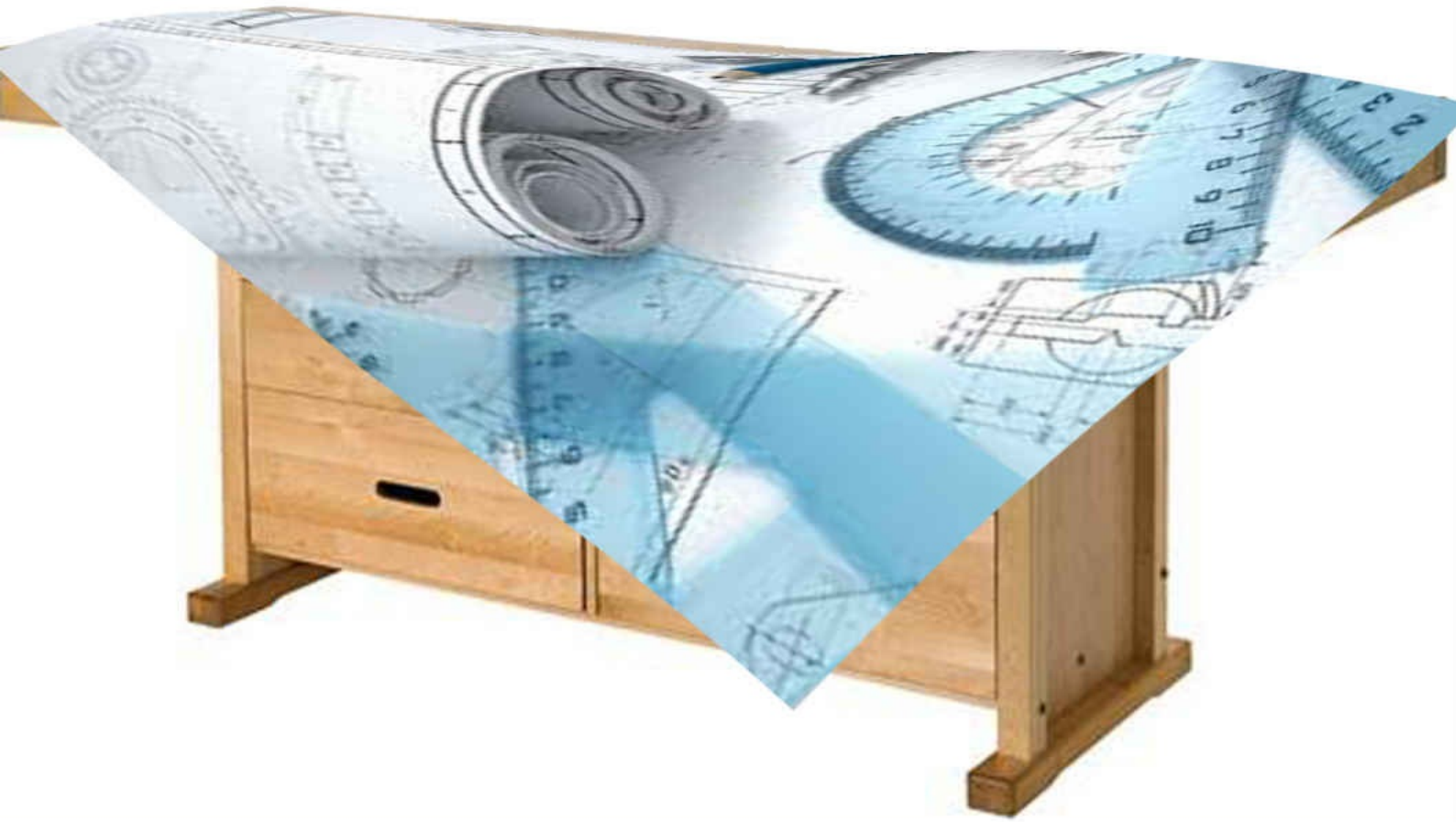
20 Projects For Your Raspberry Pi 3



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Chapter 1: Getting Started

The Raspberry Pi was released in 2012 for the purpose of education, and the creators' goal was to teach people, especially kids, coding. The Raspberry Pi took the hobbyist market by storm. Fastforward to today and it's as big as ever with the Raspberry Pi 3 being released to celebrate the Pi's 4th birthday.

The average Pi user constantly looks for new projects to complete with their credit card sized computer, and this book's purpose is to help them. This book provides the reader with many projects ranging from creating an LED lamp to creating a smartv, and will hopefully inspire users to find and make new projects.

Setting Up Your RPI

Those readers who know how to set up their Raspberry Pi can skip to the next chapter. This chapter is meant to help the person who has yet to get their Pi or has it and does not know how to set it up.

Step 1: Install NOOBS

What is NOOBS? It stands for "New Out Of the Box Software," and it is an operating system installer. As the name implies, it helps new users install the operating system(OS) for the Raspberry Pi called Raspian.

You can buy an SD card with NOOBS pre-installed. If you are unsure that you can set up an SD card with NOOBS on it by yourself, then buying a pre-installed NOOBS card is recommended.

You can also manually install an SD card with NOOBS. The most important detail about your SD card will be its memory capacity, so make sure you have an 8 GB or more SD card.

1. Download NOOBS and extract the files from the zip file.
2. Format your SD card. There are several programs that you can use to do this.

3. Transfer the extracted NOOBS files to the newly formatted SD card.
4. Remove the SD card from the computer and put it into the Raspberry Pi.

Step 2: Booting Up

1. Plug in your keyboard, mouse, and the cables that lead to your monitor.
2. Plug in the Raspberry Pi's power cable. This will boot up your Pi.
3. Your Pi should display a window with many OSs on it. Choose Raspian and click the "Install".
4. Be patient. Raspian is installing.
5. Once installation is complete, the configuration menu should pop up. You can set your time, day, enable a camera, or make user accounts.
6. When done hit the tab button and go to "Finish"

Step 3: Log in

1. Enter the username as "pi" and the password as "raspberry". This is the default log in information.

Congratulations, you're finished setting up your Raspberry Pi!

Understanding APT

APT, or Advanced Packaging Tool, helps you install, upgrade, and remove software. You need to be in “sudoers” or logged in as “root” to perform installations or removals.

Before anything else update by using the following command line:

sudo apt-get update

If you want to download software, then you put in the following command line:

sudo apt-get install [insert program name]

The window will then find the program and show you details concerning the program such as how much memory it will use and if there are any other software that needs to be installed with the primary software. A software that needs to be downloaded with the primary software is called a “dependency.” It will also ask if you want to continue and download the program. If you do, then type “y”, and if not, then type “n”.

If you want to remove a piece of software, then you enter the following command line:

sudo apt-get remove [insert program name]

Confirm that you wish to remove the program.

If there is updated versions of software you have simply enter:

sudo apt-get update

Chapter 2: What Is New With The Raspberry Pi 3?

The Raspberry Pi 3 is a leap forward from the Raspberry Pi 2. Its processing speed is 40% - 60% faster than the RPi 2, but the RPi 3 has the same graphics and RAM capabilities as the RPi 2. So, what's in the RPi 3, and what differentiates it from the RPi 2? Let's take a look.

The RPi 3 has:

- SoC BCM2837
- 4 USB Ports
- Quad Cortex A53 @ 1.2 GHz
- 40 GPIO Pins
- 1 GB SDRAM
- 802.11n Wireless LAN
- Bluetooth 4.0
- Broadcom VideoCore IV @ 400 MHz

The RPi 2 has:

- SoC BCM2835
- 4 USB Ports
- Quad-core ARM Cortex-A7 @ .9 GHz
- 40 GPIO Pins
- 1 GB SDRAM
- Broadcom VideoCore IV @ 250 MHz

What's the significance of the differences? The Raspberry Pi 3 can be used as viable

desktop computer thanks to the increase in processing power. The other notable differences are the WiFi and Bluetooth capabilities of the RPi 3. No more need for an Ethernet cable, a wired keyboard, and a wired mouse. The Bluetooth capability also enables a user to connect the RPi 3 with Bluetooth speakers.

Hackaday.com did a great service for the Raspberry Pi community and did benchmark testing for the Raspberry Pi 3. I highly recommend reading the whole article to truly understand the real-world differences between the RPi 2 and 3.

Chapter 3: How To Setup Bluetooth and WiFi

Some users have experienced problems with the RPi3 when attempting to find or use their WiFi and Bluetooth features. This chapter will help the reader with those issues by giving easy fixes, and it will give directions on how to connect a keyboard, a mouse, and a speaker via Bluetooth.

WiFi Issues

The solution here is very simple and easy. The OS is most likely not the latest update, so enter the following command line:

sudo apt-get update

then enter

sudo ap-get dist-upgrade

You can now reboot your RPi, and the WiFi should work.

Bluetooth Issues

The solution for this is generally simple and easy as well. If you have troubles after entering this step, then you'll need to search for a specific fix. Enter these command lines:

sudo apt-get install pi-bluetooth

then

sudo apt-get install bluetooth bluez blueman

You can now reboot your RPi. The Bluetooth should work.

Connecting A Keyboard, Mouse, and Speaker

Steps For Connecting A Keyboard

1. Press “Set Up New Device” after you right-click the Bluetooth symbol.
2. Hit “Next”.
3. Look at your keyboard manual and enter the combination to make it discoverable.
4. You will need to make a passkey. This number will help you confirm that the keyboard is the correct keyboard.
5. Hit “OK”.
6. There will be a prompt that asks for the passkey. Enter the passkey.
7. Your keyboard is now setup.

Steps For Connecting A Mouse

1. Press “Set Up New Device” after you right-click the Bluetooth symbol.
2. Hit “Next”.
3. Look at your keyboard manual and enter the combination to make it discoverable.
4. You will need to make a passkey. A company will generally have a passkey already made for the mouse.This number will help you confirm that the keyboard is the correct keyboard.
5. Hit “OK”.
6. There will be a prompt that asks for the passkey. Enter the passkey.
7. Your mouse is now setup.

Steps For Connecting A Speaker

1. Turn on the Discovery Mode for the Bluetooth speakers
2. Run the following command line:
   $ *bluetoothctl*
3. Run the following command line:
   power on
4. Run the following command line:
   agent on
5. Run the following command line:
   scan on
6. Once the device is found, run the following command line:
   pair [MAC address]
7. Run the following command line:
   trust [MAC address]

8. Run the following command line:
   connect [MAC address]
9. Your Bluetooth speaker is now connected.

Chapter 4: 20 Projects

There are countless projects for the Raspberry Pi user to entertain themselves with, and it can become hard to pick which project to do next because it is information overload. This chapter fixes this issue by giving the reader 20 projects to do with their RPi 3. Some deal with hardware, and some deal with software. Any user should be able to find a project in here that they will enjoy.

1. Heat Sink

The RPi 3 can run hotter than the RPi 2, and with this in mind one might wish to put a heat sink on their RPi 3 for protection. Installation of a heat sink is fairly easy, so this is a really easy project. This might seem like an insignificant project, but protecting the RPi is every users #1 concern. If increased temperatures weren't an issue for the RPi 3, then this wouldn't be a project, let alone #1.

2. Overclock

If you want to overclock your RPi 3, then you should put heat sinks on your RPi since it will run hotter than normal. Additionally, as of me writing this, no official support for overclocking the RPi 3 exist.

The author does not feel comfortable overclocking any of his computers, so he has not done this. Many readers will want to do this, so I added this to the projects list. There are two great sources for information on overclocking your RPi 3.

Notice: The author of the blog post linked only succeeded at overclocking one of his two RPi 3s. The second RPi 3 became unstable once it hit a high temperature even though it had heat sinks. You should only overclock your RPi 3 if you are comfortable doing it.

3. Download Games

Many users play games on their RPi, despite the graphics limitations on the computer. You can download emulators, but you can also download games without emulators.

Downloading games is exactly like downloading software, which is explained in an earlier chapter. A person needs to know what the name of a game is before they can download the software. If you have Raspian, then simply go to the Raspian game repository and find the name of the game you wish to play.

While doing anything can seem daunting to a beginner, especially using command lines, downloading games is an easy process.

Make sure that you have the latest version of Raspian:

sudo apt-get update

Once you find the name simply put in the command line:

sudo apt-get install [game name]

4. Download Alternative Operating Systems

Downloading an OS is easy as well. The process of downloading an OS has already been laid out in “Getting Started.”

A reader can find alternative OSs on the Raspberry Pi site, and by a simple Google search. OSs like Ubuntu can be found on the former, and OSs like Chromium. While some OSs are user friendly to new users, some OSs are meant for more advanced users.

5. LED Lamp

This is project that is fun and fairly simple. It involves hardware and software, so make sure you have the following materials:

- Your Pi
- An SD card with more than 4 GB
- A Power Adapter
- LED Strip
- Wires
- Lamp Shade

The full, short write-up on this project can be found on this blog post. It is technical, and the creator of this project deserves the credit and hits. It is a project that the author

looks forward to completing in the future.

6. Eddystone URL Beacon

For any reader wondering, “what is an Eddystone URL Beacon,” it is a device that sends out a Bluetooth signal to other devices, such as cell phones, for the purpose of sharing links. Suppose you want to share a link with your friends at a party, your URL beacon can transmit that specific link to every person within its range. This is much easier than getting everybody to correctly type in the URL itself.

The most difficult step of this project is finding your IP address for the RPi, and luckily there is a way to find it. The user must also enter a special code to send out the URL they want broadcasted.

The creator of this project not only provides all steps necessary, but also provides a link where a user can easily get the code needed to send out a specific URL.

7. Alexa

This device will be similar to Amazon’s Echo which has voice-recognition and includes a program named Alexa. Alexa is like Siri and Cortana. This is a low-cost, DIY Echo but without the voice-recognition. RPi users will be required to press a button on the microphone before speaking to the device. This hinders its ability greatly, but still could be a fun and useful project.

Amazon has written an extensive Github post on how to make the low-budget Echo on GitHub. They include tons of links to the products needed for this project, so gathering the materials will not be hard. Additionally, here is the product list for this project:

- Raspberry Pi 2 or 3
- Power Cable
- SD Card
- Ethernet Cable
- USB Keyboard & Mouse
- HDMI Monitor

- WiFi Wireless Adapter

A user should be able to simply use WiFi built into the RPi3, a Bluetooth Keyboard, and a Bluetooth mouse instead of an ethernet cable, a wired keyboard, and a wired mouse.

8. Digital Picture Frame

Have you ever walked into a home with a digital picture frame? This project will turn your computer into something cooler: a digital picture frame that doubles as a computer! All-in-all this will cost more than $100, but it will look great and you could show off your RPi 3 to your friends.

If you are not comfortable with dealing with hardware, then you should either skip this project or try it and learn from your mistakes. With that said, this can be a fun project for any Raspberry Pi user with a little time on their hands.

9. Supercomputer

This project is at the least novel. Who doesn't want a supercomputer in their room?

Many sites have covered how to build a supercomputer using Raspberry Pi systems, and now the supercomputer will be even more powerful thanks to the increased capabilities of the Raspberry Pi 3.

The difficulty of this project might prove to be too much for some users, so make sure you know what you are doing before you approach #9.

While this project excluded some users the next one will be much easier and very useful.

10. Rune Audio

Rune Audio is software that turns your Raspberry Pi into a HiFi device. You can wirelessly pair it with your phone, a tablet, or use other devices such as a USB drive so you can listen to high-quality music.

It is a great project that is of great use for those who love listening to music. Whether it be at your desk or in the kitchen, play high-quality music that you enjoy.

This might seem daunting to some, but it is simpler than the supercomputer. It will definitely provide more satisfaction for most people than the supercomputer as well.

11. RetroPie

The RetroPie is one of the best programs for a RPi, and, thankfully, the creators recently released a version for the Raspberry Pi 3!

You can play a variety of games on different console emulators with the RetroPie. For example, you could play on the NES and in the next minute be playing a Game Boy Color. You can find all you need on Github.

Furthermore, some of the game systems will not come up as an option until you download their ROMs.

Additionally, the Bluetooth capabilities in the RPi 3 also allow you to use wireless controllers, which is much better than having to deal with those pesky wires.

There are also unofficial scripts that will let you get more games for the RetroPie.

Caution: If you build this, then hours of your life might disappear from playing nostalgic games.

12. WiFi Access Point

Increasing a wifi signal or filtering what data comes in via the Internet would be a huge benefit to many, and with this project it can be realized. If this project is completed, then you would be able to use your laptop across the house or add a firewall to protect you and your devices.

While this project requires a good amount of configuration, it is an easy setup since the

walk-throughs have step-by-step and precise directions, so do not be intimidated by the amount of command lines needed to be entered.

13. Time Machine

This time machine won't send you back or forwards into time, but it will backup and preserve your data on your Mac. Time Machine takes little time to setup and is very easy to do.

Backing up data is extremely important if you have files you cannot or do not wish to lose. While you can buy a device that backs up data for you, it wouldn't be as fun as making one yourself.

14. SmartTv

This bulld will turn any "dumb" TV you have into a smart TV, with the help of the software "Kodi." This is a great alternative to buying a whole new TV.

This project does not take too long, and most of the time spent on this project is waiting for Kodi to install. It is a short and simple setup that is quite rewarding.

15. Minecraft

The game loved by countless people is one of the many games that is able to be downloaded on the Raspberry Pi. This is a treat considering how a game with such a nice environment can be played on the RPi.

Moreover, Minecraft might not play at a preferable framerate, but there is a way to increase the framerate. A user must download Optifine; the software that increases the efficiency of how Minecraft runs.

16. LibreOffice

This software is an open source version of Word, et al. If you want to have a Raspberry Pi that can be more of a desktop computer, then this program is a must if you do any writing, etc.

The setup is easy since all you do is download the software like you would a game.

17. RPi Cases

The Raspberry Pi 3 is just a circuit board exposed to the environment, and it might be hit against objects like tables. A user should protect their RPi and put it in a case.

There are several types of cases from ones you can buy to DIY cases. No matter which one you decide to buy, you should make sure that the RPi doesn't get too hot in it and that it is secure inside the case.

18. Add More USB Ports

While 4 USB ports might be perfectly fine for many users, the small amount could be a limitation for others. There is a simple way to add more ports to an RPi: buy a powered USB port hub.

This will be a great accessory if a user has to connect their keyboard and mouse via a wire.

19. Camera

Adding a camera will give you a variety of new options as to what you can do with your RPi 3, and it is simple to attach and configure.

Once you attach the camera run the following command line:

raspi-config

then select "Enable camera," hit Enter, go to "Finish," and reboot.

20. Skype

Thankfully, somebody has created a Skype program that will run on the RPi, video calls and all. This is all possible because of the ExaGear Desktop that emulates x86 apps.

This really solidifies the RPi 3 as a desktop computer.

Extra Projects

There are many other projects for Raspberry Pi 3 users to complete, but they cannot all be fit in this book. Here are 3 extra projects that are honorable mentions:

1. Super Pi Boy
2. Minecraft Kit
3. Wordclock