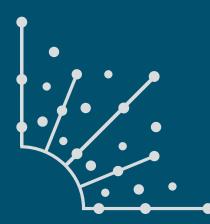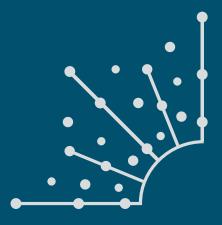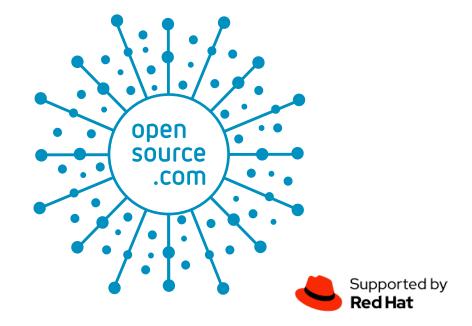# Raspberry Pi:
How to get started

What is Opensource.com?

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ANDERSON SILVA

ANDERSON SILVA GREW UP IN BRAZIL, and wrote his first program at the age of 10 using Logo. He moved on to programming in BASIC shortly thereafter, and by the time he was in High School he was coding in Pascal. When he started college in the US, he learned C, C++, Java and had several developer jobs programming with server-side languages for web development like: Coldfusion, Perl, Php, etc. He was introduced to Linux by his uncle back in 1996. In the early 2000s Anderson transitioned from being a developer to more of a system administrator/release engineer. In 2007, one of his

professional goals was achieved when he joined Red Hat as a Release Engineer in IT. Since then he has worked in several roles at Red Hat in both IT Operations, Engineering and Infosec. He has an RHCE and RHCA and is an active Fedora package maintainer.
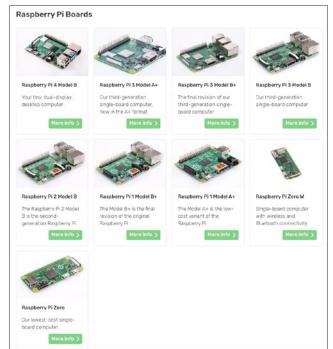
CONTENTS ··

CHAPTERS

Which Raspberry Pi
should you choose?

In the first chapter in our guide on getting started with Raspberry Pi, learn the three criteria for choosing the right model for you.

THIS IS THE FIRST CHAPTER in a guide on getting started with the Raspberry Pi [1]. Although the guide is geared towards people who have never used a Raspberry Pi or Linux or programming, there will definitely be things for more experienced readers—and I encourage those readers to leave comments and tips that build on what I write. If everyone contributes, we can make this guide even more useful for beginners, other experienced readers, and even me!
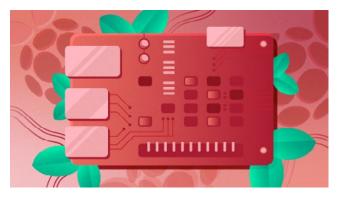
So, you want to give the Raspberry Pi a shot, but you don't know which model to buy. Maybe you want one for your classroom or your kid, but there are so many options, and you aren't sure which one is right for you.

Raspberry Pi boards—https://www.raspberrypi.org/products/

My three main criteria for choosing a new Raspberry Pi are:

- **Cost:** Don't just consider the cost of the Raspberry Pi board, but also factor the peripherals you will need in order to use it. In the US, the Raspberry Pi's cost varies from $5 (for the Raspberry Pi Zero) to $35 (for the Raspberry Pi 3 B and 3 B+). However, if you pick the Zero you will probably also need a USB hub for your mouse and keyboard, possibly a wireless adapter, and some sort of display adapter. Unless you have most (if not all) of the peripherals needed for whatever you want to do with your Raspberry Pi, make sure to add those to your Pi budget. Also, in some countries, a Raspberry Pi on its own (even without any peripherals) may be a cost burden for many students and teachers.

- **Availability:** Finding the Raspberry Pi you want can vary depending on your location, as it may be easier (or harder) to get certain versions in some countries. Availability is an even bigger issue after new models are released, and it can take a few days or even weeks for new versions to become available in your market.

- **Purpose:** Location and cost may not affect everyone, but every buyer must consider why they want a Raspberry Pi. The eight different models vary in RAM, CPU core, CPU speed, physical size, network connectivity, peripheral expansion, etc. For example, if you want the most robust solution with more "horsepower," you probably will want the Raspberry Pi 3 B+, which has the most RAM, fastest CPU, and largest number of cores. If you want something that won't require network connectivity, won't be used for CPU-intensive work, and can be hidden in a small space, you could go with a Raspberry Pi Zero.

Wikipedia's Raspberry Pi specs chart [2] is an easy way to compare the eight Raspberry Pis models.

Now that you know what to look for in a Raspberry Pi, in the next chapter, I will explain how to buy one.

Links

[1] https://www.raspberrypi.org/
[2] https://en.wikipedia.org/wiki/Raspberry_Pi#Specifications

How to buy a Raspberry Pi

Find out the best ways to get a Raspberry Pi in the second chapter in our getting started guide.

THE FIRST CHAPTER IN THIS GUIDE on getting started with Raspberry Pi offered some advice on which model you should buy [1]. Now that you have an idea of which version you want, let's find out how to get one.

The most obvious—and probably the safest and simplest—way is through the official Raspberry Pi website [2]. If you click on "Buy a Raspberry Pi" from the homepage, you'll be taken to the organization's online store [3], where you can find authorized Raspberry Pi sellers in your country where you can place an order. If your country isn't listed, there is a "Rest of the World" option, which should let you put in an international order.

Second, check Amazon.com or another major online technology retailer in your country that allows smaller shops to sell new and used items. Given the relatively low cost and size of the Raspberry Pi, it should be fairly easy for smaller shop owners to import and export the boards for reselling purposes. Before you place an order, keep an eye on the sellers' reviews though.

Third, ask your geek friends! You never know if someone has an unused Raspberry Pi gathering dust. I have given at least three Raspberry Pis away to family, not as planned gifts, but because they were just so curious about this mini-computer. I had so many lying around that I just told them to keep one!

Don't forget the extras

One final thought: don't forget that you'll need some peripherals to set up and operate your Raspberry Pi. At a minimum, you'll need a keyboard, an HDMI cable to connect to a display (and a display), a Micro SD card to install the operating system, a power cord, and a mouse will be handy, too.

If you don't already have these items, try borrowing them from friends or order them at the same time you buy your Raspberry Pi. You may want to consider one of the starter kits available from the authorized Raspberry Pi vendors—that will avoid the hassle of searching for parts one at a time.

Now that you have a Raspberry Pi, in the next chapter in this guide, we'll install the operating system and start using it.

Links

[1]   https://opensource.com/article/19/2/which-raspberry-pi-should-you-get

[2]   https://www.raspberrypi.org/

[3]   https://www.raspberrypi.org/products/

Raspberry Pi Zero W Starter Kit

V-Kits Raspberry Pi 3 B+ Starter Kit

How to boot up a new Raspberry Pi

Learn how to install a Linux operating system, in the third chapter in our guide to getting started with Raspberry Pi.

IF YOU'VE BEEN FOLLOWING along in this guide, you've chosen [1] and bought [2] your Raspberry Pi board and peripherals and now you're ready to start using it. Here, in the third chapter, let's look at what you need to do to boot it up.
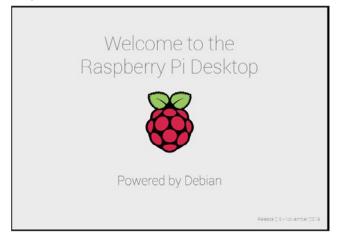
Unlike your laptop, desktop, smartphone, or tablet, the Raspberry Pi doesn't come with built-in storage. Instead, it uses a Micro SD card to store the operating system and your files. The great thing about this is it gives you the flexibility to carry your files (even if you don't have your Raspberry Pi with you). The downside is it may also increase the risk of losing or damaging the card—and thus losing your files. Just protect your Micro SD card, and you should be fine.

You should also know that SD cards aren't as fast as mechanical or solid state drives, so booting, reading, and writing from your Pi will not be as speedy as you would expect from other devices.

How to install Raspbian

The first thing you need to do when you get a new Raspberry Pi is to install its operating system on a Micro SD card. Even though there are other operating systems (both Linux- and non-Linux-based) available for the Raspberry Pi, this guide focuses on Raspbian [3], Raspberry Pi's official Linux version.

Raspian boot screen

The easiest way to install Raspbian is with NOOBS [4], which stands for "New Out Of Box Software." Raspberry Pi offers great documentation for NOOBS [5], so I won't repeat the installation instructions here.

NOOBS gives you the choice of installing the following operating systems:

- Raspbian [6]
- LibreELEC [7]
- OSMC [8]
- Recalbox [9]
- Lakka [10]
- RISC OS [11]
- Screenly OSE [12]
- Windows 10 IoT Core [13]
- TLXOS [14]

Again, Raspbian is the operating system we'll use in this guide, so go ahead, grab your Micro SD and follow the NOOBS documentation to install it. I'll meet you in the fourth chapter in this guide, where we'll look at how to use Linux, including some of the main commands you'll need to know.

Links

[1] https://opensource.com/article/19/3/which-raspberry-pi-choose
[2] https://opensource.com/article/19/2/how-buy-raspberry-pi
[3] https://www.raspbian.org/RaspbianFAQ
[4] https://www.raspberrypi.org/downloads/noobs/
[5] https://www.raspberrypi.org/documentation/installation/noobs.md
[6] http://raspbian.org/
[7] https://libreelec.tv/
[8] https://osmc.tv/
[9] https://www.recalbox.com/
[10] http://www.lakka.tv/
[11] https://www.riscosopen.org/wiki/documentation/show/Welcome%20to%20RISC%20OS%20Pi
[12] https://www.screenly.io/ose/
[13] https://developer.microsoft.com/en-us/windows/iot
[14] https://thinlinx.com/

Learn Linux with the Raspberry Pi

The fourth chapter in our guide to getting started with the Raspberry Pi dives into the Linux command line.
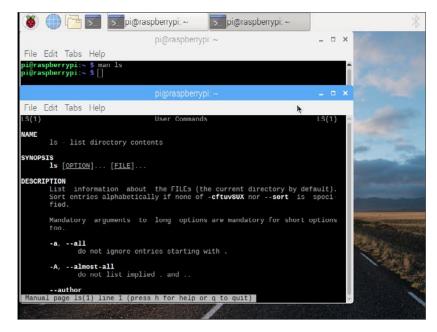
IN THE THIRD CHAPTER in this guide on getting started with Raspberry Pi, I shared info on installing Raspbian, the official version of Linux for Raspberry Pi. Now that you've installed Raspbian and booted up your new Pi, you're ready to start learning about Linux.

It's impossible to tackle a topic as big as "how to use Linux" in a short chapter like this, so instead I'll give you some ideas about how you can use the Raspberry Pi to learn more about Linux in general.

Start by spending time on the command line (aka the "terminal"). Linux window managers [1] and graphical interfaces have come a long way since the mid-'90s. Nowadays you can use Linux by pointing-and-clicking on things, just as easily as you can in *other* operating systems. In my opinion, there is a difference between just "using Linux" and being "a Linux user," and the latter means at a minimum being able to navigate in the terminal.

If you want to become a Linux *user*, start by trying out the following on the command line:

- Navigate your home directory with commands like **ls**, **cd**, and **pwd**.
- Create, delete, and rename directories using the **mkdir**, **rm**, **mv**, and **cp** commands.
- Create a text file with a command line editor such as Vi, Vim, Emacs, or Nano.
- Try out some other useful commands, such as **chmod**, **chown**, **w**, **cat**, **more**, **less**, **tail**, **free**, **df**, **ps**, **uname**, and **kill**
- Look around **/bin** and **/usr/bin** for other commands.

The best way to get help with a command is by reading its "man page" (short for manual); type **man <command>** on the command line to pull it up. And make sure to search the internet for Linux command cheat sheets—you should find a lot of options that will help you learn.

Raspbian, like most Linux distributions, has many commands and over time you will end up using some commands a lot more than others. I've been using Linux on the command line for over two decades, and there are still some commands that I've never used, even ones that have been around as long as I've been using Linux.

At the end of the day, you can use your graphical interface environment to get work done faster, but make sure to dive into the Linux command line, for that's where you will get the true power and knowledge of the operating system.

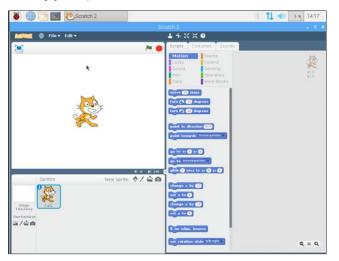Links

[1] https://opensource.com/article/18/8/window-manager

5 ways to teach kids to program with Raspberry Pi

The fifth chapter in our guide to getting started with the Raspberry Pi explores resources for helping kids learn to program.

AS COUNTLESS SCHOOLS, libraries, and families have proven, the Raspberry Pi is a great way to expose kids to programming. In the first four chapters in this guide, you've learned about purchasing [1], installing [2], and configuring [3] a Raspberry Pi. In this fifth chapter, I'll share some helpful resources to get kids started programming with the Raspberry Pi.

Scratch

Scratch [4] is a great way to introduce kids to basic programming concepts like variables, boolean logic, loops, and more. It's included in Raspbian, and you can find numerous articles and tutorials about Scratch on the internet, including Is Scratch today like the Logo of the '80s for teaching kids to code? [5] on Opensource.com.

Code.org

Code.org [6] is another great online resource for kids learning to program. The organization's mission is to expose more people to coding through courses, tutorials, and the popular Hour of Code event. Many schools—including my fifth-grade son's—use it to expose more kids to programming and computer science concepts.

Reading

Reading books is another great way to learn how to program. You don't necessarily need to speak English to learn how to program, but the more you know, the easier it will be, as most programming languages use English keywords to describe the commands. If your English is good enough to follow this Raspberry Pi guide, you are most likely well-equipped to read books, forums, and other publications about programming. One book I recommend is *Python for Kids: A Playful Introduction to Programming* [7] by Jason Biggs.

Raspberry Jam

Another way to get your kids into programming is by helping them interact with others at meetups. The Raspberry Pi Foundation sponsors events called Raspberry Jams [8] around the world where kids and adults can join forces and learn together on the Raspberry Pi. If there isn't a Raspberry Jam in your area, the foundation has a guidebook [9] and other resources to help you start one.

Gaming

Last, but not least, there's a version of Minecraft [10] for the Raspberry Pi. Minecraft has grown from a multi-player "digital Lego"-like game into a programming platform where anyone can use Python and other languages to build on Minecraft's virtual world. Check out Getting Started with Minecraft Pi [11] and Minecraft Hour of Code Tutorials [12].

Links

[1] https://opensource.com/article/19/2/how-buy-raspberry-pi
[2] https://opensource.com/article/19/2/how-boot-new-raspberry-pi
[3] https://opensource.com/article/19/3/learn-linux-raspberry-pi
[4] https://scratch.mit.edu/
[5] https://opensource.com/article/17/3/logo-scratch-teach-programming-kids
[6] https://code.org/
[7] https://www.amazon.com/Python-Kids-Playful-Introduction-Programming/dp/1593274076
[8] https://www.raspberrypi.org/jam/#map-section
[9] https://static.raspberrypi.org/files/jam/Raspberry-Jam-Guidebook-2017-04-26.pdf
[10] https://minecraft.net/en-us/edition/pi/
[11] https://projects.raspberrypi.org/en/projects/getting-started-with-minecraft-pi
[12] https://code.org/minecraft

3 popular programming languages
you can learn with Raspberry Pi

Become more valuable on the job market by learning to program with the Raspberry Pi.

IN THE LAST CHAPTER in this guide, I shared some ways to teach kids to program with Raspberry Pi [1]. In theory, there is absolutely nothing stopping an adult from using resources designed for kids, but you might be better served by learning the programming languages that are in demand in the job market.

Here are three programming languages you can learn with the Raspberry Pi.

Python

Python [2] has become one of the most popular programming languages [3] in the open source world. Its interpreter has been packaged and made available in every popular Linux distribution. If you install Raspbian on your Raspberry Pi, you will see an app called Thonny [4], which is a Python integrated development environment (IDE) for beginners. In a nutshell, an IDE is an application that provides all you need to get your code executed, often including things like debuggers, documentation, auto-completion, and emulators. Here is a great little tutorial [5] to get you started using Thonny and Python on the Raspberry Pi.

Java

Although arguably not as attractive as it once was, Java [6] remains heavily used in universities around the world and deeply embedded in the enterprise. So, even though some will disagree that I'm recommending it as a beginner's language, I am compelled to do so; for

one thing, it still very popular, and for another, there are a lot of books, classes, and other information available for you to learn Java. Get started on the Raspberry Pi by using the BlueJ [7] Java IDE.

JavaScript

"Back in my day…" JavaScript [8] was a client-side language that basically allowed people to streamline and automate user events in a browser and modify HTML elements. Today, JavaScript has escaped the browser and is available for other types of clients like mobile apps and even server-side programming. Node.js [9] is a popular runtime environment that allows developers to code beyond the client-browser paradigm. To learn more about running Node.js on the Raspberry Pi, check out W3Schools tutorial [10].

Other languages

If there's another language you want to learn, don't despair. There's a high likelihood that you can use your Raspberry Pi to compile or interpret any language of choice, including C, C++, PHP, and Ruby.

Microsoft's Visual Studio Code [11] also runs on the Raspberry Pi [12]. It's an open source code editor from Microsoft that supports several markup and programming languages.

Links
[1] https://opensource.com/article/19/2/teach-kids-program-raspberry-pi
[2] https://opensource.com/resources/python
[3] https://www.economist.com/graphic-detail/2018/07/26/python-is-becoming-the-worlds-most-popular-coding-language
[4] https://thonny.org/
[5] https://raspberrypihq.com/getting-started-with-python-programming-and-the-raspberry-pi/
[6] https://opensource.com/resources/java
[7] https://www.bluej.org/raspberrypi/
[8] https://developer.mozilla.org/en-US/docs/Web/JavaScript
[9] https://nodejs.org/en/
[10] https://www.w3schools.com/nodejs/nodejs_raspberrypi.asp
[11] https://code.visualstudio.com/
[12] https://pimylifeup.com/raspberry-pi-visual-studio-code/

How to keep your
Raspberry Pi updated

Learn how to keep your Raspberry Pi patched and working well in the seventh chapter in our guide to getting started with the Raspberry Pi.

JUST LIKE YOUR TABLET, CELLPHONE, AND LAPTOP, you need to keep your Raspberry Pi updated. Not only will the latest enhancements keep your Pi running smoothly, they will also keep you safer, especially if you are connected to a network. The seventh chapter in our guide to getting started with the Raspberry Pi shares two pieces of advice on keeping your Pi working well.

Update Raspbian

Updating your Raspbian installation is a two-step process [1]:
   In your terminal type: **sudo apt-get update**
1. The command **sudo** allows you to run **apt-get update** as admin (aka root). Note that **apt-get update** will not install anything new on your system; rather it will update the list of packages and dependencies that need to be updated.
2. Then type: **sudo apt-get dist-upgrade**
   From the documentation: "Generally speaking, doing this regularly will keep your installation up to date, in

that it will be equivalent to the latest released image available from raspberrypi.org/downloads." [2]

Be careful with rpi-update

Raspbian comes with another little update utility called rpi-update [3]. This utility can be used to upgrade your Pi to the latest firmware which may or may not be broken/buggy. You may find information explaining how to use it, but as of late it is recommended never to use this application unless you have a really good reason to do so.
   Bottom line: Keep your systems updated!

Links

[1] https://www.raspberrypi.org/documentation/raspbian/updating.md

[2] https://www.raspberrypi.org/downloads/

[3] https://github.com/Hexxeh/rpi-update

How to use your Raspberry Pi
for entertainment

Learn how to watch Netflix and listen to music on your Raspberry Pi, in the eighth chapter in our guide to getting started with Raspberry Pi.

SO FAR, THIS GUIDE has focused on more serious topics—how to choose [1], buy [2], set up [3], and update [4] your Raspberry Pi, and different things kids [5] and adults [6] can learn with it (including Linux [7]). But now it's time to change up the subject and have some fun! In this chapter, we'll look at ways to use your Raspberry Pi for entertainment, and tomorrow we'll continue the fun with gaming.

Watch TV and movies

You can use your Raspberry Pi and the Open Source Media Center (OSMC) [8] to watch Netflix [9]! The OSMC is a system based on the Kodi [10] project that allows you to play back media from your local network, attached storage, and the internet. It's also known for having the best feature set and community among media center applications.

NOOBS (which we talked about in the third chapter in this guide) allows you to install OSMC [11] on your Raspberry Pi as easily as possible. NOOBS also offers another media center system based on Kodi called LibreELEC [12].

Listen to music

You can also stream music on your network via attached storage or services like Spotify on your Raspberry Pi with the Pi Music Box [13] project. I wrote about it [14] a while ago, but you can find newer instructions, including how to's and DIY projects, on the Pi Music Box website [15].

Links

[1] https://opensource.com/article/19/3/which-raspberry-pi-choose

[2] https://opensource.com/article/19/2/how-buy-raspberry-pi

[3] https://opensource.com/article/19/2/how-boot-new-raspberry-pi

[4] https://opensource.com/article/19/2/how-keep-your-raspberry-pi-updated-and-patched

[5] https://opensource.com/article/19/3/teach-kids-program-raspberry-pi

[6] https://opensource.com/article/19/2/3-popular-programming-languages-you-can-learn-raspberry-pi

[7] https://opensource.com/article/19/2/learn-linux-raspberry-pi

[8] https://osmc.tv/

[9] https://www.dailydot.com/upstream/netflix-raspberry-pi/

[10] http://kodi.tv/

[11] https://www.raspberrypi.org/documentation/usage/kodi/

[12] https://libreelec.tv/

[13] https://github.com/pimusicbox/pimusicbox/tree/master

[14] https://opensource.com/life/15/3/pi-musicbox-guide

[15] https://www.pimusicbox.com/

Emulators and Native Linux games
on the Raspberry Pi

The Raspberry Pi is a great platform for gaming; learn how in the ninth chapter in our guide on getting started with the Raspberry Pi.

BACK IN THE FIFTH CHAPTER in our guide on getting started with the Raspberry Pi, I mentioned Minecraft as a way to teach kids to program using a gaming platform. In this chapter, we'll talk about other ways you can play games on your Raspberry Pi, as it's a great platform for gaming—with and without emulators.

Gaming with emulators

Emulators are software that allow you to play games from different systems and different decades on your Raspberry Pi. Of the many emulators available today, the most popular for the Raspberry Pi is RetroPi [1]. You can use it to play games from systems such as Apple II, Amiga, Atari 2600, Commodore 64, Game Boy Advance, and many others [2].

If RetroPi sounds interesting, check out these instructions [3] on how to get started, and start having fun today!

Native Linux games

There are also plenty of native Linux games available on Raspbian, Raspberry Pi's operating system. Make Use Of has a great article on how to play 10 old favorites [4] like Doom and Nuke Dukem 3D on the Raspberry Pi.

You can also use your Raspberry Pi as a game server [5]. For example, you can set up Terraria, Minecraft, and Quake-World servers on the Raspberry Pi.

Links

[1] https://retropie.org.uk/
[2] https://retropie.org.uk/about/systems
[3] https://opensource.com/article/19/1/retropie
[4] https://www.makeuseof.com/tag/classic-games-raspberry-pi-without-emulators/
[5] https://www.makeuseof.com/tag/raspberry-pi-game-servers/

Let's get physical: How to use GPIO pins on the Raspberry Pi

The 10th chapter in our guide on getting started with Raspberry Pi explains how the GPIO pins work.

UNTIL NOW, THIS GUIDE has focused on the Raspberry Pi's software side, but in this chapter, we'll get into the hardware. The availability of general-purpose input/output (GPIO) [1] pins was one of the main features that interested me in the Pi when it first came out. GPIO allows you to programmatically interact with the physical world by attaching sensors, relays, and other types of circuitry to the Raspberry Pi.

Each pin on the board either has a predefined function or is designated as general purpose. Also, different Raspberry Pi models have either 26 or 40 pins for you to use at your discretion. Wikipedia has a good overview of each pin [2] and its functionality.

You can do many things with the Pi's GPIO pins. I've written some other articles about using the GPIOs, including a trio of articles (Part I [3], Part II [4], and Part III [5]) about controlling holiday lights with the Raspberry Pi while using open source software to pair the lights with music.

The Raspberry Pi community has done a great job in creating libraries in different programming languages, so you should be able to interact with the pins using C [6], Python [7], Scratch [8], and other languages.

Also, if you want the ultimate experience to interact with the physical world, pick up a Raspberry Pi Sense Hat [9]. It is an affordable expansion board for the Pi that plugs into the GPIO pins so you can programmatically interact with LEDs, joysticks, and barometric pressure, temperature, humidity, gyroscope, accelerometer, and magnetometer sensors.

Links

[1] https://www.raspberrypi.org/documentation/usage/gpio/
[2] https://en.wikipedia.org/wiki/Raspberry_Pi#General_purpose_input-output_(GPIO)_connector
[3] https://opensource.com/life/15/2/music-light-show-with-raspberry-pi
[4] https://opensource.com/life/15/12/ssh-your-christmas-tree-raspberry-pi
[5] https://opensource.com/article/18/12/lightshowpi-raspberry-pi
[6] https://www.bigmessowires.com/2018/05/26/raspberry-pi-gpio-programming-in-c/
[7] https://www.raspberrypi.org/documentation/usage/gpio/python/README.md
[8] https://www.raspberrypi.org/documentation/usage/gpio/scratch2/README.md
[9] https://opensource.com/life/16/4/experimenting-raspberry-pi-sense-hat

Learn about computer security
with the Raspberry Pi and Kali Linux

Raspberry Pi is a great way to learn about computer security. Learn how in the 11th chapter in our getting-started guide.

IS THERE A HOTTER TOPIC in technology than securing your computer? Some experts will tell you that there is no such thing as perfect security. They joke that if you want your server or application to be truly secure, then turn off your server, unplug it from the network, and put it in a safe somewhere. The problem with that should be obvious: What good is an app or server that nobody can use?

That's the conundrum around security. How can we make something secure enough and still usable and valuable? I am not a security expert by any means, although I hope to be one day. With that in mind, I thought it would make sense to share some ideas about what you can do with a Raspberry Pi to learn more about security.

I should note that, like the other chapters in this guide dedicated to Raspberry Pi beginners, my goal is not to dive in deep, rather to light a fire of interest for you to learn more about these topics.

Kali Linux

When it comes to "doing security things," one of the Linux distributions that comes to mind is Kali Linux [1]. Kali's development is primarily focused on forensics and penetration testing. It has more than 600 preinstalled penetration-testing programs [2] to test your computer's security, and a forensics mode [3], which prevents it from touching the internal hard drive or swap space of the system being examined.

Like Raspbian, Kali Linux is based on the Debian distribution, and you can find directions on installing it on the Raspberry Pi in its main documentation portal [4]. If you installed Raspbian or another Linux distribution on your Raspberry Pi, you should have no problem installing Kali. Kali Linux's creators have even put together training, workshops, and certifications [5] to help boost your career in the security field.

Other Linux distros

Most standard Linux distributions, like Raspbian, Ubuntu, and Fedora, also have many security tools available [6] in their repositories. Some great tools to explore include Nmap [7], Wireshark [8], auditctl [9], and SELinux [10].

Projects

There are many other security-related projects you can run on your Raspberry Pi, such as Honeypots [11], Ad blockers [12], and USB sanitizers [13]. Take some time and learn about them!

Links

[1]   https://www.kali.org/
[2]   https://en.wikipedia.org/wiki/Kali_Linux#Development
[3]   https://docs.kali.org/general-use/kali-linux-forensics-mode
[4]   https://www.kali.org/docs/arm/kali-linux-raspberry-pi/
[5]   https://www.kali.org/penetration-testing-with-kali-linux/
[6]   https://linuxblog.darkduck.com/2019/02/9-best-linux-based-security-tools.html
[7]   https://nmap.org/
[8]   https://www.wireshark.org/
[9]   https://linux.die.net/man/8/auditctl
[10] https://opensource.com/article/18/7/sysadmin-guide-selinux
[11] https://trustfoundry.net/honeypi-easy-honeypot-raspberry-pi/
[12] https://pi-hole.net/
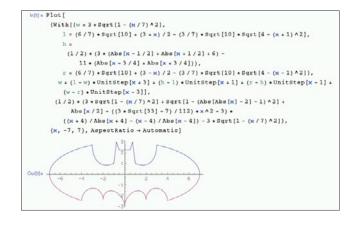[13] https://www.circl.lu/projects/CIRCLean/

Do advanced math with
Mathematica on the Raspberry Pi

Wolfram bundles a version of Mathematica with Raspbian. Learn how to use it in the 12th chapter in our guide on getting started with Raspberry Pi.

IN THE MID-'90S, I started college as a math major, and, even though I graduated with a computer science degree, I had taken enough classes to graduate with a minor—and only two classes short of a double-major—in math. At the time, I was introduced to an application called Mathematica [1] by Wolfram [2], where we would take many of our algebraic and differential equations from the blackboard into the computer. I spent a few hours a month in the lab learning the Wolfram Language and solving integrals and such on Mathematica.

Mathematica was closed source and expensive for a college student, so it was a nice surprise to see almost 20 years later Wolfram bundling a version of Mathematica with Raspbian and the Raspberry Pi. If you decide to use another Debian-based distribution, you can download it [3] on your Pi. Note that this version is free for non-commercial use only.

The Raspberry Pi Foundation's introduction to Mathematica [4] covers some basic concepts such as variables and loops, solving some math problems, creating graphs, doing linear algebra, and even interacting with the GPIO pins through the application.

To dive deeper into Mathematica, check out the Wolfram Language documentation [5]. If you just want to solve some basic calculus problems, check out its functions [6]. And read this tutorial if you want to plot some 2D and 3D graphs [7].

Or, if you want to stick with open source tools while doing math, check out the command-line tools **expr**, **factor**, and **bc**. (Remember to use the **man** command [8] to read up on these utilities.) And if you want to graph something, Gnuplot [9] is a great option.

Links

[1] https://en.wikipedia.org/wiki/Wolfram_Mathematica
[2] https://wolfram.com/
[3] https://www.wolfram.com/raspberry-pi/
[4] https://projects.raspberrypi.org/en/projects/getting-started-with-mathematica/
[5] https://www.wolfram.com/language/
[6] https://reference.wolfram.com/language/guide/Calculus.html
[7] https://reference.wolfram.com/language/howto/PlotAGraph.html
[8] https://opensource.com/article/19/3/learn-linux-raspberry-pi
[9] http://gnuplot.info/

Contribute to the Raspberry Pi community

Find ways to get involved in the Raspberry Pi community in the 13th chapter in our getting-started guide.

THINGS ARE STARTING TO WIND DOWN in this guide, and as much fun as I've had writing it, mostly I hope it has helped someone out there use start using a Raspberry Pi for education or entertainment. Maybe the chapters convinced you to buy your first Raspberry Pi or perhaps helped you rediscover the device that was collecting dust in a drawer. If any of that is true, I'll consider the guide a success.

If you now want to pay it forward and help spread the word on how versatile this little green digital board is, here are a few ways you can get connected to the Raspberry Pi community:

- Contribute to improving the official documentation [1]
- Contribute code to projects [2] the Raspberry Pi depends on
- File bugs [3] with Raspbian
- File bugs with the different ARM architecture platform distributions
- Help kids learn to code by taking a look at the Raspberry Pi Foundation's Code Club [4] in the UK or Code Club International [5] outside the UK
- Help with translation [6]
- Volunteer on a Raspberry Jam [7]

These are just a few of the ways you can contribute to the Raspberry Pi community. Last but not least, you can join me and contribute articles [8] to your favorite open source website, Opensource.com [9]. :-)

Links

[1] https://www.raspberrypi.org/documentation/CONTRIBUTING.md
[2] https://www.raspberrypi.org/github/
[3] https://www.raspbian.org/RaspbianBugs
[4] https://www.codeclub.org.uk/
[5] https://www.codeclubworld.org/
[6] https://www.raspberrypi.org/translate/
[7] https://www.raspberrypi.org/jam/
[8] https://opensource.com/participate
[9] http://opensource.com/