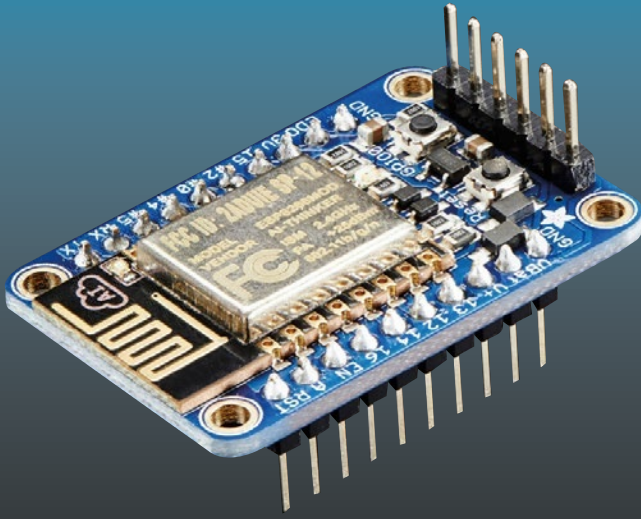


TECHNOLOGY IN ACTION™



Raspberry Pi IoT Projects

Prototyping Experiments for Makers



—
John C. Shovic

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Raspberry Pi IoT Projects

Prototyping Experiments for Makers



John C. Shovic, PhD

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Raspberry Pi IoT Projects: Prototyping Experiments for Makers

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*To my best friend Laurie and also to my cat Panther,
who is an IOT device by himself.*

Contents at a Glance

About the Author	xv
About the Technical Reviewer	xvii
Acknowledgments	xix
Introduction	xxi
Chapters at a Glance	xxiii
■ Chapter 1: Introduction to IOT	1
■ Chapter 2: Sensing Your IOT Environment	9
■ Chapter 3: Building a Solar Powered IOT Weather Station	63
■ Chapter 4: Changing Your Environment with IOT and iBeacons ...	113
■ Chapter 5: Connecting an IOT Device to a Cloud Server - IOTPulse.....	147
■ Chapter 6: Using IOT for RFID and MQTT and the Raspberry Pi	187
■ Chapter 7: Computer Security and the IOT	213
■ Appendix: Suggestions for Further Work	229
Index.....	231

Contents

About the Author	xv
About the Technical Reviewer	xvii
Acknowledgments	xix
Introduction	xxi
Chapters at a Glance	xxiii
■ Chapter 1: Introduction to IOT	1
Choosing a Raspberry Pi Model	2
Choosing an IOT Device.....	3
Characterizing an IOT Project.....	3
Communications.....	4
Processor Power.....	4
Local Storage.....	4
Power Consumption	5
Functionality	5
Cost.....	5
The Right Tools to Deal with Hardware	5
Writing Code in Python and the Arduino IDE	7
In This Book.....	8

Chapter 2: Sensing Your IOT Environment	9
IOT Sensor Nets.....	10
IOT Characterization of This Project	10
How Does This Device Hook Up to the IOT?.....	11
What Is an ESP8266?.....	11
The LightSwarm Design	12
Building Your First IOT Swarm.....	16
Installing Arduino Support on the PC or Mac.....	16
Your First Sketch for the ESP8266.....	16
The Hardware	17
The Software	25
Self-Organizing Behavior	43
Monitoring and Debugging the System with the Raspberry Pi (the Smart Guy on the Block)	44
LightSwarm Logging Software Written in Python.....	44
The RasPiConnect Control Panel in Real Time.....	54
Results	58
What Else Can You Do with This Architecture?	61
Conclusion.....	61
Chapter 3: Building a Solar Powered IOT Weather Station	63
IOT Characterization of This Project	65
How Does This Device Hook Up to the IOT?.....	65
Data Gathering	65
The Project - IOTWeatherPi	66
How This All Works	68
The Subsystems	68
The I2C Bus.....	71

Sizing Your Solar Power System 76

Power Up and Power Down..... 78

 The Brownout Problem 80

 Shutting Off the Pi 80

Starting the Pi 81

 The Issue 81

 Power Your Pi Up and Down with the USB Power Control 82

 The USB Power Controller Board 83

 One More Scenario 84

What Do You Need to Build This Project? 86

Connecting and Testing the Hardware 88

The Full Wiring List..... 90

The Software 95

 Non-Normal Requirements for your Pi 95

 The IOTWeatherPi Python Software 95

 The RasPiConnect Control Panel 97

 Improvements..... 98

Tweeting Your Weather Data 98

 Getting Started 98

 Registering a Twitter App..... 99

Texting Your Weather Data..... 102

Supplying Your Data to the World - CWOP 105

 CWOP 105

 CWOP Software Interface to IOTWeatherPi 105

 CWOP Software..... 105

 Example CWOP Packet 108

 Results..... 108

Conclusion..... 110

- Chapter 4: Changing Your Environment with IOT and iBeacons..... 113**
- The IOTBeaconAir 113
 - IOT Characterization of This Project..... 114
 - How Does This Device Hook Up to the IOT?..... 115
 - Hardware List 115
- iBeacons..... 116
 - Bluetooth iBeacon Scanner 118
 - Phillips Hue Lighting System 119
 - Phillips Hue Hub 120
- BeaconAir Hardware, Software, and Configuration 121
 - BeaconAir Hardware Description..... 121
 - BeaconAir Software Description..... 121
 - BeaconAir Configuration File 133
 - iBeacon Software 134
 - Trilateralization 134
 - The IOTBeaconAir Control Panel 135
- Installing blueZ and phue on the Raspberry Pi..... 138
 - BlueZ..... 139
 - phue..... 141
- RasPiConnectServer Startup 141
 - Startup Procedure 141
 - Making IOTBeaconAir Start on Bootup 142
 - How It Works in Practice..... 143
- Things to Do 143
- The Classic Distributed System Problems..... 144
- Conclusion..... 145

■ Chapter 5: Connecting an IOT Device to a Cloud Server - IOTPulse.....	147
IOT Characterization of This Project	148
The Internet Of Things on the Global Network	148
Cloud Computing	149
Application Builders.....	150
Display and Report Generation	150
The IBM Bluemix Internet Of Things Solution	151
The IOTPulse Design.....	152
Building the IOTPulse.....	155
3D Printing Files for the IOT Case	157
Software Needed	160
The IOTPulse Code.....	160
Reviewing the Arduino IDE Serial Monitor Results	170
Joining IBM Bluemix and the IoT Foundation	173
Sending your Data to Bluemix	175
Displaying Real-Time Data on the IBM Bluemix IOT Platform.....	179
Advanced Topics.....	184
Historical Data	184
Node-RED Applications.....	185
Watson Applications	186
Conclusion.....	186
■ Chapter 6: Using IOT for RFID and MQTT and the Raspberry Pi.....	187
IOT Characterization of This Project	187
What Is RFID Technology?	188
What Is MQTT?	189
Hardware Used for IOTRFID	190
Building an MQTT Server on a Raspberry Pi	191

The Software on the Raspberry Pi.....	192
Installing the MQTT “Mosquitto”.....	192
Configuring and Starting the Mosquitto Server.....	193
Starting the Mosquitto Server.....	194
Testing the Mosquitto Server.....	194
Building the IOTRFID.....	195
The Parts Needed.....	195
Installing Arduino Support on the PC or Mac.....	196
The Hardware.....	196
What Is This Sensor We Are Using?.....	196
3D Printed Case.....	197
The Full Wiring List.....	199
The Software for the IOTRFID Project.....	201
The Libraries.....	201
The Main Software.....	202
Testing the IOTRFID System.....	205
Setting Up the Mosquitto Debug Window.....	206
Set Up a Subscriber on the Raspberry Pi.....	207
Testing the Entire IOTRFID System.....	208
What to Do with the RFID Data on the Server.....	210
Conclusion.....	210
■ Chapter 7: Computer Security and the IOT.....	213
IOT: Top Five Things to Know About IOT Computer Security.....	214
Number 1: This is <i>important</i> . You can prove your application <i>is insecure</i> , but you can’t prove your application <i>is secure</i>	214
Number 2: Security through Obscurity Is Not Security.....	214
Number 3: Always Connected? Always Vulnerable.....	214

Number 4: Focus On What Is *Important* to Be Secure in your IOT Application..... 215

Number 5: Computer Security Rests on Three Main Aspects: Confidentiality, Integrity, and Availability..... 215

What Are the Dangers?..... 216

Assigning Value to Information..... 216

Building The Three Basic Security Components for IOT Computers.... 217

 Confidentiality - Cryptography..... 217

 Integrity - Authentication..... 222

 Availability - Handling DOS / Loss of Server / Watchdogs 225

Key Management 226

Update Management..... 227

Conclusion..... 227

■ **Appendix: Suggestions for Further Work 229**

 Parting Words... 230

Index..... 231

About the Author



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Introduction

The Internet Of Things (IOT) is a complex concept made up of many computers and many communication paths. Some IOT devices are connected to the Internet and some are not. Some IOT devices form swarms that communicate among themselves. Some are designed for a single purpose, while some are more general purpose computers. This book is designed to show you the IOT from the inside out. By building IOT devices, the reader will understand the basic concepts and will be able to innovate using the basics to create his or her own IOT applications.

These included projects will show the reader how to build their own IOT projects and to expand upon the examples shown. The importance of Computer Security in IOT devices is also discussed and various techniques for keeping the IOT safe from unauthorized users or hackers. The most important takeaway from this book is in building the projects yourself.

Chapters at a Glance

In this book, we built examples of all the major parts of simple and complex IOT devices.

In Chapter 1, the basic concepts of IOT are explained in basic terms, and you will learn what parts and tools are needed to start prototyping your own IOT devices.

In Chapter 2, you'll learn how to sense the environment with electronics and that even the behavior of simple LightSwarm type of devices can be very unpredictable.

Chapter 3 introduces important concepts about how to build real systems that can respond to power issues and programming errors by the use of good system design and watchdogs.

Chapter 4 turns a Raspberry Pi into a battery-powered device that senses iBeacons and controls the lighting in a house while reporting your location to a server.

In Chapter 5, you'll do IOT the way the big boys do by connecting up to the IBM BlueMix IOT Server and sending our biometric pulse rates up for storage and display.

In Chapter 6, we'll build a small RFID Inventory system and use standard protocols like MQTT to send information to a Raspberry Pi, a complete IOT product.

Chapter 7 shows the dark side of the IOT, Computer Security. The way you protect your IOT device from hackers and network problems is the most difficult part of IOT device and system design.

Are you totally secure? You will never know. Plan for it.

The reference appendix provides resources for further study and suggestions for other projects.

CHAPTER 1



Introduction to IOT

Chapter Goal: Understand What the IOT Is and How to Prototype IOT Devices

Topics Covered in This Chapter:

- What is IOT
- Choosing a Raspberry Pi Model
- Choosing your IOT Device
- Characterization of IOT Devices
- Buying the right tools to deal with Hardware
- Writing code in Python and in the Arduino IDE

The IOT is a name for the vast collection of “things” that are being networked together in the home and workplace (up to 20 billion by 2020 according to Gardner, a technology consulting firm). That is a very vast collection. And they may be underestimating it.

We all have large numbers of computers in a modern house. I just did a walkthrough of my house, ignoring my office (which is filled with another ~100 computers). I found 65 different devices having embedded computers. I’m sure I missed some of them. Now of those computer-based devices, I counted 20 of them that have IP addresses, although I know that I am missing a few (such as the thermostat). So in a real sense, this house has 20 IOT devices. And it is only 2016 as of the writing of this book. With over 100 million households in the United States alone, 20 billion IOT devices somehow don’t seem so many.

So what are the three defining characteristics of the IOT?

- Networking - these IOT devices talk to one another (M2M communication) or to servers located in the local network or on the Internet. Being on the network allows the device the common ability to consume and produce data.
- Sensing - IOT devices sense something about their environment.

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- Actuators - IOT devices that do something. Lock doors, beep, turn lights on, or turn the TV on.

Of course, not every IOT device will have all three, but these are the characteristics of what we will find out there.

Is the IOT valuable? Will it make a difference? Nobody is sure what the killer application will be, but people are betting huge sums of money that there will be a killer application. Reading this book and doing the projects will teach you a lot about the technology and enable you to build your own IOT applications.

Choosing a Raspberry Pi Model

The Raspberry Pi family of single board computers (see Figure 1-1) is a product of the Raspberry Pi Foundation (RaspberryPi.org). They have sold over 9 million of these small, inexpensive computers. The Raspberry Pi runs a number of different operating systems, the most common of which is the Raspian release of Ubuntu Linux.

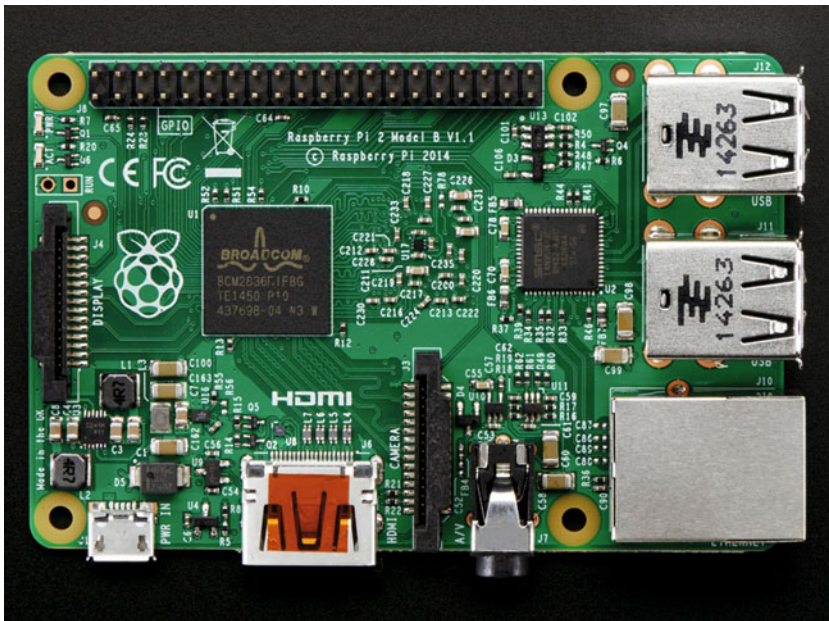


Figure 1-1. *Raspberry Pi 2*

Like Windows, Linux is a multitasking operating system, but unlike Windows, it is an open source system. You can get all the source code and compile it if you wish, but I would not recommend that to a beginner.

One of the best parts of the Raspberry Pi is that there are a huge number of device and sensor drivers available, which makes it a good choice for building IOT projects,