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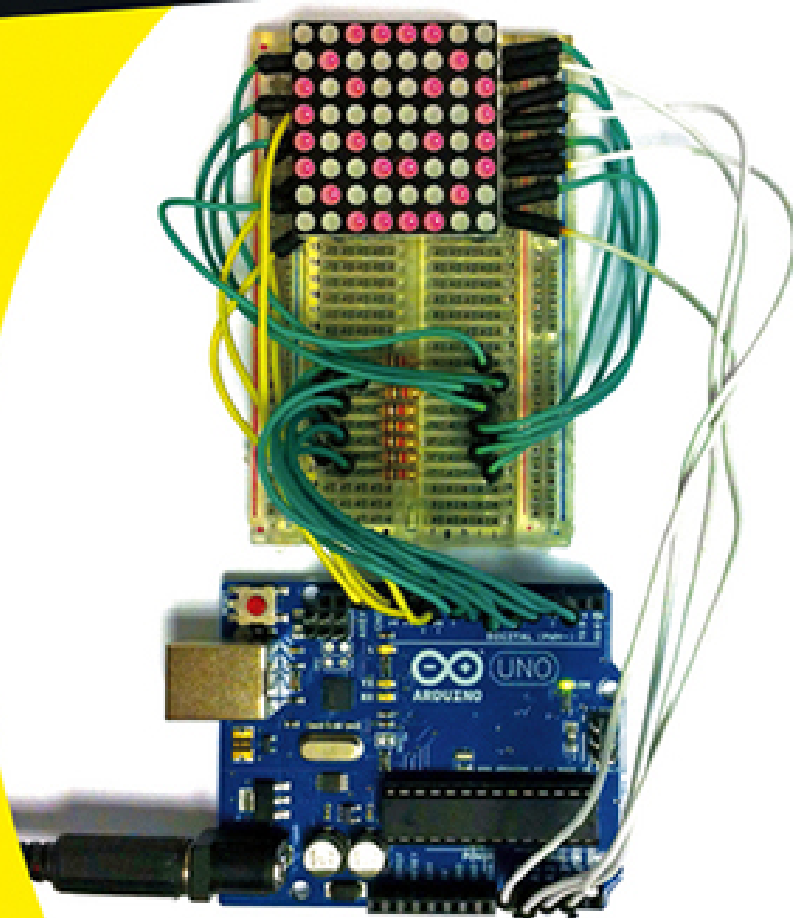
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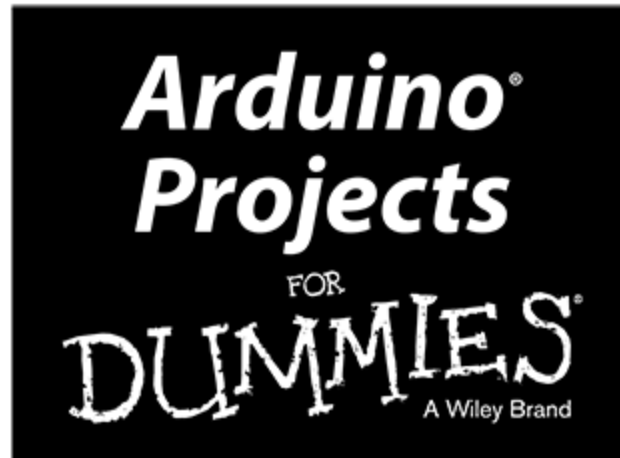
A Wiley Brand

Learn to:

- Set up a workspace for your projects
- Create projects with Arduino Uno
- Automate the home and garden, including a tweeting pet door
- Build a GPS data logger and an RFID reader

Brock Craft





by Brock Craft



Arduino® Projects For Dummies®

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About the Author

Brock Craft is a Lecturer in the Department of Computing at Goldsmiths, University of London. He is also a Senior Tutor at the Royal College of Art. He is a specialist in physical computing, data visualization, and the Internet of Things. Brock's background is in the field of human-computer interaction, and he has over a decade of experience making interactive things that people can use, explore, and play with. He was a co-director of the design consultancy Tinker London, along with Alexandra Deschamps-Sonsino and Massimo Banzi, one of the founders of the Arduino Project. He has taught hundreds of people to create things with Arduinos.

When he is not teaching and learning, Brock likes to make interactive stuff and digital art.

Dedication

For Barbara, who has supported me steadfastly on this most incredible journey, and without whom this book would not have been possible. She has put at least as much work into this effort as I have. I also dedicate this book to my mother, Lea Gaydos, who taught me that I can do anything I put my mind to. I would like to acknowledge and dedicate this book to the memory of Craig Veal, the best teacher I ever had.

And most especially, this book is for Eleanor, who I hope will grow up to make everything in her world come alive with creativity.

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Introduction

Have you heard a lot about Arduinos and wanted to get to know how they work a little bit better? Maybe you have a friend who's used an Arduino to build some crazy project or interactive gizmo. Perhaps you have an Arduino lying around that you always thought you'd get working but never had the time to do it. It's time to blow the dust off!

Maybe you just want some inspiration and fun projects to do in your spare time or on the weekends. If so, this is exactly the book for you. The projects here show off some of the amazing capabilities of an Arduino, and they can all be completed without any prior expertise or experience. It's also a great companion to other Arduino books that you may have bought or skimmed through.

Arduino Projects For Dummies is an inspiring collection of fun and interesting things you can do with an Arduino. I've packed in a wide range of cool ideas for things you can do. Best of all, I selected them so that after you've done a few of them, you'll have most of the technical knowledge you'll need to come up with your own amazing gadgets, widgets, and interactive stuff. Whether you are an Arduino newbie or a seasoned pro, these projects are super fun to build and help you to really get your creative ideas flowing.

Why Arduino?

It's no secret that Arduino has been making a lot of news lately, especially among makers, tinkerers, and hobbyists. All kinds of people are getting into the powerful and interactive things you can do with an

Arduino — from school kids to university researchers, to artists and designers. One thing that sets apart Arduino from a lot of other platforms is that anyone can write new programs to use with it and share them online. Even more powerfully, special code collections called libraries extend the things Arduino can do by allowing you to connect cameras, motors, printers, scanners, remote controls — you name it. Because anyone can create code for Arduino and share it online, the community is really growing fast. It's been instrumental in renewing interest in electronics and new hacker spaces all over the country where people build cool things, such as autonomous robots, 3D printers, and interactive artwork.

Foolish Assumptions

I'm assuming in this book that you have an idea of what an Arduino is and maybe have played around with one a bit. You also may have done some basic electronics, either in a school physics class or on your own, but you may not be aware of or remember much about the basic principles of electronics. That's no problem, because I'll go over what you need to know and explain a bit about how the electronic circuits in this book work, mainly what you need to know to get the projects going.

I also figure you've tried your hand at writing a little code before. But whether you have written any code at all, I explain how all of the programs in this book work in fine detail. That way you can learn how to program your Arduino to do not just the things in this book but the things you want to do.

I'm also assuming you want to get your Arduino to do its thing on its own and without having to rely on a computer for power or a data connection. So all of the projects in this book can operate just fine without the

need for keeping your Arduino connected to your desktop or laptop.

Which brings me to another assumption — that you have a computer you can work on consistently and that you're pretty familiar with how to operate it, move and save files, and generally keep your system organized. I'm also assuming you are familiar with downloading zipped files from the Internet and extracting them.

Safety and Arduino Projects

When working with electricity, safety is paramount. If you connect something incorrectly, you can easily fry your hardware or yourself, especially if you do anything with household power. That's why none of the projects in this book are connected directly to the main power. All of the projects use low voltage, direct current components. It's simply a safer way to operate.

However, it is still possible to fry something if you aren't careful. So you should pay particular attention that you are wiring things up according to the diagrams provided. There are warning icons in the margins for steps that are particularly hairy, so keep an eye out for them. And speaking of your eyes, some of the projects require a little light fabrication, so you should use those safety goggles. Also, if you do any soldering, you have to be careful about the hot soldering iron. Make sure you set up your workbench to be a safe and productive environment.

How This Book Is Organized

In general, I've organized the book with the easier projects toward the beginning and the harder ones toward the end. But if you see a project you really want to get going on, dive right in.

Check out the table of contents to see what you might want to tackle first, and if you need to look something up, the index is a handy reference.

The parts in this book are divided into chapters, so you can find what you need quickly and easily.

Part I: Getting Started with Arduino Projects

You should check out Part I before you get started, to make sure you are ready to go and your project building workspace has everything you'll need to get your work done. I discuss the basics of setting up your workbench and getting the right project building supplies and tools in [Chapter 2](#), and I cover setting up your Arduino on your computer.



I also describe the most popular kinds of Arduino boards and suggest which ones are good for different applications, although all of the projects in the book can be built with the basic Arduino Uno.

I also cover setting up your Arduino and provide some tips on “packaging up” your project. A lot of Arduino project guides online neglect the part about building a

good enclosure, so there are some creative tips in this section.

[Chapter 3](#) describes the basics of writing Arduino code and the basics of physically building your projects. If you know nothing about writing code for Arduino, you should definitely read this chapter. Pretty much everyone who has used an Arduino has made an LED blink, and that's what you do in [Chapter 3](#), when you set up your Arduino. I also describe the kinds of things you can do with your Arduino — sensing things in the environment and actuating things. I give an overview of the kinds of electronic components you will find out there on the market and provide some tips on soldering and building your projects.

Part II: Basic Arduino Projects

Part II is all about lights and timing. [Chapter 4](#) takes LEDs bit further, describing how to make lots of LEDs blink in what I call an All-Seeing Eye — think *Battlestar Galactica*. [Chapter 5](#) describes how to make LEDs pulsate so you can create a light pet with a personality. [Chapter 6](#) takes LEDs to a more functional application — writing with light, in which timing is a key factor. [Chapter 7](#) rounds things off with another timing application — building an alarm clock. This is the most advanced project in Part II, so if you are just getting your feet wet, save it for last.

Part III: The Interactive Home and Garden

Turn to Part III if you are fascinated by sensors and home automation. People have been automating their homes and apartments since the 1980s, at least — but with Arduino, you can take things to a whole new level! [Chapter 8](#) shows you how to build a keypad entry system

for your door — very James Bond. When you've completed it, you can extend its capabilities with the keycard reader in [Chapter 9](#). Only someone with a properly registered keycard will be able to gain access.

Once you've made it easier to come and go, you can build the plant irrigation system in [Chapter 10](#). That way, when you've gone out for a long trip, you can make sure your houseplant or even a whole indoor garden stays healthy and happy.

While you are smartening up your home, you can give your pets a new voice as well. The tweeting pet door in [Chapter 11](#) helps give your dog or cat a voice online. You'll be able to tell whenever they are coming and going by wiring up your pet door to the Internet — with no computer required, once it's set up!

The last project in Part III takes this one step further and shows you how to connect live data feeds from your house to a data tracking system online. In [Chapter 12](#), you build your own home sensing station that posts regular information about temperature and light levels around your house — accessible from anywhere you can get an Internet connection. You can even embed data charts into your own website. Once you've got a handle on how the code works, you can hook up just about any sensor to the Internet — whether in your home, garden, or treehouse.

Part IV: Advanced Arduino Projects

I've saved some of my favorite and trickiest projects for last, in Part IV. [Chapter 13](#) shows you how to build a GPS data logger. You don't have to settle for the GPS in your car or on your phone. You can use it just about anywhere and log the data to a standard SD data card. There are all kinds of clever uses for this, including tracking

vehicles, packages, pets, and logging your own explorations in the city or country.

No electronics-related project book would be complete without a remote- controlled device of some kind.

[Chapter 14](#) shows you how to build your own remote-controlled car out of a few easily found supplies and some potato chip cans. The clever part is that you use any old remote control around your house to control the car. By the time you finish this project, you'll not only have a pretty cool vehicle, but you'll also understand the basics of using servo motors and how to use an Arduino to make just about anything remote controllable.

[Chapter 15](#) gets back to playing around with light. LED cubes are getting really popular and if you haven't seen them already, you will. This chapter shows you how to make and program your own. There's also an online tool for building your own animated lighting patterns. Both the code and the physical construction are pretty challenging, but the results are really cool. If, like me, you are mesmerized by blinking lights, you're gonna love this one.

Part V: The Part of Tens

Every book in the *For Dummies* series has a “top ten” style list where you can find further information quickly. This part is where I get to share some of my favorite Arduino resources and some handy tips and tricks with you.

[Chapter 16](#) describes the best suppliers and Arduino resources for the stuff you'll need to build the projects and take things even further. I also get to brag about my favorite suppliers — and friends — in the Arduino world. Every projects book should help you out with troubleshooting as much as possible. [Chapter 17](#)

provides tips for solving problems. This can be tricky, since the problems could arise from your software or your hardware — *or both!* I hope that the tips in this chapter will help you figure out why your project might not be working.

The Companion Website

This book has a companion website that offers some additional projects and a tool for creating patterns for the LED cube you build in [Chapter 15](#). Go to www.dummies.com/go/arduinoprojectsfordummies and look on the Downloads tab. You can also find schematics and full-color parts placement diagrams here to help you build the projects in this book.



Several of the projects require additional code libraries to make them work. You can find these libraries in a .zip file on the Downloads tab of the companion website. Later, if updates become available for this book, you can also find them on the Downloads tab.

Besides this book's companion website on dummies.com, you can also go to my personal website at www.brockcraft.com. Everyone I've ever met who tinkers with Arduino is happy to help out other folks in improving their code and their projects. So, if you have any suggestions for enhancing or improving these projects, please let me know!

Icons Used in This Book

I can't highlight the most important passages in this book with my trusty Sharpie or yellow highlighter, so I've

used icons to draw your attention to the important parts.



Tips highlight information that can save you time or money or just make things easier to do. You'll have a lot more fun if you keep the tips in mind as you go along, and they can help you with your own projects, too.



Building projects can be tricky or hazardous or both. I've placed warnings to highlight areas where it's easy to make a mistake or fry something or generally get something messed up. The warnings are there so that you don't have to learn the hard way — because I probably already did that for you!



Sometimes there are important points that you really need to keep in mind when you are working on a project or writing code. I've use this icon to highlight these important points. That way, you can easily find them when you are reviewing a project or building a new one of your own.



This is a pretty technical book, but sometimes there are extremely geeky topics that are either interesting or useful to know. I've identified these with this icon. You can skip this stuff because it's not essential to know in order to build the projects, but I've included it here in case you want to understand a little better how things work.

Part I
**Getting Started with
Arduino Projects**

