



Raspberry Pi Zero NPR One Radio

Created by Todd Treece



<https://learn.adafruit.com/raspberry-pi-zero-npr-one-radio>

Last updated on 2024-06-03 01:56:25 PM EDT

Table of Contents

Overview	3
Hardware	4
<ul style="list-style-type: none">• Raspberry Pi Zero• WiFi Dongle• MAX98357 I2S Amp• MPR121	
NPR Dev Center Setup	9
<ul style="list-style-type: none">• Updating Account Info• Requesting API Access• Creating Your First Application	
Software Configuration	16
<ul style="list-style-type: none">• NPR One Raspbian Image• WiFi Config• Connecting to the Pi Zero• Expanding the Filesystem• Authenticating with NPR One• Starting the Radio on Boot	
Thanks & Next Steps	20

Overview



This project started last summer when I was sniffing traffic from the [NPR One iOS app \(https://adafru.it/obx\)](https://adafru.it/obx) with [wireshark \(https://adafru.it/eDB\)](https://adafru.it/eDB). After logging a bunch of requests, I thought it might be possible to create a simple radio using a Raspberry Pi, since I'm unable to get a decent FM signal from [WYPR \(https://adafru.it/oby\)](https://adafru.it/oby) or [WAMU \(https://adafru.it/obz\)](https://adafru.it/obz).

While testing out the endpoints, I spotted a link to NPR One [public API docs \(https://adafru.it/obA\)](https://adafru.it/obA) in the error response. The project was pushed forward by the availability of great API docs, and a bunch of application development and design documentation at the [NPR One Developer Center \(https://adafru.it/obB\)](https://adafru.it/obB). Since the NPR One API docs were written using [swagger \(https://adafru.it/obC\)](https://adafru.it/obC), it didn't take much work to develop a full [Node.js API client for NPR One \(https://adafru.it/obD\)](https://adafru.it/obD) by using [swagger-client \(https://adafru.it/obE\)](https://adafru.it/obE) to connect to the API.

From there, I used the Node.js API client to create a simple [NPR One command line interface \(https://adafru.it/obF\)](https://adafru.it/obF) that supports both keyboard and [MPR121 \(http://adafru.it/1982\)](http://adafru.it/1982) touch controls with the new [adafruit-mpr121 \(https://adafru.it/obG\)](https://adafru.it/obG) Node.js package. This was all integrated into a hand carved enclosure, which can be seen below.

We will not be covering enclosure design in this tutorial, but the Ruiz Brothers created an amazing 3D printed enclosure for this project.

You can follow their build in the videos below:

- [Raspberry Pi Zero NPR One Radio](#)

- [NPR One Radio Demo](#)
- [CNC Milling NPR Logo on Wood](#)
- [Layer by Layer LIVE - Raspberry Pi Radio PT 1](#)
- [Layer by Layer LIVE - Raspberry Pi Radio PT 2](#)
- [Layer by Layer LIVE - Raspberry Pi Radio PT 3](#)

The NPR logo is a registered trademark of NPR used with permission from NPR. All rights reserved.

Hardware

Raspberry Pi Zero

This project was designed for the Raspberry Pi Zero, but any Raspberry Pi model will work if you are unable to get your hands on the elusive Pi Zero.



[Raspberry Pi Zero](#)

Note: Due to popular demand, there might be some delay in shipping products containing Pi Zero! At first glance, the Pi Zero isn't much. It just looks like a slimmed...

<https://www.adafruit.com/product/2818>

The Raspberry Pi A+ is a great alternative if the Pi Zero is out of stock.



[Raspberry Pi Model A+ 512MB RAM](#)

Note: As of August 10th, 2016 the Raspberry Pi A+ now includes 512 MB of RAM! The Raspberry Pi Model A+ is the perfect board for the minimalist Pi fan. This...

<https://www.adafruit.com/product/2266>

WiFi Dongle

The WiFi dongle below can be used with a USB OTG adapter, or you can attach the dongle directly to the Zero using the [WiFi piggyback hack](https://adafru.it/obl) (<https://adafru.it/obl>).

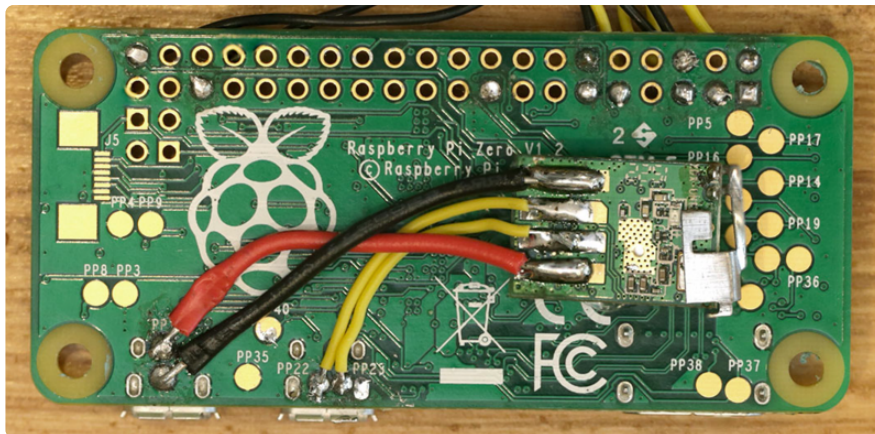


Miniature WiFi (802.11b/g/n) Module: For Raspberry Pi and more

Make your Internet of Things device cable-free by adding WiFi. Take advantage of the Raspberry Pi and Beagle Bone's USB port to add a low cost, but high-reliability wireless link....

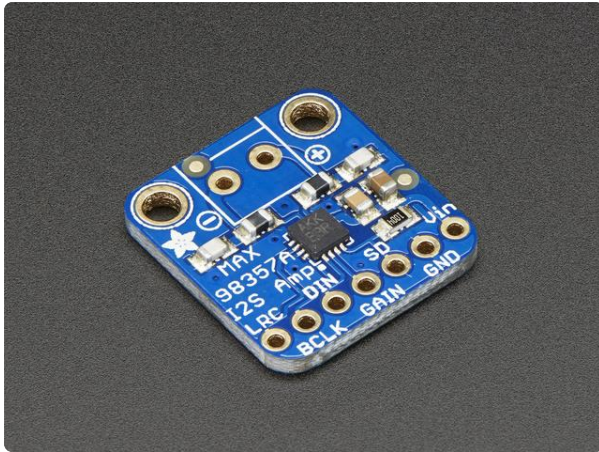
<https://www.adafruit.com/product/814>

Here is a closeup of the WiFi Piggyback hack. Make sure to keep the two yellow wires equal length so that there aren't issues with the USB connection. The WiFi configuration will be covered in the next section.



MAX98357 I2S Amp

For audio, this project uses the MAX98357 I2S breakout.

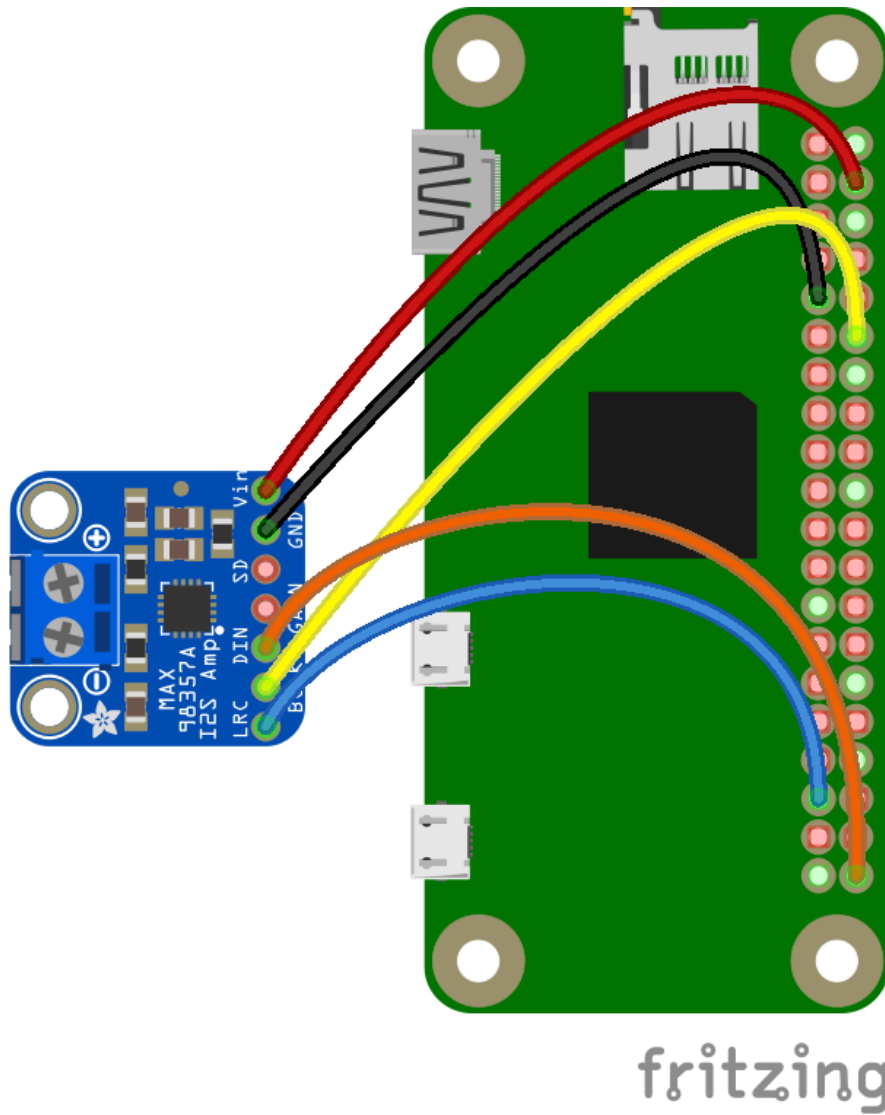


Adafruit I2S 3W Class D Amplifier Breakout - MAX98357A

Listen to this good news - we now have an all in one digital audio amp breakout board that works incredibly well with the <https://www.adafruit.com/product/3006>

You will need to connect it to the Pi Zero using the following pins:

- Amp **Vin** to Raspberry Pi **5V**
- Amp **GND** to Raspberry Pi **GND**
- Amp **DIN** to Raspberry Pi **#21**
- Amp **BCLK** to Raspberry Pi **#18**
- Amp **LRCLK** to Raspberry Pi **#19**

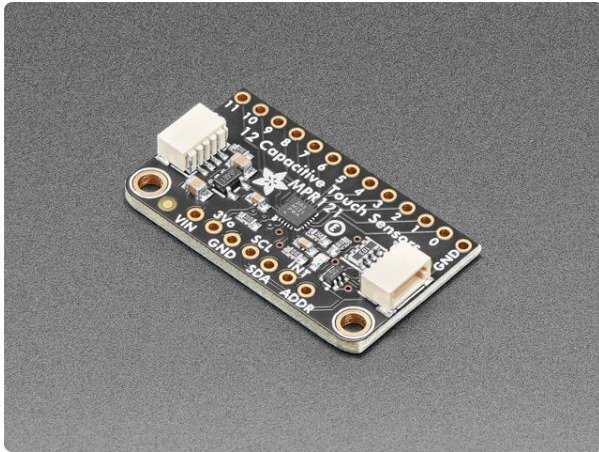


For more information about connecting the I2S amp, please visit the [Adafruit MAX98357 I2S Class-D Mono Amp \(https://adafru.it/obK\)](https://adafru.it/obK) guide. You will not need to do any of the software configuration mentioned in that guide. That is handled for you in the next section.

MPR121

This project will use 6 electrodes on the MPR121, and they are configured as follows:

- Pin 0 -> Rewind 15 seconds
- Pin 1 -> Play/Pause toggle
- Pin 2 -> Skip to the next story
- Pin 3 -> Mark story as interesting
- Pin 4 -> Volume down
- Pin 5 -> Volume up



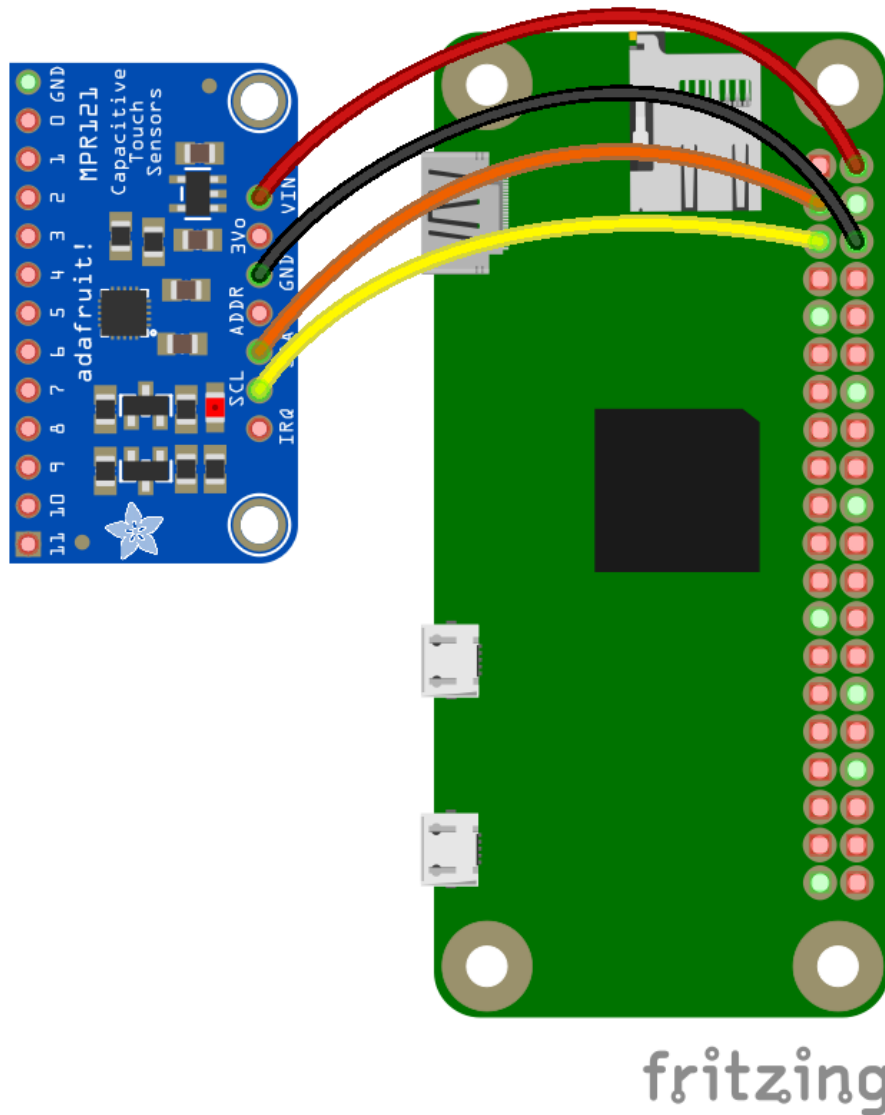
Adafruit 12-Key Capacitive Touch Sensor Breakout - MPR121

Add lots of touch sensors to your next microcontroller project with this easy-to-use 12-channel capacitive touch sensor breakout board, starring the MPR121. This chip can handle up to...

<https://www.adafruit.com/product/1982>

You will need to connect the Raspberry Pi to the following pins on the MPR121:

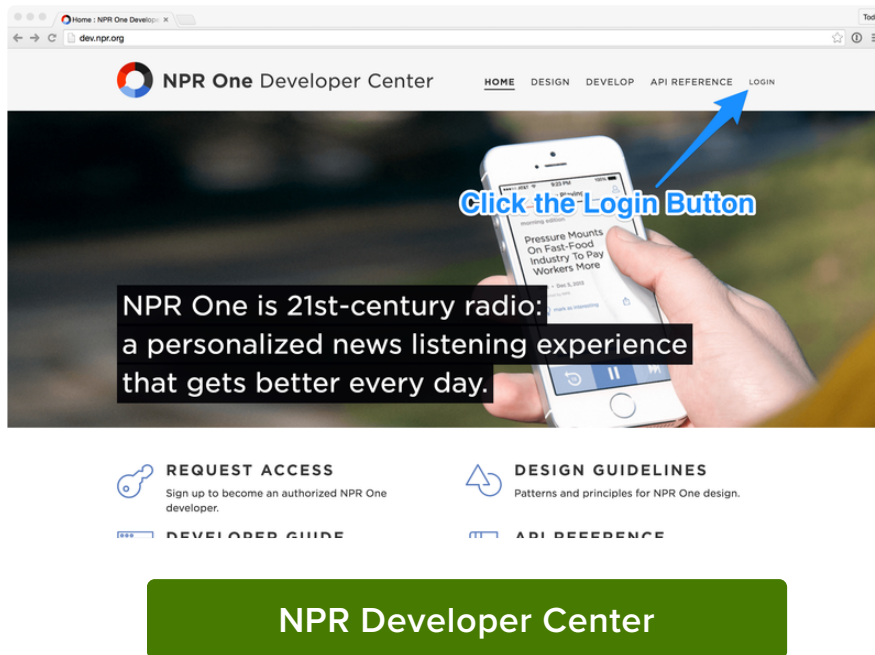
- Connect **Raspberry Pi 3.3V** to **MPR121 VIN**.
- Connect **Raspberry Pi GND** to **MPR121 GND**.
- Connect **Raspberry Pi SCL** to **MPR121 SCL**.
- Connect **Raspberry Pi SDA** to **MPR121 SDA**.



Once the hardware is connected to your Raspberry Pi Zero, continue on to learn how to install the software for this project.

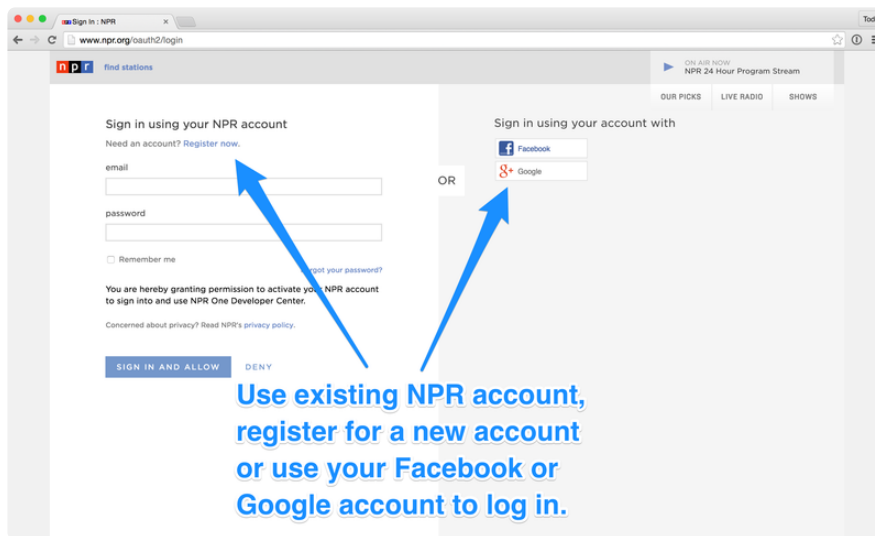
NPR Dev Center Setup

We will need to create or use an existing NPR account in order to get access to the NPR One API. First, visit the [NPR One Developer Center \(https://adafru.it/obl\)](https://adafru.it/obl), and click the login button.

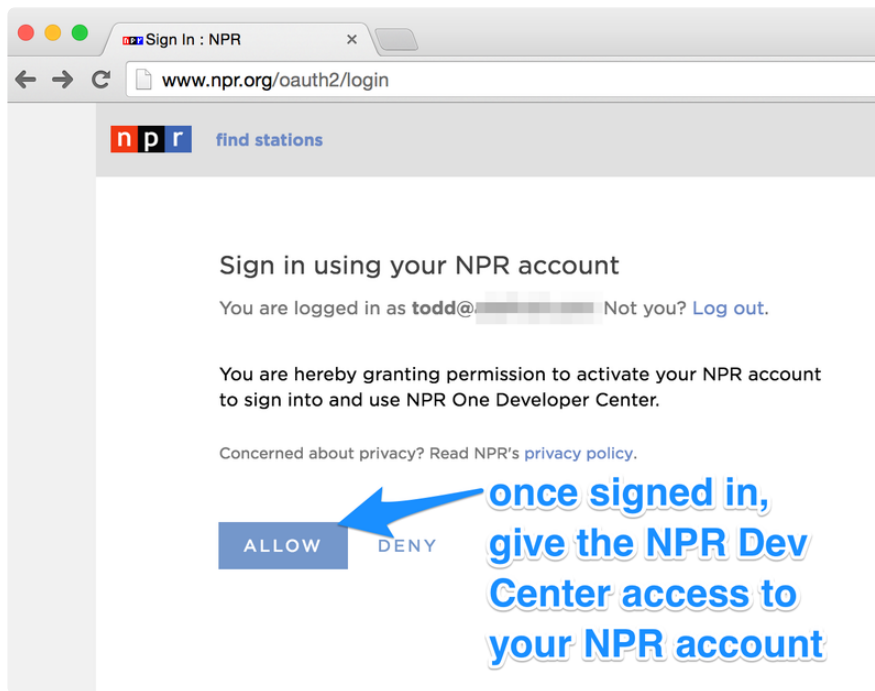


<https://adafru.it/obM>

Use your existing NPR, Facebook, or Google account to sign in, or register for a new NPR account.

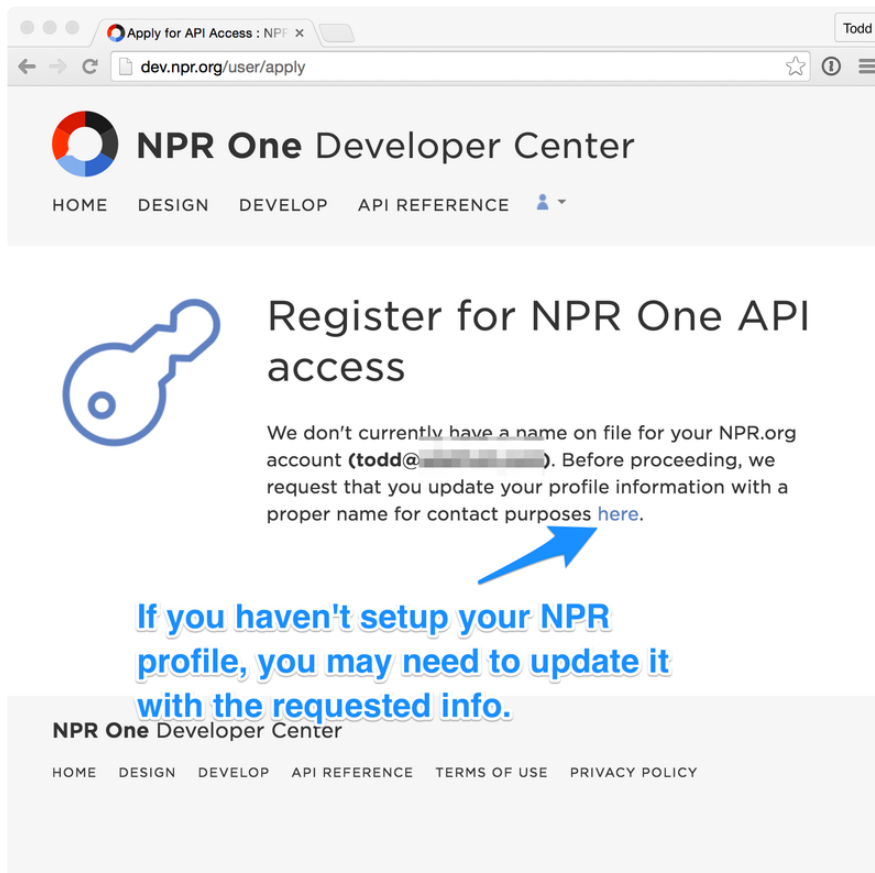


Click the Allow button to give the NPR Dev Center access to your NPR account.



Updating Account Info

If you haven't set your first and last name in your NPR account profile, you may be required to do so before accessing the NPR Dev Center.



Enter your first and last name, and then save changes.

The screenshot shows the NPR account profile page. At the top, there's a navigation bar with the NPR logo and 'find stations' link. Below that, a 'manage your account' section is visible. The main content area is titled 'personal' and contains a form for updating profile information. The form includes fields for 'first name' (containing 'Todd'), 'last name' (containing 'Treece'), 'display name' (containing 'adafruit_todd'), 'email address' (containing 'todd@...'), and 'password'. There is also a 'country' dropdown menu set to 'United States' and a 'SAVE CHANGES' button. A blue callout box with the text 'Enter your first and last name, and then click save changes' has three blue arrows pointing to the first name, last name, and save changes button fields respectively.

manage your account

personal

The information you share with NPR is governed by NPR's Privacy Policy. Your first name and last name aren't required, but we do believe that real names lead to a more civil community.

first name
Todd

last name
Treece

display name
adafruit_todd

This will be displayed when you post comments on NPR.org. It must be unique, and can consist only of letters, numbers, and underscores.

email address
todd@...

country
United States

password
.....

ENABLE COMMENTING

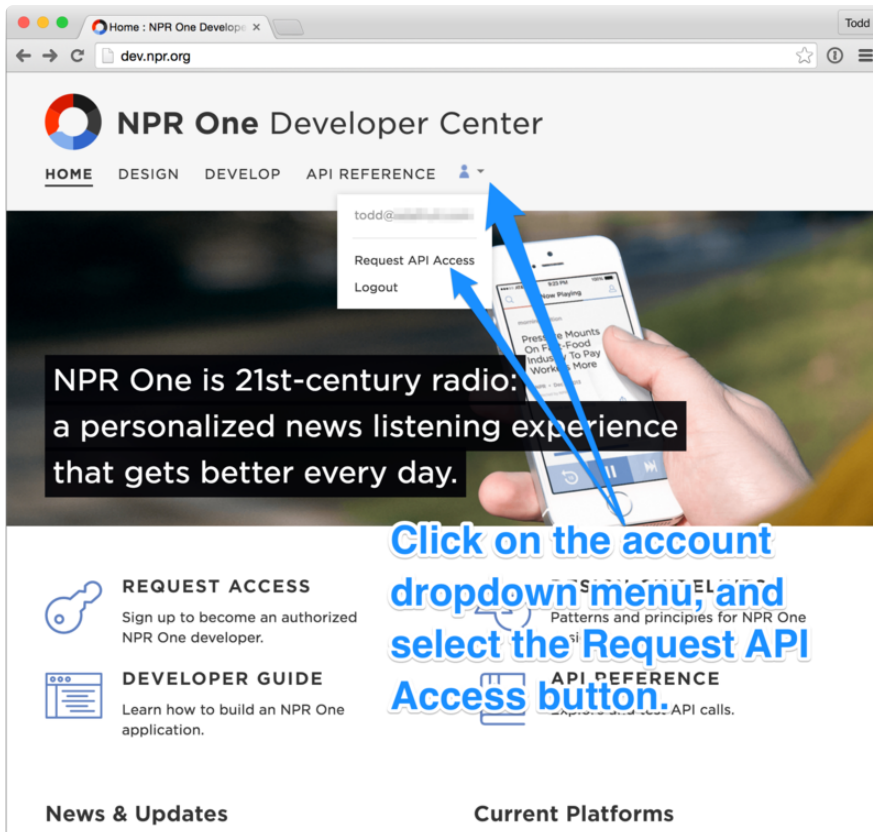
When you post comments on npr.org stories, you confirm that you are 16 years of age or older. See the NPR Community help documentation for information about commenting.

Enter your first and last name, and then click save changes

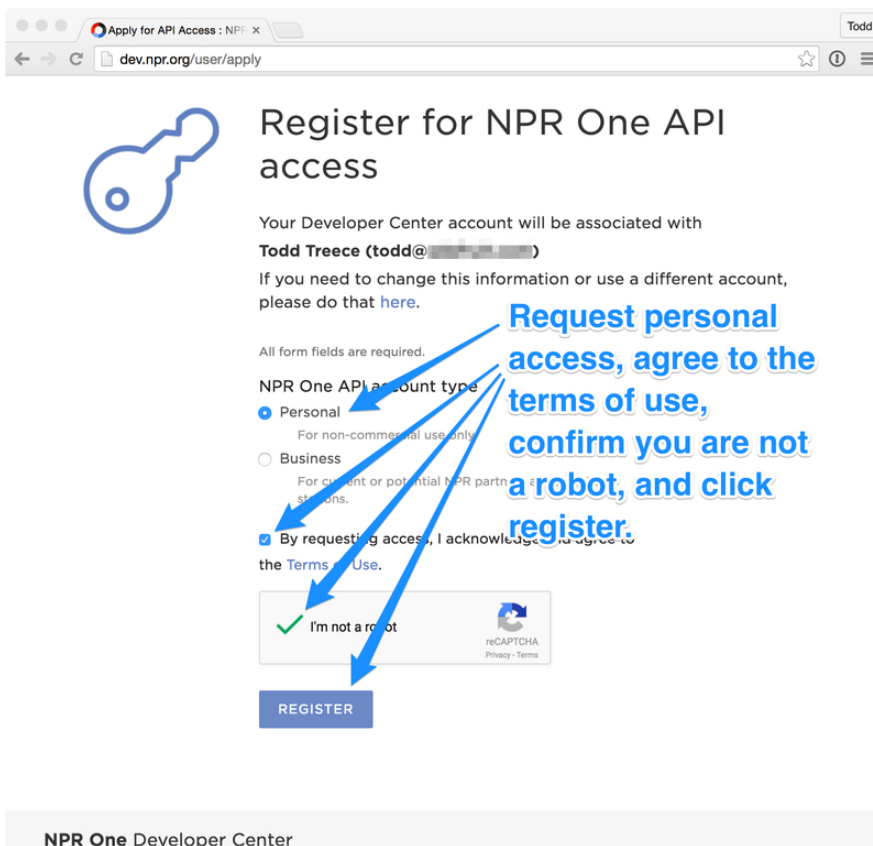
SAVE CHANGES

Requesting API Access

Navigate back to the [NPR One Developer Center \(https://adafru.it/obL\)](https://adafru.it/obL), and select the Request API Access menu item from the account menu.

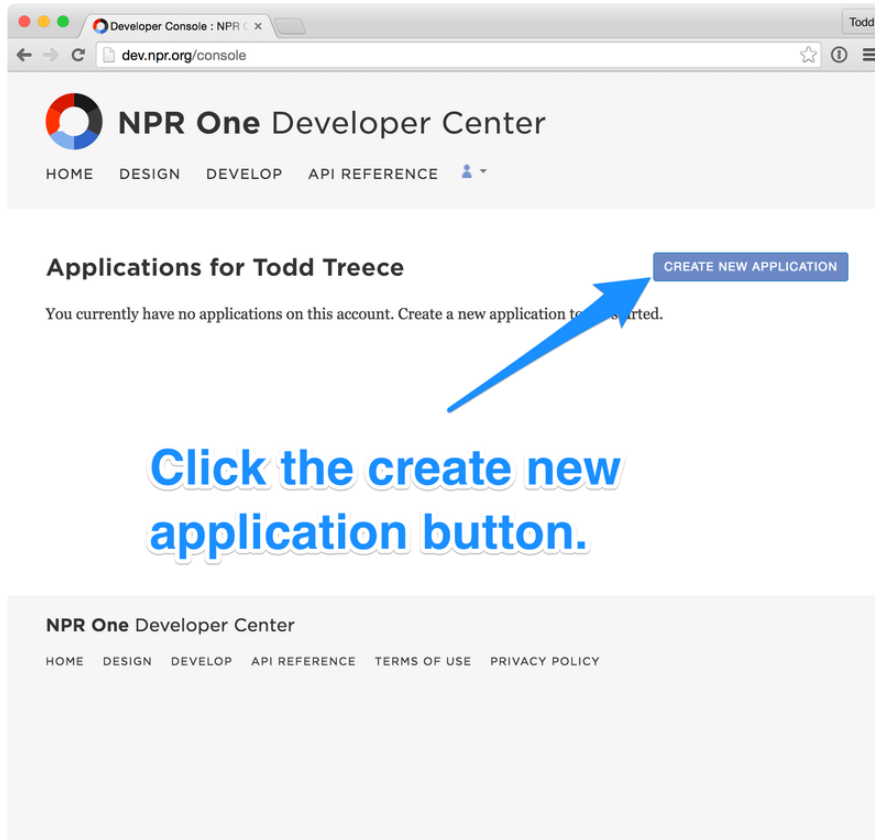


Next, you will need to register for personal access to the NPR One API.

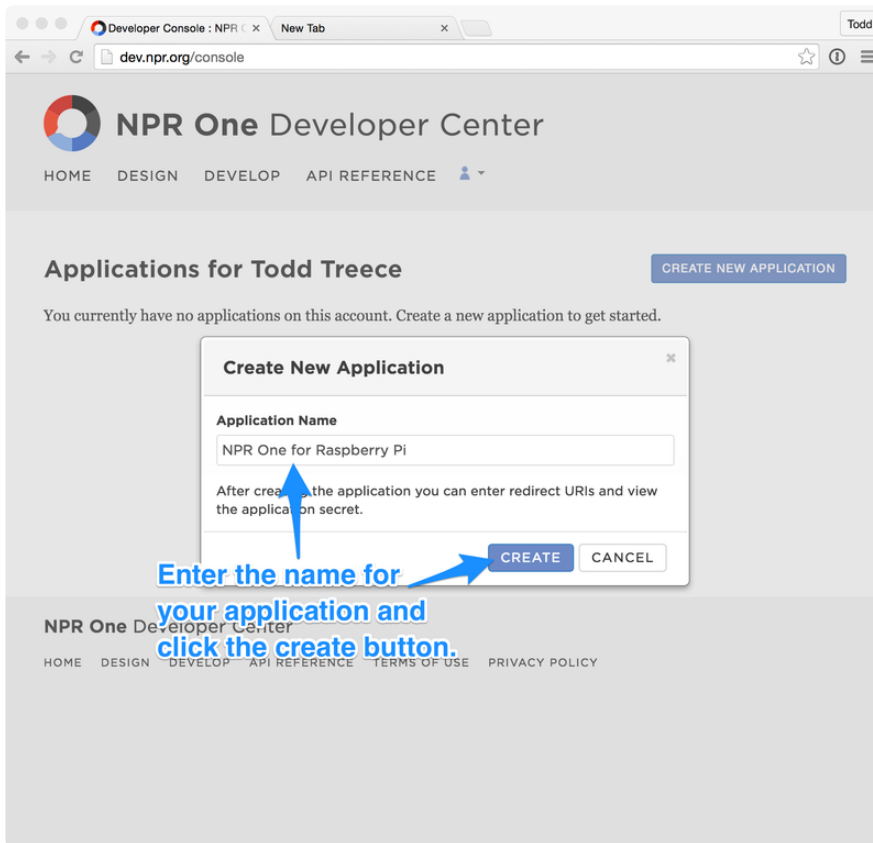


Creating Your First Application

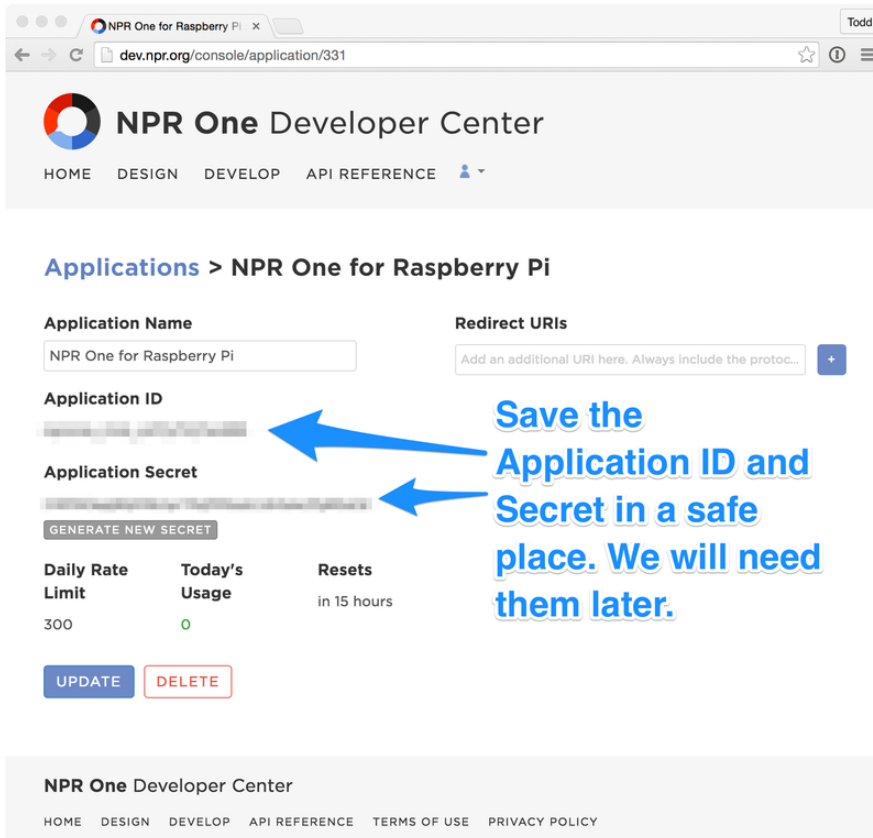
We now need to create the NPR One for Raspberry Pi application. Click the Create New Application button to start the process.



Enter the name of your application. In this example, we used NPR One for Raspberry Pi.



After the application has been created, save the Application ID and Application Secret in a safe place, or leave the window open so that you can easily access them in the next section.



Software Configuration

NPR One Raspbian Image

First, you will need to download a copy of the NPR One Radio Raspbian image, and transfer it to a 8GB SD card. If this is your first time making a SD card for a Raspberry Pi, you can [head over to our tutorial \(https://adafru.it/dDL\)](https://adafru.it/dDL) for more info about the process.

NPR One Raspbian Image

<https://adafru.it/obN>

WiFi Config

Before inserting the SD card into the Pi Zero, you will need to edit the **occidentalis.txt** file using your favorite text editor on your computer. You can find the **occidentalis.txt** file on the boot partition of the SD card.

It should look something like this:

```
# hostname for your Raspberry Pi:
hostname=nprone

# basic wireless networking options:
wifi_ssid=your network here
wifi_password=your password or passphrase here
```

Update the SSID and password with the appropriate values for your network, and save the file.

Connecting to the Pi Zero

Once you have the WiFi config saved, you are now ready to insert the SD card into the Raspberry Pi Zero, and power it on. You can connect to it over SSH as the **pi** user with the default password **raspberry** using the following command.

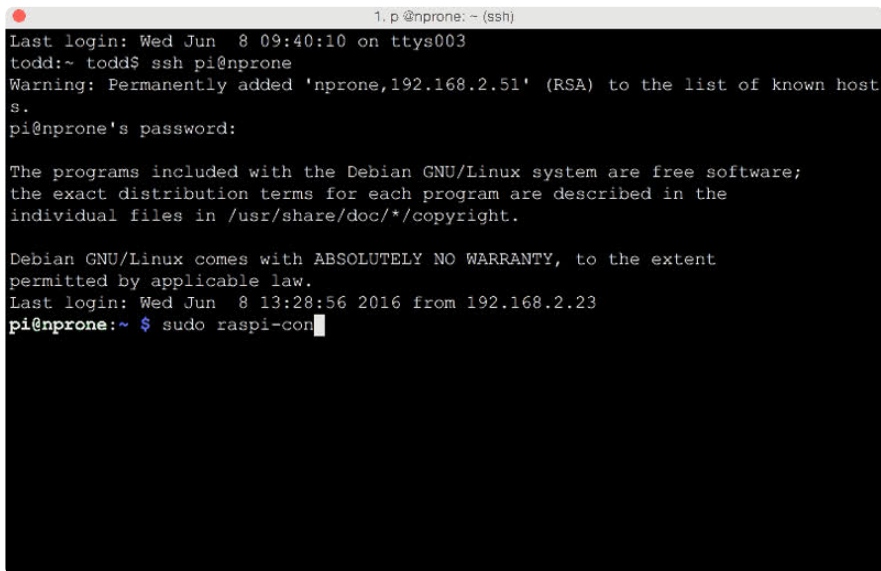
```
$ ssh pi@nprone.local
```

If you are unfamiliar with SSH, you can use the Terminal feature of [our Pi Finder \(https://adafru.it/iDP\)](https://adafru.it/iDP) to connect to your pi.

Expanding the Filesystem

You will need to expand the filesystem to fill your SD card. You can do this by running `raspi-config`, and selecting the first option. You will need to reboot for this to take effect.

```
sudo raspi-config
```



```
1. p @nprone: ~ (ssh)
Last login: Wed Jun  8 09:40:10 on ttys003
todd:~ todd$ ssh pi@nprone
Warning: Permanently added 'nprone,192.168.2.51' (RSA) to the list of known hosts.
pi@nprone's password:

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Jun  8 13:28:56 2016 from 192.168.2.23
pi@nprone:~ $ sudo raspi-con
```

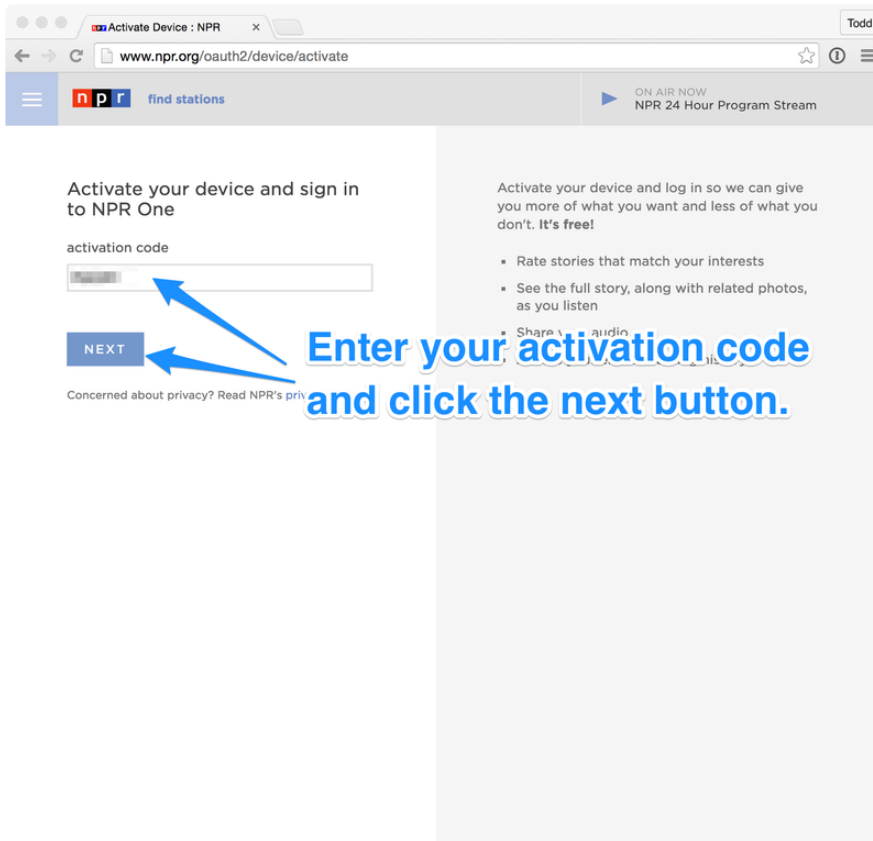
Authenticating with NPR One

Next, you will need to use the Application ID and Secret from the NPR One Dev Center to authorize your Pi. Enter the ID and Secret when prompted, and visit <http://www.npr.org/device> (<https://adafru.it/obO>) when the CLI presents your device code.

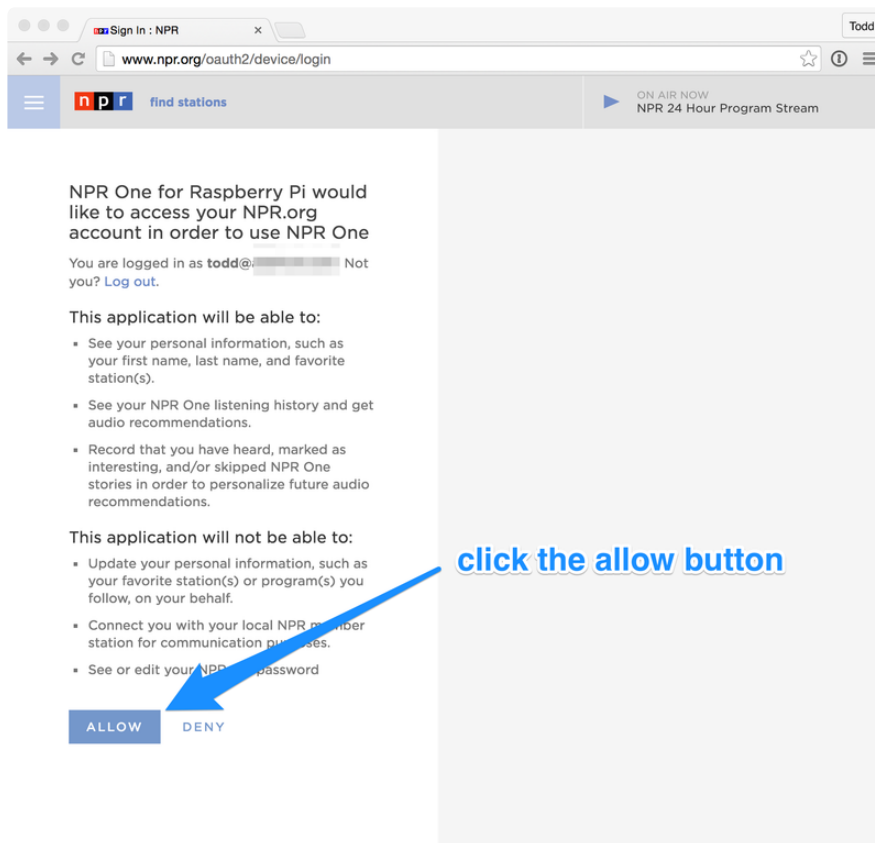
Do not select the complete option until you have authorized the app at <http://www.npr.org/device> (<https://adafru.it/obO>).

```
1. pi@nprone: ~ (ssh)
permitted by applicable law.
Last login: Tue Jun  7 16:20:12 2016 from 192.168.2.23
pi@nprone:~$ npr-one
connecting to npr one...
? NPR Application ID [redacted]
? NPR Application Secret [redacted]
? Authorize the NPR One CLI @ http://www.npr.org/device using code: [redacted] (Use
arrow keys)
> Complete
Exit
```

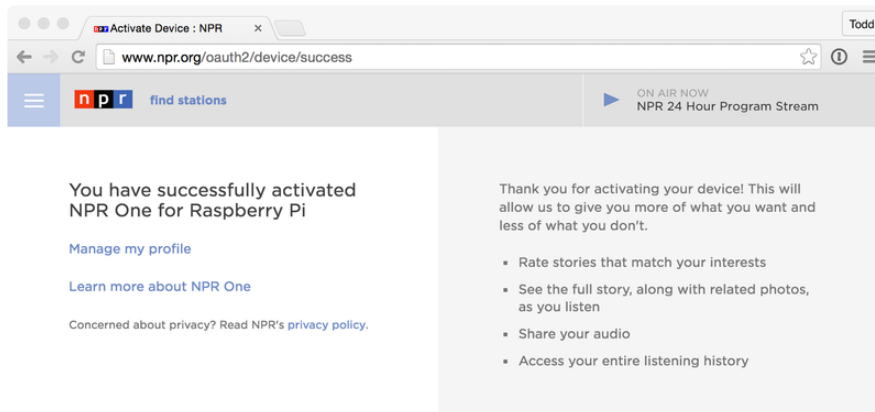
Enter your activation code on the NPR website, and press the Next button.



Grant access to the Pi by pressing the Allow button.



You should see a success message on the NPR site. Once you see this, you are ready to move back to the Pi.



Press return to select the **complete** option on the Pi, and you should see the stories start to load and play.



Starting the Radio on Boot

If you would like to start the radio on boot, you can do that by running the following command.

```
$ pm2 start npr-one &&& pm2 save
```

That will start the radio, and keep it running until you pause it or stop it using the play/pause button. You can also force quit the radio by running this command.

```
$ pm2 stop npr-one
```

Thanks & Next Steps

Thanks for all of the help and support from the NPR One team. They were very helpful with adding support to their NPR One dev center so that individuals could easily sign up for API access, which is what made this tutorial possible. If you are a developer, you should check out their new developer blog at npr.codes.

Also, a very big thanks to the Ruiz Brothers for the great work on their 3D printed enclosure, and for their help testing the radio. Again, if you missed it, check out the Ruiz Brothers' videos for their 3D printed enclosure:

- [Raspberry Pi Zero NPR One Radio](#)
- [NPR One Radio Demo](#)
- [CNC Milling NPR Logo on Wood](#)
- [Layer by Layer LIVE - Raspberry Pi Radio PT 1](#)

- [Layer by Layer LIVE - Raspberry Pi Radio PT 2](#)
- [Layer by Layer LIVE - Raspberry Pi Radio PT 3](#)

The NPR logo is a registered trademark of NPR used with permission from NPR. All rights reserved.