

Community Experience Distilled

Raspberry Pi Robotics Essentials

Harness the power of Raspberry Pi with Six Degrees of Freedom (6DoF) to create an amazing walking robot

Richard Grimmett

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PUBLISHING

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BIRMINGHAM - MUMBAI

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Richard Grimmett has more fun working on robotic projects than should be allowed. He also enjoys teaching computer science and electrical engineering at Brigham Young University, Idaho. He has a bachelor's and master's degree in electrical engineering and a PhD in leadership studies. He has written books on how to use Raspberry Pi, Arduino, and BeagleBone Black for robotics projects.

About the Reviewers

Ashwin Pajankar is a Bangalore-based engineer who wears many different hats depending on the occasion. He graduated from IIIT Hyderabad in 2012 with a master of technology degree in computer science and engineering. He has a total of 5 years of experience in the software industry, where he has worked in different domains, such as testing, data warehousing, replication, and automation. He is very well versed in DB concepts, SQL, and scripting with Bash and Python. He has earned professional certifications in products from Oracle, IBM, Informatica, and Teradata. He's also an ISTQB-certified tester.

In his free time, he volunteers for different technical hackathons or social-service activities. He was introduced to the Raspberry Pi in one of the hackathons, and he's been hooked on it ever since. He writes a lot of code in Python, C, C++, and Shell on his Raspberry Pi B+ cluster. He's currently working on creating his own Beowulf cluster of 64 Raspberry Pi 2 models.

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Since 2013, Werner has been working as a Magento developer and the head of programming at mStage GmbH, an eCommerce company focused on Magento.

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Preface

There have been many recent technological advances that have really changed the way we live, work, and play. The television, the computer, and the cell phone all have dramatically affected our lives. Each of these generally started out with a few early adopters, for the most part, individuals with lots of resources that were able to afford the new technology. However, soon after, there was a movement to make the technology more affordable for a wider range of people.

The latest technological movement is robotics. The number, kind, and use of robots is growing dramatically. The first of these robots were developed in university labs or in military research centers. However, just as with the adaption of the computer, there is already a growing grassroots movement of do-it-yourself developers that has sprung up to make robots a part of our everyday life.

This movement has been fueled by inexpensive hardware and free, open source software. However, it has also been enabled by a community of developers who are willing to help others get started or overcome challenges that they have experienced.

This book is offered in the spirit of this do-it-yourself movement. Inside the book, you'll find details about how to take Raspberry Pi B 2, an inexpensive, small, but versatile computer, and marry it with inexpensive hardware and open source software to build a bipedal robot that can walk, sense barriers, and even see its surroundings.

However, be careful – this sort of information can be dangerous. Before long, you may be creating the next generation of thinking, walking, sensing machines that will be at the heart of the robotic revolution.

What this book covers

Chapter 1, Configuring and Programming Raspberry Pi, begins with a discussion on how to connect power, and it continues through setting up a full system that's configured and ready to begin connecting any of the amazing devices and Software capabilities to develop advanced robotics applications.

Chapter 2, Building the Biped, shows how to construct the mechanics of the biped platform whether you want to use 3D print, purchase, or construct your own legs and body.

Chapter 3, Motion for the Biped, talks about how once you have the platform built, you'll need to program it to walk, wave, play dead, or perform any number of neat motion segments so that you can coordinate the movement of your platform.

Chapter 4, Avoiding Obstacles Using Sensors, shows you how to add IR sensors so that you can avoid running into barriers.

Chapter 5, Path Planning and Your Biped, covers how to plan the movement of your biped. As you move around, you'll want to be able to move from point A to point B.

Chapter 6, Adding Vision to Your Biped, provides the details of how to connect a webcam, the hardware, and the software so that we can use it to input visual data into our system.

Chapter 7, Accessing Your Biped Remotely, covers the basics of how to configure the Raspberry Pi as a wireless access point so that you can control your biped remotely.

What you need for this book

Here is the list of what you need:

- Raspbian
- putty
- Image Writer for Windows
- libusb-1.0-0-dev
- VncServer

Who this book is for

This book is for anyone who has some background in using the Raspberry Pi to create robotics projects. Some programming background is assumed as you create a biped robot that can walk, sense its environment, plan its movements, and follow movement and color – all autonomously.

Conventions

In this book, you will find a number of text styles that distinguish between different kinds of information. Here are some examples of these styles and an explanation of their meaning.

Code words in text, database table names, folder names, filenames, file extensions, pathnames, dummy URLs, user input, and Twitter handles are shown as follows:


"However, you do need to find the `/dev` device label for your card"


Any command-line input or output is written as follows:

```
sudo dd if=2015-01-31-raspbian.img of=/dev/sdX
```

New terms and **important words** are shown in bold. Words that you see on the screen, for example, in menus or dialog boxes, appear in the text like this:

"Clicking the **Next** button moves you to the next screen."

[ Warnings or important notes appear in a box like this.]

[ Tips and tricks appear like this.]

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Configuring and Programming Raspberry Pi

Robots are beginning to infiltrate our world. They come in all shapes and sizes, with a wide range of capabilities. And, just like the evolution of the personal computer before them, much of what is happening in the robot development world is coming from hobbyists and do-it-yourselfers that are using a new generation of inexpensive hardware and free, open source software to build machines with all kinds of amazing capabilities. In this book, you will learn how to build robots by building a robot, a four-legged quadruped with sensor and vision capabilities. The skills you will learn, however, can also be used on a wide variety of walking, rolling, swimming, or flying robots.

In this chapter, you'll learn:

- How to configure your Raspberry Pi, the control center of your robot, with the Raspbian operating system
- How to set up a remote development environment so you can program your robot
- Basic programming skills in both Python and C so you can both create and edit the programs your robot will need to do all those amazing things