is suitable for self-taught programmers, engineers, or anyone who wants to brush up on algorithms. About the Author Aditya Bhargava is a Software Engineer with a dual background in Computer Science and Fine Arts. He blogs on programming at adit.io. Table of Contents Introduction to algorithms Selection sort Recursion Quicksort Hash tables Breadth-first search Dijkstra's algorithm Greedy algorithms Dynamic programming K-nearest neighbors

Simulation, Modeling, and Programming for Autonomous Robots-Itsuki Noda 2012-09-19 This book constitutes the refereed proceedings of the Third International Conference on Simulation, Modeling, and Programming for Autonomous Robots, SIMPAR 2012, held in Tsukuba, Japan, in November 2012. The 33 revised full papers and presented together with 3 invited talks were carefully reviewed and selected from 46 submissions. Ten papers describe design of complex behaviors of autonomous robots, 9 address software layers, 8 papers refer to related modeling and learning. The papers are organized in topical sections on mobile robots, software modeling and architecture and humanoid and biped robots.

Python for Programmers-Paul J. Deitel 2019-03-15 The professional programmer's Deitel® guide to Python® with introductory artificial intelligence case studies Written for programmers with a background in another high-level language, Python for Programmers uses hands-on instruction to teach today's most compelling, leading-edge computing technologies and programming in Python—one of the world's most popular and fastest-growing languages. Please read the Table of Contents diagram inside the front cover and the Preface for more details. In the context of 500+, real-world examples ranging from individual snippets to 40 large scripts and full implementation case studies, you'll use the interactive IPython interpreter with code in Jupyter Notebooks to quickly master the latest Python coding idioms. After covering Python Chapters 1-5 and a few key parts of Chapters 6-7, you'll be able to handle significant portions of the hands-on introductory AI case studies in Chapters 11-16, which are loaded with cool, powerful, contemporary examples. These include natural language processing, data mining Twitter® for sentiment analysis, cognitive computing with IBM® Watson™, supervised machine learning with classification and regression, unsupervised machine learning with clustering, computer vision through deep learning and convolutional neural networks, deep learning with recurrent neural networks, big data with Hadoop®, Spark™ and NoSQL databases, the Internet of Things and more. You'll also work directly or indirectly with cloud-based services, including Twitter, Google Translate™, IBM Watson, Microsoft® Azure®, OpenMapQuest, PubNub and more. Features 500+ hands-on, real-world, live-code examples from snippets to case studies IPython + code in Jupyter® Notebooks Library-focused: Uses Python Standard Library and data science libraries to accomplish significant tasks with minimal code Rich Python coverage: Control statements, functions, strings, files, JSON serialization, CSV, exceptions Procedural, functional-style and object-oriented programming Collections: Lists, tuples, dictionaries, sets, NumPy arrays, pandas Series & DataFrames Static, dynamic and interactive visualizations Data experiences with real-world datasets and data sources Intro to Data Science sections: AI, basic stats, simulation, animation, random variables, data wrangling, regression AI, big data and cloud data science case studies: NLP, data mining Twitter®, IBM® Watson™, machine learning, deep learning, computer vision, Hadoop®, Spark™, NoSQL, IoT Open-source libraries: NumPy, pandas, Matplotlib, Seaborn, Folium, SciPy, NLTK, TextBlob, spaCy, Textatistic, Tweepy, scikit-learn®, Keras and more Accompanying code examples are available here: http://ptgmedia.pearsoncmg.com/imprint_downloads/informit/bookreg/9780135224335/9780135224335_examples.zip. Register your product for convenient access to downloads, updates, and/or corrections as they become available. See inside book for more information.

Probabilistic Robotics-Sebastian Thrun 2005-08-19 Probabilistic robotics is a growing area in the subject, concerned with perception and control in the face of uncertainty and giving robots a level of robustness in real-world situations. This book introduces techniques and algorithms in the field.

Effective Python-Brett Slatkin 2020

A Mathematical Introduction to Robotic Manipulation-Richard M. Murray 2017-12-14 A Mathematical Introduction to Robotic Manipulation presents a mathematical formulation of the kinematics, dynamics, and control of robot manipulators. It uses an elegant set of mathematical tools that emphasizes the geometry of robot motion and allows a large class of robotic manipulation problems to be analyzed within a unified framework. The foundation of the book is a derivation of robot kinematics using the product of the exponentials formula. The authors explore the kinematics of open-chain manipulators and multifingered robot hands, present an analysis of the dynamics and control of robot systems, discuss the specification and control of internal forces and internal motions, and address the implications of the nonholonomic nature of rolling contact are addressed, as well. The wealth of information, numerous examples, and exercises make A Mathematical Introduction to Robotic Manipulation valuable as both a reference for robotics researchers and a text for students in advanced robotics courses.

Mobile Robotics-Alonzo Kelly 2013-11-11 Introduction -- Math fundamentals -- Numerical methods -- Dynamics -- Optimal estimation -- State estimation -- Control -- Perception -- Localization and mapping -- Motion planning

Learning Robotics with Robotis Dream Systems-Chi N Thai 2018-02-26 The DREAM II(TM) (School Set) programmable robotic kit was released by ROBOTIS(R) in Spring 2018 for the USA market with a cost around \$220 US. It is recommended for users at age 8 or older. It comes with instructions to build 23 programmable robot examples and it can be interfaced with two free popular programming tools: 1) The first interface uses a ROBOTIS tool called TASK(TM) which can generate machine code that runs on the robot controller CM-150 allowing it to interact with its built-in NIR sensors and miniature speaker, along with a variety of external actuators and sensors. These TASK codes can be developed on MS Windows(R) platforms or on iOS(R) and Android(R) mobile devices, and they can be deployed via USB (wired) or Bluetooth(R). 2) The second interface uses the Off-Line version of MIT's SCRATCH(R) 2 software to combine the power and multimedia services of a Windows PC with a direct control of the robot controller CM-150 via USB (wired) or Bluetooth and a helper application named RJSCRATCH, provided by ROBOTIS. This book is for you if you are a young robotics enthusiast looking at achieving on your own a firm foundation in robotics design and programming, or if you are an adult investigating the possible use of the DREAM II School Set to help children learn about robotics programming and design. This book will show that this kit can be quite a versatile tool to introduce students from 8 to 12 years old to fundamental concepts in several areas: mechanical design, computer programming, robot control, inter-device commu-nications and multimedia programming for richer story telling. This book consists of 6 chapters: 1) Chapter 1 presents an overview of the DREAM II system and its relationship with the SMART III system. The Sense-Think-Act paradigm used in developing the contents of this book is also described in this chapter. 2) Chapter 2 describes the hardware and software capabilities of the complete DREAM II system and shows how to get started with the School Set on Windows PCs as well as on Mobile Devices. This chapter also shows how to use the ROBOTIS MANAGER software tool using a basic wheeled robot design. 3) Chapter 3 is a substantial chapter providing a gradual but in-depth tutorial about applications of the R+TASK software tool using three robot designs - "Avoider/Follower," "TriCycle" and "Dowel Scanner." Topics included autonomous-behavior and remote-control algorithms, communications and audio programming techniques. PC and Mobile uses of the TASK tool are developed in this chapter. 4) Chapter 4 is also another substantial chapter mirroring the instructional approach and topics devel-oped in Chapter 3 but now using the R+SCRATCH/SCRATCH 2 tool chain and its multimedia and event programming features. 5) Chapter 5 presents mechanical design concepts inherent in the mechanical components provided in Level 1 of the "complete" DREAM II system (i.e. non-programmable), with the goal of helping students understand the mechanical design concepts represented in the provided Level 1 example robots and be creative in their own robot designs by showcasing additional mechanical concepts and robot designs. 6) Chapter 6 provides a closer look at select programmable robots provided in the School Set (i.e. Levels 2 and 3) to explain their hardware/software features and to offer suggestions to expand some selected robots beyond their original designs or solutions. This book also provides appropriate source codes and tutorial videos (via YouTube(R)) to illustrate the presented concepts, along with review questions to help students master learned materials. Please visit www.cntrobotics.com/dreambook for access options to the source codes and tutorial videos.

Exploring Robotics with ROBOTIS Systems-Chi N. Thai 2017-07-31 This 2nd edition textbook has been expanded to include of 175 additional pages of additional content, created in response to readers feedback, as well as to new hardware and software releases. The book presents foundational robotics concepts using the ROBOTIS BIOLOID and OpenCM-904 robotic systems, and is suitable as a curriculum for a first course in robotics for undergraduate students or a self-learner. It covers wheel-based robots, as well as walking robots. Although it uses the standard "Sense, Think, Act" approach, communications (bot-to-bot and PC-to-bot) programming concepts are treated in more depth (wired and wireless ZigBee/BlueTooth). Algorithms are developed and described via ROBOTIS' proprietary RoboPlus IDE, as well as the more open Arduino-based Embedded C environments. Additionally, a vast array of web-based multimedia materials are used for illustrating robotics concepts, code implementations and videos of actual resulting robot behaviors. Advanced sensor interfacing for gyroscope, inertial measuring unit, foot pressure sensor and color camera are also demonstrated.

Advances in Automation and Robotics Research in Latin America-Ignacio Chang 2017-03-14 This book contains the proceedings of the 1st Latin American Congress on Automation and Robotics held at Panama City, Panama in February 2017. It gathers research work from researchers, scientists, and engineers from academia and private industry, and presents current and exciting research applications and future challenges in Latin American. The scope of this book covers a wide range of themes associated with advances in automation and robotics research encountered in engineering and scientific research and practice. These topics are related to control algorithms, systems automation, perception, mobile robotics, computer vision, educational robotics, robotics modeling and simulation, and robotics and mechanism design. LACAR 2017 has been sponsored by SENACYT (Secretaria Nacional de Ciencia, Tecnologia e Inovacion of Panama).

Learning ROS for Robotics Programming-Aaron Martinez 2013-09-25 The book will take an easy-to-follow and engaging tutorial approach, providing a practical and comprehensive way to learn ROS.If you are a robotic enthusiast who wants to learn how to build and program your own robots in an easy-to-develop, maintainable and shareable way, "Learning ROS for Robotics Programming" is for you. In order to make the most of the book, you should have some C++ programming background, knowledge of GNU/Linux systems, and computer science in general. No previous background on ROS is required, since this book provides all the skills required. It is also advisable to have some background on version control systems, like svn or git, which are often used to share the code by the community.

The Robotics Primer-Maja J. Matarić 2007 1. What is a robot? 2. Where do robots come from? 3. What's in a robot? 4. Arms, legs, wheels, tracks, and really drives them 5. Move it! 6. Grasping at straws 7. What's going on? 8. Switch on ghe light 9. Sonars, lasers, and cameras 10. Stay in control 11. The building bolcks of control 12. What's in your head? 13. Think hard, act later 14. Don't think, react! 15. Think and act separately, in parallel 16. Think the way you act 17. Making your robot behave 18. When the unexpected happens 19. Going places 20. Go, team! 21. Things keep getting better 22. Where to next?

Hands-On Neuroevolution with Python-Iaroslav Omelianenko 2019-12-24 Increase the performance of various neural network architectures using NEAT, HyperNEAT, ES-HyperNEAT, Novelty Search, SAFE, and deep neuroevolution Key Features Implement neuroevolution algorithms to improve the performance of neural network architectures Understand evolutionary algorithms and neuroevolution methods with real-world examples Learn essential neuroevolution concepts and how they are used in domains including games, robotics, and simulations Book Description Neuroevolution is a form of artificial intelligence learning that uses evolutionary algorithms to simplify the process of solving complex tasks in domains such as games, robotics, and the simulation of natural processes. This book will give you comprehensive insights into essential neuroevolution concepts and equip you with the skills you need to apply neuroevolution-based algorithms to solve practical, real-world problems. You'll start with learning the key neuroevolution concepts and methods by writing code with Python. You'll also get hands-on experience with popular Python libraries and cover examples of classical reinforcement learning, path planning for autonomous agents, and developing agents to autonomously play Atari games. Next, you'll learn to solve common and not-so-common challenges in natural computing using neuroevolution-based algorithms. Later, you'll understand how to apply neuroevolution strategies to existing neural network designs to improve training and inference performance. Finally, you'll gain clear insights into the topology of neural networks and how neuroevolution allows you to develop complex networks, starting with simple ones. By the end of this book, you will not only have explored existing neuroevolution-based algorithms, but also have the skills you need to apply them in your research and work assignments. What you will learn Discover the most popular neuroevolution algorithms - NEAT, HyperNEAT, and ES-HyperNEAT Explore how to implement neuroevolution-based algorithms in Python Get up to speed with advanced visualization tools to examine evolved neural network graphs Understand how to examine the results of experiments and analyze algorithm performance Delve into neuroevolution techniques to improve the performance of existing methods Apply deep neuroevolution to develop agents for playing Atari games Who this book is for This book is for machine learning practitioners, deep learning researchers, and AI enthusiasts who are looking to implement neuroevolution algorithms from scratch. Working knowledge of the Python programming language and basic knowledge of deep learning and neural networks are mandatory.

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