

Community Experience Distilled

Netduino Home Automation Projects

Automate your house, save lives, and survive the apocalypse with .NET on a Netduino!

Matt Cavanagh

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BIRMINGHAM - MUMBAI

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Matt Cavanagh is a professional maker and tinkerer. From his armchair in Durban, South Africa, he lives the dream, wearing suit and slippers with cigar in his hand (fine, just the slippers). He gave up corporate development to start his own company writing Windows and Windows Phone apps, but mostly messes around all day with Netduinos, 3D printers, and his pet quadrocopter. He is also a Nokia Developer Champion who occasionally gives talks on Windows Phone and Netduino.

Oh, and he writes stuff too.

I would like to thank Secret Labs for being awesome, and the Netduino community for being an endless source of ideas and help. Most of all though, I need to thank my beautiful wife, Kaila, for putting up with most of our house being covered in wires and servos.

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Lance McCarthy is a professional XAML developer, XAML Support Specialist at Telerik, and a Nokia Developer Ambassador for the Northeastern United States. He is an award winning Windows Phone developer and has been writing for the platform since September 2010. Passionate about melding hardware and software, in his spare time Lance uses the power of the Netduino and Windows Phone to create projects that blend the worlds of electronics and human interaction.

I would like to thank Matt Cavanagh for his pure awesomeness, my employers for encouraging creativity, and my wife Amy for her undying patience with my mad scientist moments.

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This is dedicated to my father, Brett, who is solely responsible for my technology addiction.

I would like to thank Secret Labs for being awesome, and the Netduino community for being an endless source of ideas and help. Most of all though, I need to thank my beautiful wife, Kaila, for putting up with most of our house being covered in wires and servos.

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Preface

When I was a kid I had a Meccano set, which is pretty much the coolest childhood "toy" that exists because it allows you to build things without actually knowing how to build things. But it was limited—there was no interactivity beyond a switch and a motor.

So I started pulling apart appliances such as Hi-Fis and putting them back together. I got so good at doing this that, at one stage, was able to put things back together with only a small handful of screws and parts left over.

But there was a very definite gap between what I wanted to do and what I could actually do with my limited knowledge. Child-oriented electronics kits were pretty useless too, as they would help you make one or two very specific projects, but didn't equip you for anything beyond that.

Jump forward to today, and finally there is something to bridge that gap. For me, that is the Netduino. The Netduino (and other development boards like it) allows everyone from a hobbyist to an electronic engineer to build pretty much anything, and removes all the complexities that were holding us back before. You get all of the power, and a lot less of the frustration.

This book will guide even a novice .NET developer through a range of projects specifically chosen to cover all the fundamentals of the platform. With the knowledge gained from these projects, you will be able to build a massive range of gadgets—only limited by what you can think up, not just by the index page of this book. It will even give you a jumpstart into developing apps for the AGENT smartwatch, which is a watch running the .NET Micro Framework, developed by the team that made the Netduino.

When you've completed the book, head on over to <http://blog.roguecode.co.za>, where I regularly blog about more advanced topics usually related to Netduino and Windows Phone.

With the rise of electronic development boards, 3D printing, homemade laser cutters, and much more, being a maker is cool now. So go forth and conquer.

What this book covers

Chapter 1, Getting Started with Your New Toy, explains installing the software to use your Netduino, getting it connected, and making sure it is updated.

Chapter 2, Lights, Camera, Action – Sound-controlled Ambient LEDs, explains controlling ambient light intensity with sound, making movie time that bit more awesome.

Chapter 3, Get Connected – Bluetooth Basics, explains how to connect your mobile phone to your Netduino to control your projects.

Chapter 4, Let There Be Light, by Clapping or Tapping, explains turning lights (and other appliances) on and off by using sound.

Chapter 5, Honey, I'm Home – Automated Garage Doors with Your Mobile Phone, explains how to open and close your garage doors using your mobile phone over Bluetooth.

Chapter 6, You've Got Mail, and Here's a Flag to Prove It, explains how to get your Netduino to raise a flag when you have a new e-mail – and display a preview on a screen.

Chapter 7, I'm Completely Dude, Sober – a Homemade Breathalyzer, explains how to make a breathalyzer at home.

Chapter 8, Hide Yo' Kids, Hide Yo' Wife – with Automated Locks, explains how to use a keypad and pin to lock/unlock your doors.

Chapter 9, Rogue Alert – Detect Intruders in Your House or Fridge, explains how to make your Netduino e-mail you when motion is detected in your house, fridge, or cupboards, and when doors are opened, or a tripwire is tripped.

Chapter 10, Saving Lives – Automated Watering, covers automatically watering your plants or filling up your pets' water bowls when the soil becomes dry or their water gets low.

What you need for this book

The following hardware and software is required to follow the examples given in the book:

- Visual C# Express 2010 or Visual Studio 2010 or above
- .NET Micro Framework SDK Version 4.2
- Netduino SDK Version 4.2.2.0

Who this book is for

This book is ideally suited for a lazy person who has some experience in C#, and has used a Netduino before but wants to explore more advanced topics. However, the book starts from the very basics so can be picked up even by novices.

Conventions


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



Code words in text are shown as follows: "Now add `using Toolbox.NETMF.NET;` to the top of Program.cs."

A block of code is set as follows:

```
private static void btn_OnInterrupt(uint data1, uint data2,
    DateTime time) {
    HandlePress('*');
}
```

New terms and **important words** are shown in bold. Words that you see on the screen, in menus or dialog boxes, for example, appear in the text like this: "Open up Visual Studio and create a new **Netduino Plus 2 Application**."

 Warnings or important notes appear in a box like this. 

 Tips and tricks appear like this. 

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1

Getting Started with Your New Toy

Congratulations on becoming the proud new owner of a shiny little Netduino Plus 2! But before devising a plan to take over the world, you will probably want to get it plugged in and updated. Keeping both the Netduino firmware and the software on your PC updated is paramount to world domination.

In this chapter we will cover:

- How and what software to install to be able to write programs for the Netduino
- Getting your Netduino's firmware up-to-date
- Writing your first Netduino program

To find each of the files required, navigate to <http://bit.ly/LazyDownloads>. You should install everything in the order laid out in the following sections or the world may potentially end.



This book uses the latest versions available at the time of writing. This means that, by the time you read this, there could be a newer update. You can keep the software up-to-date with the latest betas by heading over to the Netduino forums (<http://forums.netduino.com/>) and visiting the **General Discussion** section. Alternatively, if you prefer to use only final (nonbeta) software, then you should get your software from <http://bit.ly/LazyNetduinoDownloads>.

Prerequisites

While it is possible to develop for the Netduino on OSX and Linux, in this book we only cover Windows. In terms of hardware, most of the projects can be done on any Netduino model, but we will be focusing on the Netduino Plus 2 because it is the latest and greatest version.

Visual Studio

To write all the code, we will be using C# with Visual Studio as the IDE. If you've never used Visual Studio before, no problem, it's very simple and powerful. But best of all, the Express edition is free (free as in beer)! You can use either Visual C# 2010, or Visual Studio 2012 Express for Windows Desktop. We will be using the latter, which requires Windows 7 or above.

Download the ~600 MB `.iso` file (or the install package). If you have downloaded the `.iso` file, then right-click on the file and click on **Mount**. A window will pop up showing the contents of the disc image. Run the `wdexpress_full.exe` file.

After the installation is done, you can launch it. You will be prompted to enter a serial key, which you can get for free by registering, or you can use it without a serial key for 30 days.


The .NETMF SDK and the Netduino SDK

To develop using Netduino, you will need both the **.NET Micro Framework SDK** and the **Netduino SDK** installed. The former is an open source framework which is a subset of .NET developed by Microsoft to make it easier to write code for low-powered embedded devices. The Netduino SDK is built on top of that to add Netduino-specific functionality and helper functions. Follow these steps to install the required software:

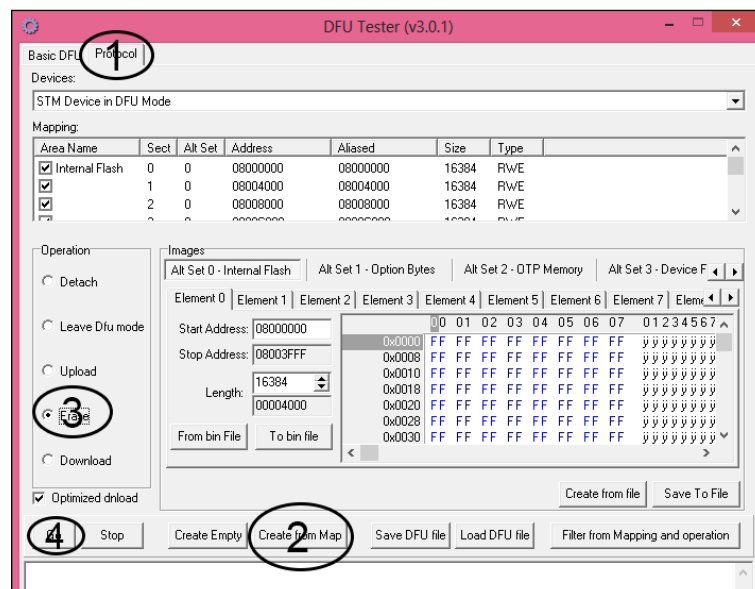
1. Download the ~20 MB .NET Micro Framework SDK and install it. Select the **Complete** option when prompted.
2. Download the ~10 MB Netduino SDK and install it. Accept the permission prompts.
3. Once all are successfully installed, it's usually a good idea to restart Windows.
4. You can now plug in the Netduino with the supplied USB cable! The first time you do this, Windows will install drivers for it automatically.

The Netduino firmware

The final step before being able to use your Netduino is to update its firmware. Currently, this latest firmware is beta (v4.3.0.0 beta 1), but should be final soon. Although you don't have to update it, it is recommended that you do. Whether you use the beta firmware, or the final version, the following steps will show you how to get it onto the Netduino:

 The following steps are an expansion of the ones over on the Netduino Forums: <http://bit.ly/LazyBetaFirmware>

1. You need to get the Netduino into the bootloader mode. So with it unplugged, press and hold the push button (this is located just below the **netduino plus 2** text seen on the board), then plug in the USB cable to your computer. There should now be two lights glowing on the Netduino, one white and one blue. You can release the button once it is plugged in.
2. Download and install STDFU Tester v3.0.1 from <http://bit.ly/LazyDFUSE> and launch the application from your start menu.
3. Follow these steps to first erase the current firmware:
 1. Click on the **Protocol** tab near the top.
 2. Click on the **Create from Map** button near the bottom.
 3. Check the **Erase** radio button on the left.
 4. Finally, click on the **Go** button at the bottom left.



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