Community Experience Distilled

Arduino Electronics Blueprints

Make common electronic devices interact with an Arduino board to build amazing out-of-the-box projects

Don Wilcher

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First published: July 2015

Production reference: 1200715

Published by Packt Publishing Ltd.

Livery Place

35 Livery Street

Birmingham B3 2PB, UK.

ISBN 978-1-78439-360-1

www.packtpub.com

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Don Wilcher

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Cover Work

Komal Ramchandani

About the Author

Don Wilcher is a passionate educator of electronics and robotics technology and an electrical engineer with 26 years of experience. He has authored several books on Lego Robotics and Arduinos. His latest book published by Maker Media, titled *Make: Basic Arduino Projects*, has been approved by the Alabama State Department of Education to be on their reading list. He's also a Certified Electronics Technician (CETa) and Exam Administrator (CA) with ETA International as well as State Certified Teacher for Career Technical Education (CTE) as a Level 2 Specialist in electronics technology. He has worked on industrial robotic systems, automotive electronic modules/systems, and embedded wireless controls for small consumer appliances. While at the Chrysler Corporation, Don developed a weekend enrichment pre-engineering program for inner city kids. He's a contributing writer and webinar lecturer for *Design News Magazine*. He is also an electronics and robotics technologist who has developed 21st century educational products and training materials for Makers, hardware start-up entrepreneurs, and educators.

I would like to thank my wife, Mattalene, and three children, Tiana, D'Vonn, and D'Mar, for their patience and understanding as I worked diligently to build and test Arduino circuits, coding, and writing during family time activities. This book is dedicated to you all. Also, I would like to thank my awesome Packt Publishing editors: Ajinkya Paranjape (content development editor), Harsha, Bharwani (acquisition editor), and Tejaswita V. Kavir (technical editor) for your patience, dedication, comments, and great suggestions on creating a wonderful book. I look forward to working with you all soon on another book project.

About the Reviewers

Samuel de Ancos lives in Madrid, Spain. He loves developing software. He is currently working as a senior engineer at Carriots.com IoT and M2M platform and is a member of the Fourcoders software developers team. He writes a blog about software developing (in Spanish).

He has more than 7 years of experience in developing web applications with PHP / MySql / MongoDB using frameworks such as Symfony 1.4 / 2.x / Silex and also has more than 5 years of experience with Python, knowledge of the Tornado Web Server framework, Web.py framework, and the Bottle framework. He has more than 4 years of experience in developing the IoT and M2M platforms with knowledge of MongoDB, RabbitMQ, and Redis.

Liam Lacey is a software developer who specializes in C/C++ development, mainly in the fields of audio and MIDI, of OS-level applications. Most of his development skills have been self-taught through a strong passion for the field; however, he was first introduced to software development at the university, where he received a first class BSc honors in audio and music technology. He has designed and developed software modules for new products, from the concept/prototype stage all the way through to the production stage, within teams and as an independent developer.

He has a strong interest in audio plugin development, connected devices, music interaction, new interfaces for musical expression, and augmented instruments using platforms such as Arduino and JUCE. He is also a guitarist, musician, composer, producer, performer, and sound designer.

He aims to develop his current software development skills toward a highly professional level as well as develop skills in other related areas, such as audio DSP, sound synthesis and design, and electronics.

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Preface

You have purchased your first Arduino, and now you're wondering what project to build with it. There are hundreds of websites with an assortment of electronic gadgets and devices to build, but the search and choosing the first project can be overwhelming. Besides building awesome Arduino gadgets, some of the website projects leave out how the electronics and code work with a programmable prototyping platform. Also, the projects found on the Web don't provide additional challenges to test your new Maker skills as well.

The *Arduino Electronics Blueprints* book was written to address the concerns mentioned in a user friendly and educational format. Every chapter in the book starts off with either a historical reference to electronic discoveries or a brief discussion of present technologies used in contemporary consumer, entertainment, or industrial products. The book was designed to show how to build awesome electronic devices using parts found in laboratory bins or junk boxes. Also, new prototyping materials such as littleBits electronic modules and Elenco SNAP circuit kits are introduced to readers as well. The new and exciting prototyping materials presented allow us to rapidly build the target Arduino device discussed in some of the book's chapters. To aid readers in building the fun Arduino projects, a Parts list of electronic components is included in each chapter of the book. Detailed circuit schematic and wiring diagrams and Arduino code are provided in each chapter. Also, basic circuit theory and Arduino code explanations are provided in each project chapter as well. To conclude the chapter, a DIY challenge is presented, so readers may explore additional prototyping topics in new product designs of their own. I enjoyed designing, building, and testing each chapter's project and hope readers of the *Arduino Electronics Blueprints* book will find the projects to be fun and entertaining as well.

What this book covers

Chapter 1, *A Sound Effects Machine,* will teach the reader how to build an Arduino sound effects machine using an SD module, digital logic switches, a transistor speaker amplifier, and `.wav` files. Also, the reader will learn how to add a random function in order as to play different sounds automatically without using digital logic switches.

Chapter 2, *Programmable DC Motor Controller with an LCD,* shows the reader how to build an Arduino programmable controller to operate small DC motors. Also, to aid in operating the programmable controller, the reader will learn how to add a Liquid Crystal Display (LCD) to the electronic device as well.

Chapter 3, *A Talking Logic Probe*, explains a talking electronic instrument that the reader can build to test microcontroller and digital circuits. Also, the reader will learn how to wire an Arduino to an EMIC 2 (text-to-speech) module and program it using special character codes.

Chapter 4, *Human Machine Interface,* A Human Machine Interface (HMI) used in industrial controls to operate electromechancial devices, such as motors, will be discussed in this chapter. The reader will also learn how to build a HMI using an Arduino, a virtual server, and JavaScript to control a small DC motor.

Chapter 5, *IR Remote Control Tester,* allows the reader to learn how to build a testing device to check the operation of any IR remote control. Also, the reader will learn about IR detectors and digital codes using this electronic tester.

Chapter 6, *A Simple Chat Device with LCD,* will teach the reader how to send text messages to an Arduino using a Bluetooth Low Energy (BLE) device and an Android smartphone. Also, the RedBearLabs BLE Arduino shield used to send and receive text messages will be introduced to the reader in this chapter.

Chapter 7, *Bluetooth Low Energy Controller,* will show the reader how to send BLE control signals to an Arduino using the RedBearLabs BLE shield and an Android smartphone to control a DC motor. Also, a seven segment LED display's electrical operation will be discussed along with making letter characters using the BLE Controller.

Chapter 8, *Capacitive Touch Sensing*, explores a simple DC motor controller using an Arduino and a 555 timer IC-based capacitive touch sensor. The reader will learn the basic operation of the 555 timer by building an Arduino-enabled touch sensing controller.

Chapter 9, *Arduino-SNAP Circuit AM Radio,* introduces the reader the Elenco SNAP circuit kit by building an AM radio. Also, the reader will learn how to operate the AM radio using the RedBearLab BLE shield and an Android smartphone.

Chapter 10, *Arduino Scrolling Marquee*, discusses organic light-emitting diode (OLED) technology by building an Arduino-based scrolling marquee. Also, the reader will learn to use any ordinary IR handheld remote to control the scrolling effect of the OLED marquee.

What you need for this book

To build the awesome electronics gadgets and devices in this book, the following materials are required:

- An Arduino Uno (Rev 3 electronics board).
- The latest Arduino IDE can be downloaded from the website http://www.arduino.cc/en/Main/Software.
- An assortment of electronic components (resistors, capacitors, transistors, diodes, seven segment LED display, 74LS04 Hex inverter IC, and 74LS00 NAND logic gate IC).
- The EMIC 2 text-to-speech module. The module can be purchased from Parallax Inc's website https://www.parallax.com/product/30016.
- littleBits deluxe set. The electronics module kit can be purchased from littleBits website http://littlebits.cc/shop.
- The Elenco SNAP circuit kit. The Elenco SNAP circuit kit can be purchased from Adafruit website https://www.adafruit.com/category/117.
- A solderless breadboard.
- A jumper wire kit.
- A small variable DC power supply (the variable output voltage rating of 0-24V DC with an output current rating of 2A max).
- 9V batteries with battery snap connectors.

Who this book is for

This book is intended for those who want to learn about electronics and coding by building amazing devices and gadgets with the Arduino. If you are an experienced developer who understands the basics of electronics, then you can quickly learn how to build smart devices using the Arduino. Perhaps you have never used electronic components and are new to the Arduino, but have coding skills. In either case, this book will provide you with the knowledge to build amazing, smart, and fun-to-use devices. The only experience needed is a desire to learn about electronics, circuit breadboarding, and coding.

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: "The `<Serial.h>` library allows the text message to be converted into its equivalent ASCII code."

A block of code is set as follows:

```
void loop(){

  // read the status of the Program Switch value:
  ProgramStatus = digitalRead(ProgramPin);

  // check if Program switch is ON.
  if(ProgramStatus == HIGH) {
    digitalWrite(OUTPin, HIGH);

  }
  else{
     digitalWrite(OUTPin,LOW);

  }
}
```

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: "Click on the **Connect** button on the Breakout server application."

> ## Note
>
> Warnings or important notes appear in a box like this.

> ## Tip
>
> Tips and tricks appear like this.

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