



Raspberry Pi Zero NPR One Radio

Created by Todd Treece



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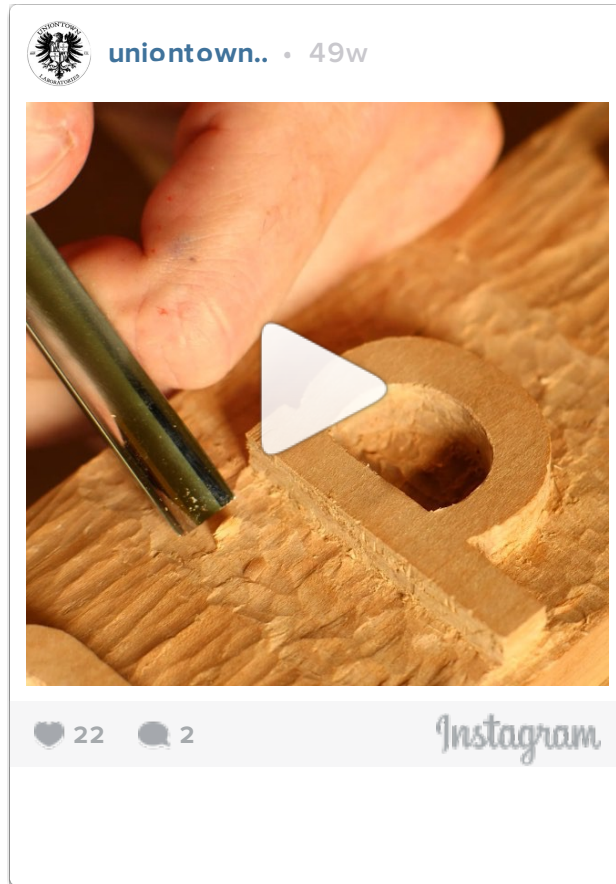
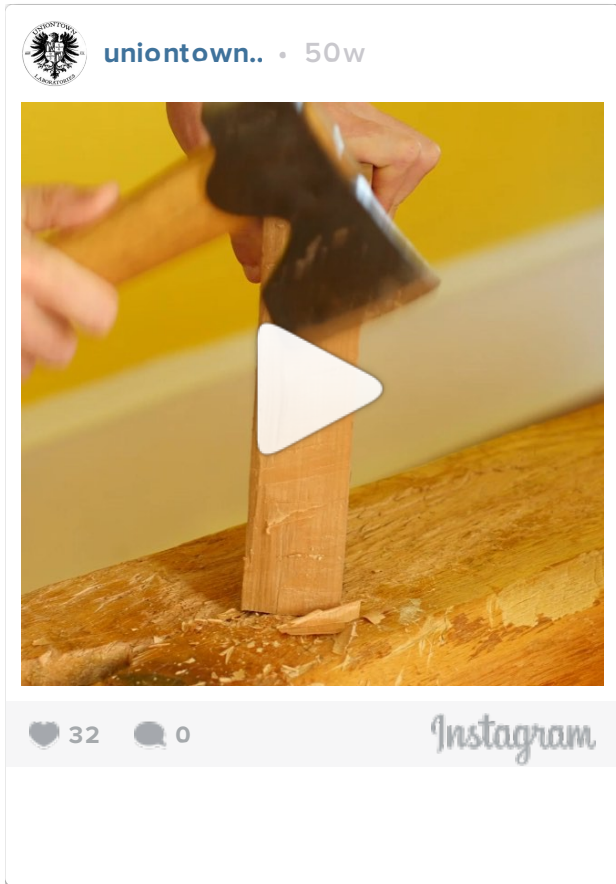
Overview



This project started last summer when I was sniffing traffic from the [NPR One iOS app](http://adafru.it/obx) (<http://adafru.it/obx>) with [wireshark](http://adafru.it/eDB) (<http://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](http://adafru.it/oby) (<http://adafru.it/oby>) or [WAMU](http://adafru.it/obz) (<http://adafru.it/obz>).

While testing out the endpoints, I spotted a link to NPR One [public API docs](http://adafru.it/obA) (<http://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](http://adafru.it/obB) (<http://adafru.it/obB>). Since the NPR One API docs were written using [swagger](http://adafru.it/obC) (<http://adafru.it/obC>), it didn't take much work to develop a full [Node.js API client for NPR One](http://adafru.it/obD) (<http://adafru.it/obD>) by using [swagger-client](http://adafru.it/obE) (<http://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](http://adafru.it/obF) (<http://adafru.it/obF>) that supports both keyboard and [MPR121](http://adafru.it/1982) (<http://adafru.it/1982>) touch controls with the new [adafruit-mpx121](http://adafru.it/obG) (<http://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](#)

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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

PRODUCT ID: 2818

<http://adafru.it/obH>

\$5.0

IN STOCK

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



Raspberry Pi Model A+ 256MB RAM

PRODUCT ID: 2266

<http://adafru.it/ell>

\$24.95

IN STOCK

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 \(http://adafru.it/obl\)](http://adafru.it/obl).



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

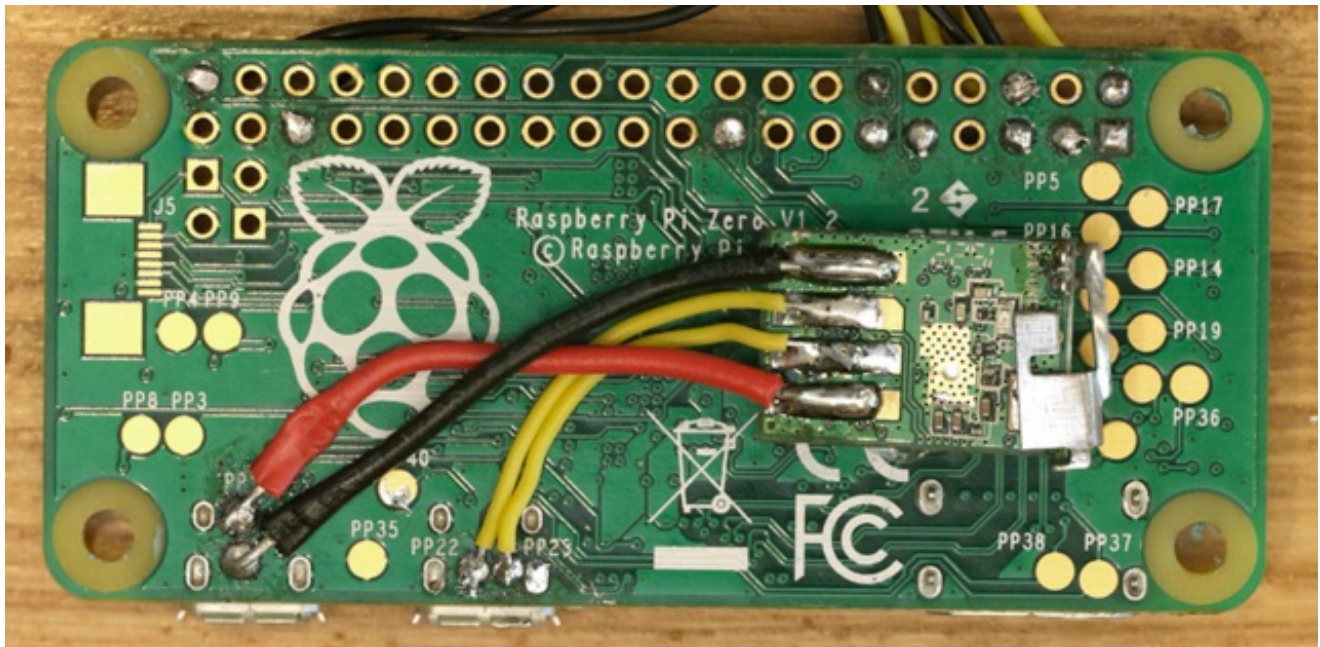
PRODUCT ID: 814

<http://adafruit.it/elp>

\$11.95

IN STOCK

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

PRODUCT ID: 3006

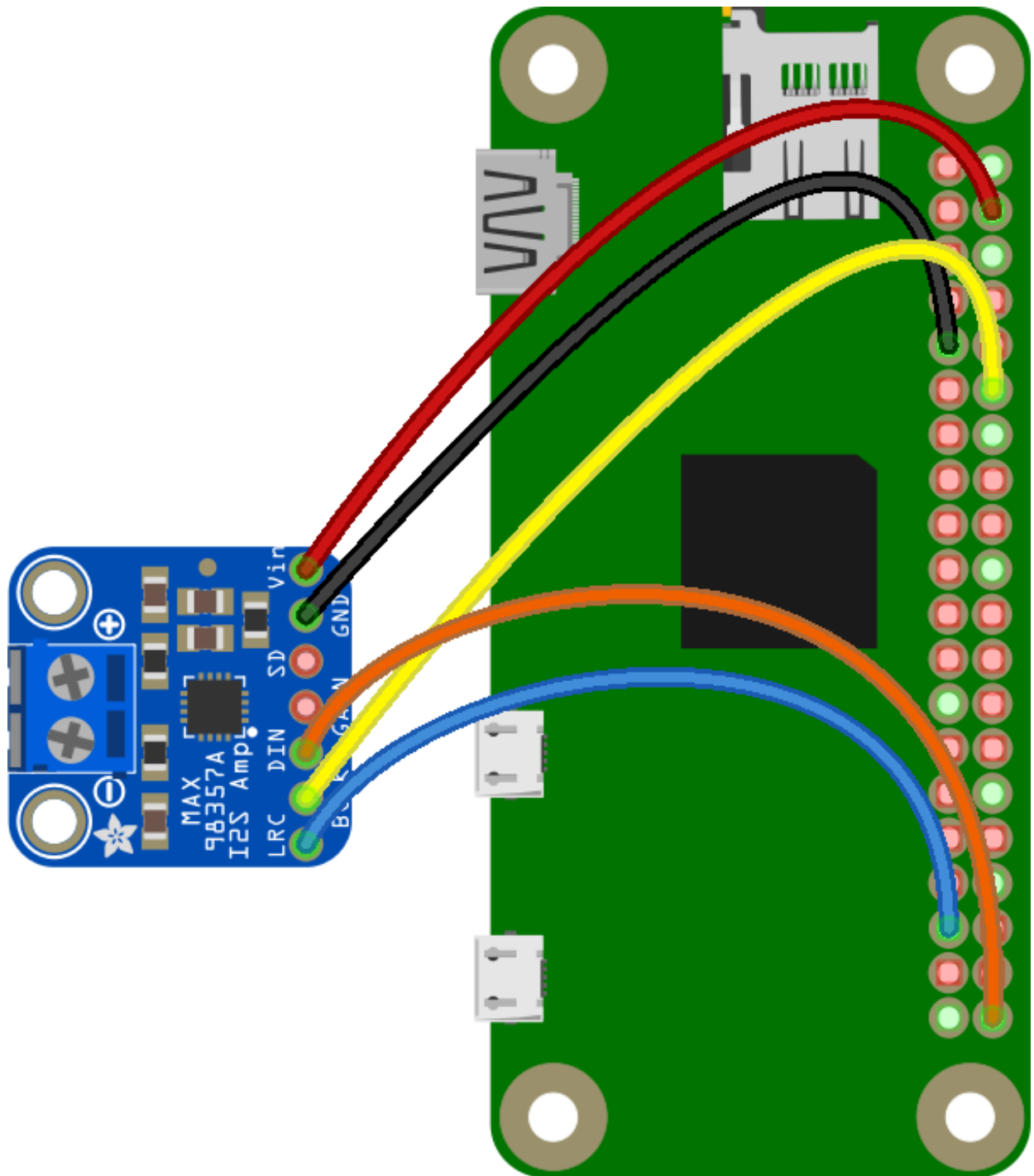
<http://adafruit.it/obj>

\$5.95

IN STOCK

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**



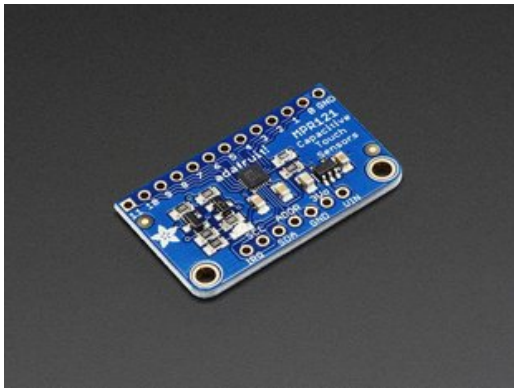
fritzing

For more information about connecting the I2S amp, please visit the [Adafruit MAX98357 I2S Class-D Mono Amp](http://adafruit.com/blog/posts/2016-08-15-Adafruit-MAX98357-I2S-Class-D-Mono-Amp) (<http://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

PRODUCT ID: 1982

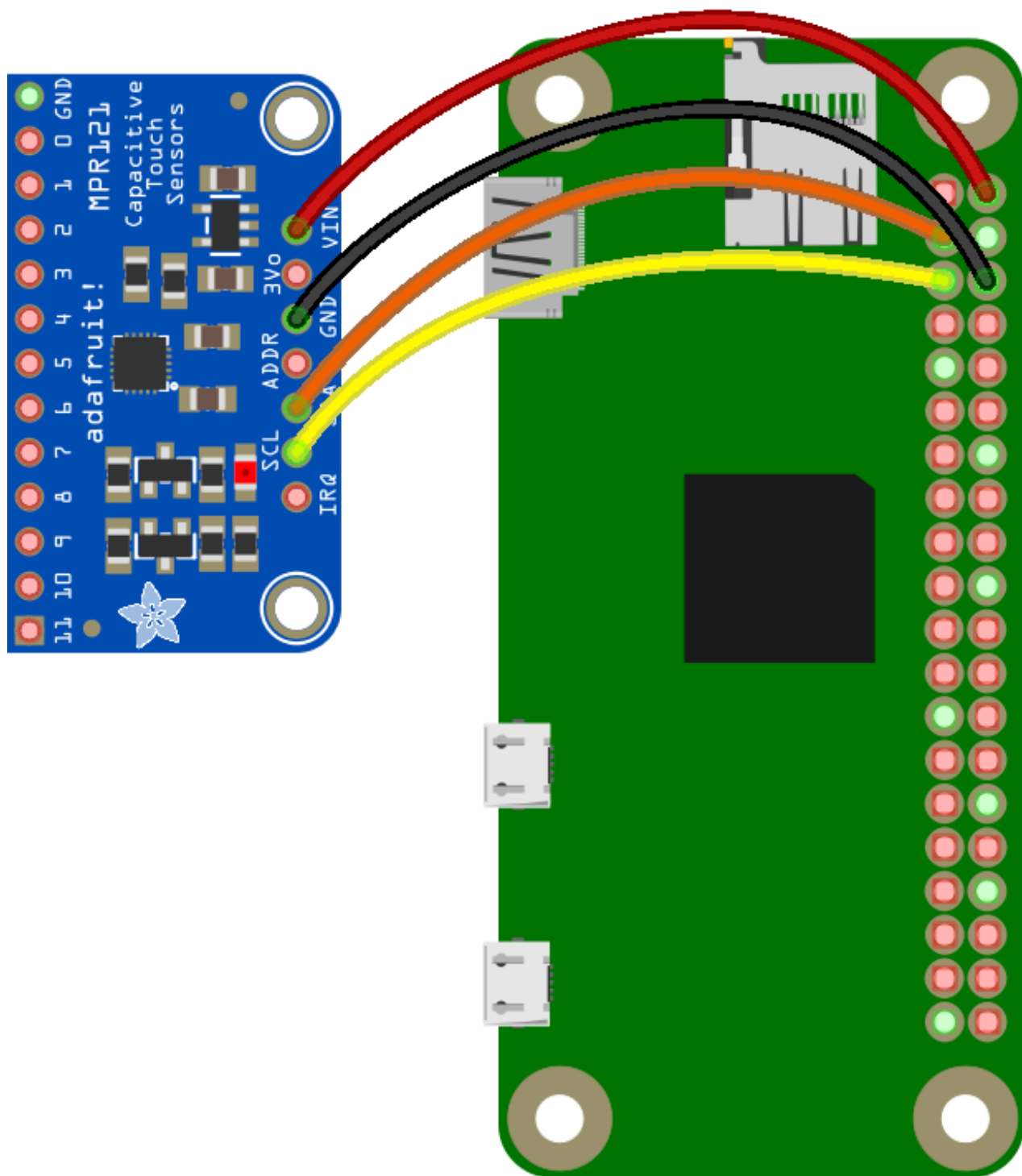
<http://adafru.it/dKK>

\$7.95

IN STOCK

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**.

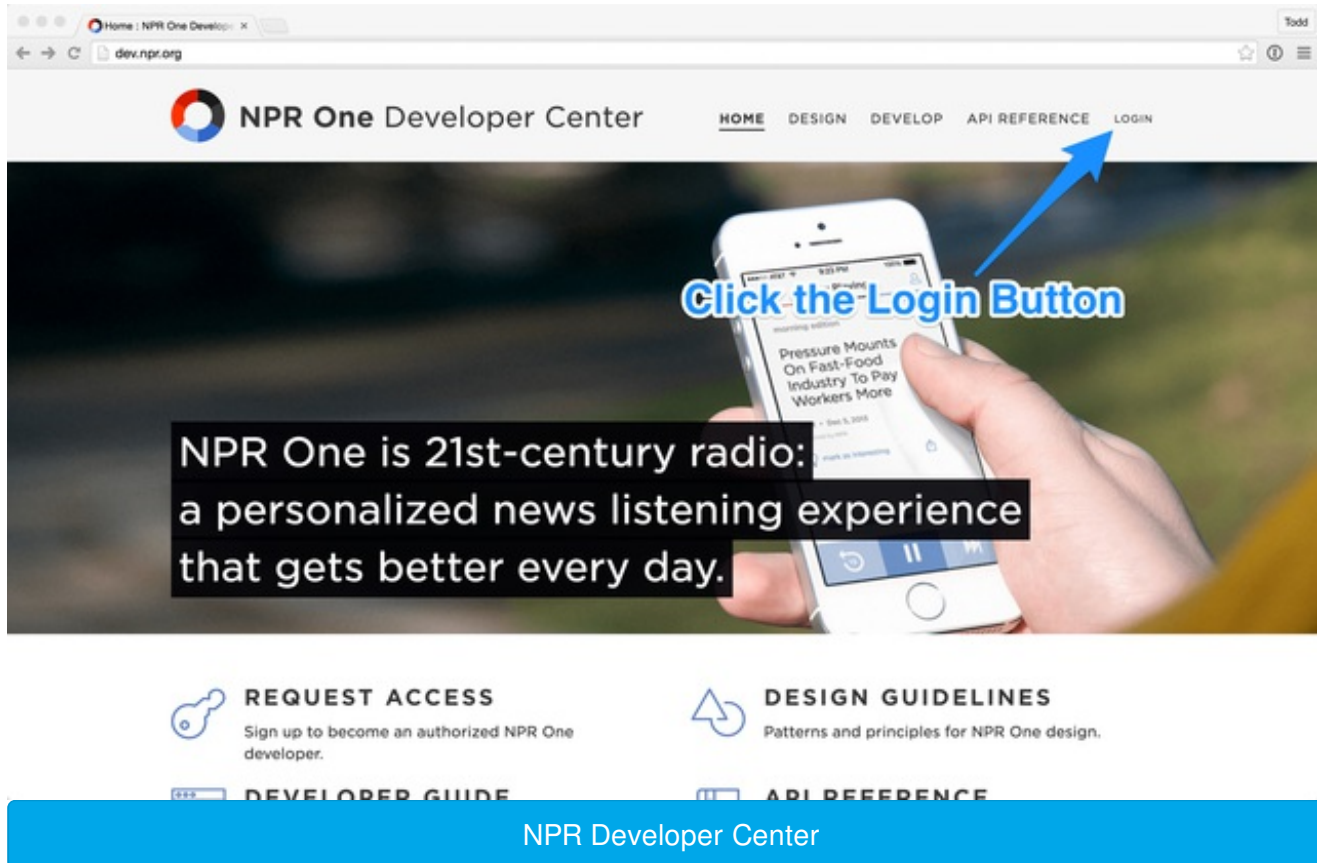


fritzing

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

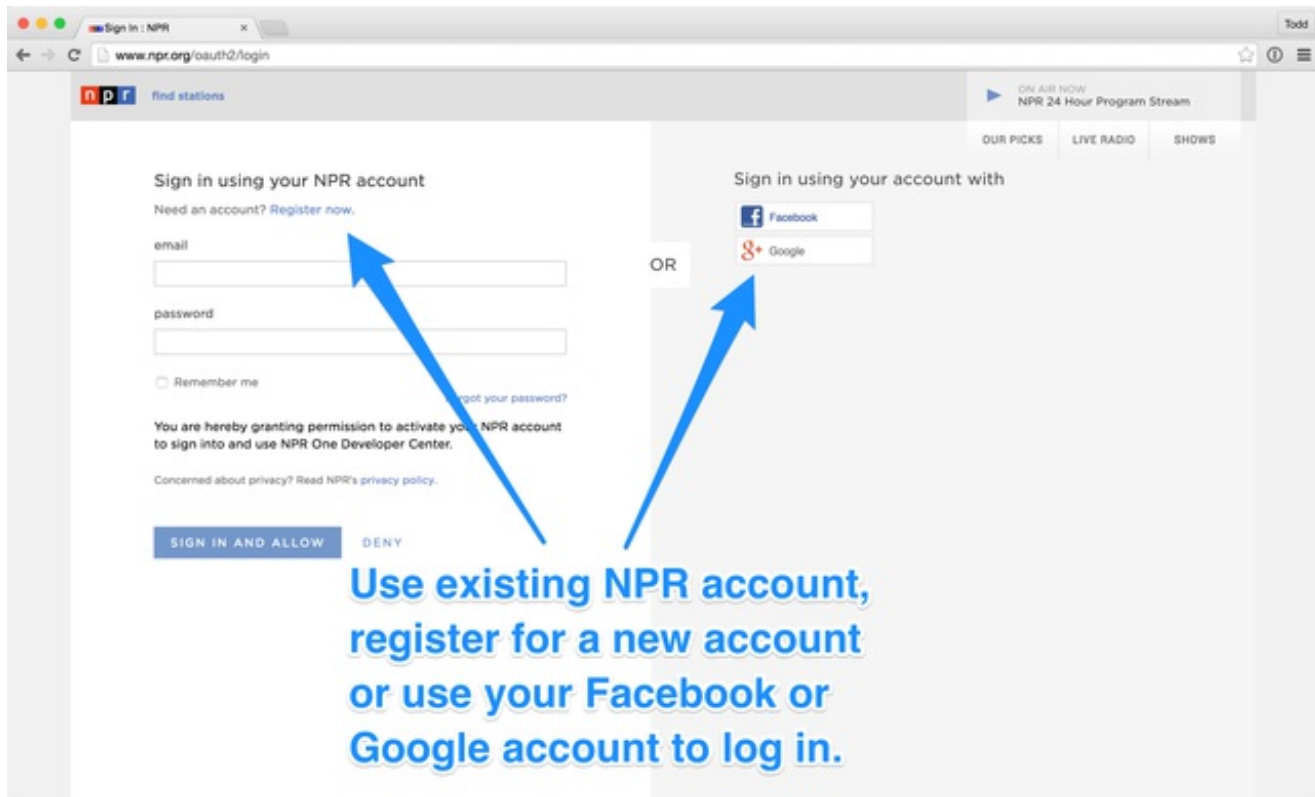
NPR Dev Center Setup

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 \(http://adafru.it/obL\)](http://adafru.it/obL), and click the login button.

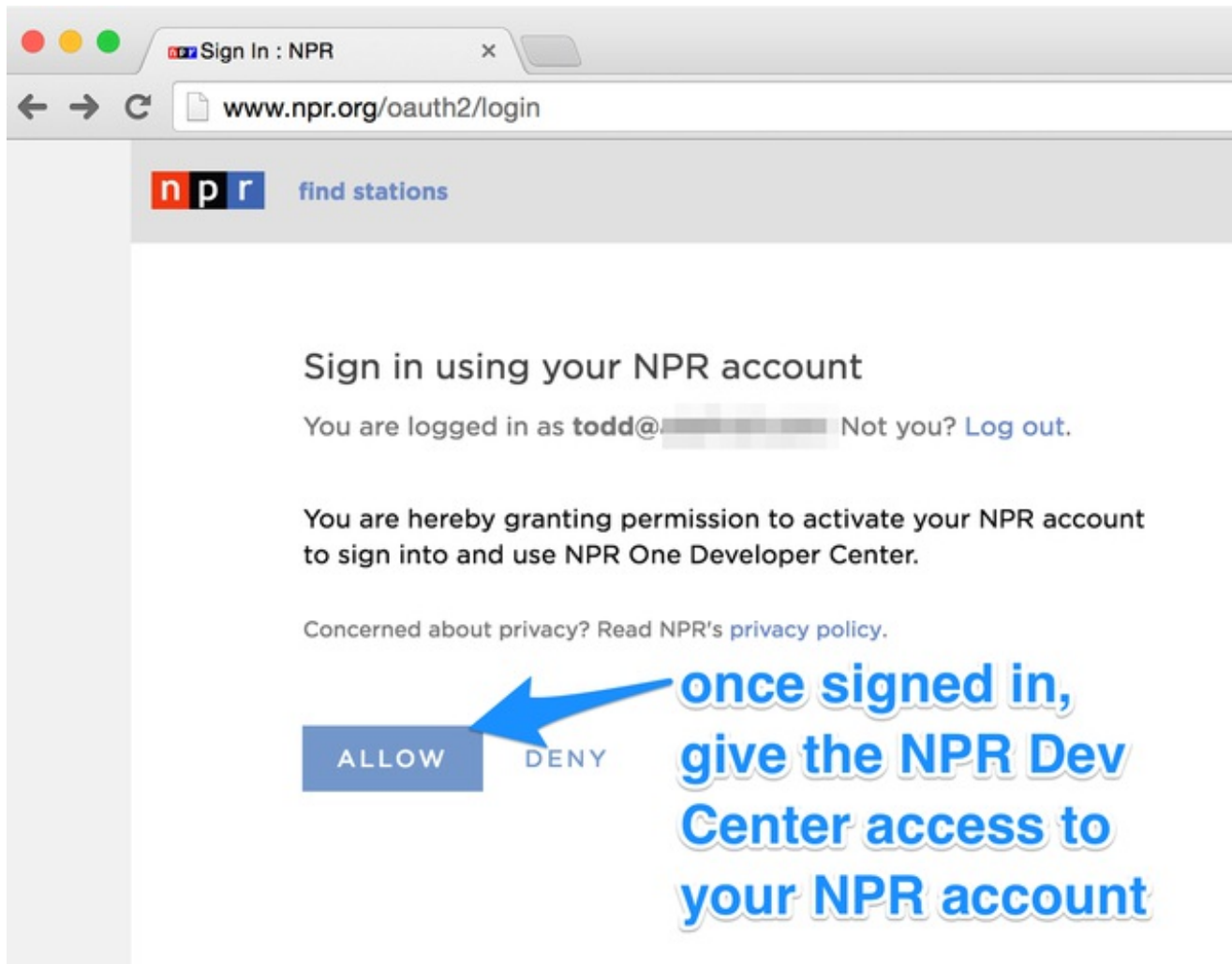


<http://adafru.it/obM>

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.


Apply for API Access : NPR x


dev.npr.org/user/apply

Todd





NPR One Developer Center

HOME DESIGN DEVELOP API REFERENCE 



Register for NPR One API access

We don't currently have a name on file for your NPR.org account (todd@). Before proceeding, we request that you update your profile information with a proper name for contact purposes [here](#).



If you haven't setup your NPR profile, you may need to update it with the requested info.

NPR One Developer Center

HOME DESIGN DEVELOP API REFERENCE TERMS OF USE PRIVACY POLICY

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

The screenshot shows the NPR account profile page at www.npr.org/account/profile. The page has a header with the NPR logo and a 'find stations' link. Below the header, there's a 'manage your account' section. The 'personal' section contains a privacy notice and several input fields: 'first name' (containing 'Todd'), 'last name' (containing 'Treece'), 'display name' (containing 'adafruit_todd'), 'email address' (containing 'todd@...'), and 'country' (a dropdown menu set to 'United States'). There is also a 'password' field with masked characters. A 'SAVE CHANGES' button is at the bottom left. Three blue arrows point from a large text overlay to the 'first name', 'last name', and 'SAVE CHANGES' fields. The text overlay reads: 'Enter your first and last name, and then click save changes'.

NPR Profile : NPR x

www.npr.org/account/profile

find stations

ON AIR NOW
NPR 24 Hour Program Stream

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.

enable commenting

When you post comments on npr.org stories, you confirm that you are 18 years of age or older. See the [NPR Community help documentation](#) for information about commenting.

email address
todd@...

password
.....

country
United States

SAVE CHANGES

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

Requesting API Access

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

The screenshot shows the NPR One Developer Center website in a browser. The browser's address bar displays 'dev.npr.org'. The website's header includes the NPR logo and navigation links: HOME, DESIGN, DEVELOP, and API REFERENCE. A user profile dropdown menu is open, showing the email 'todd@...', 'Request API Access', and 'Logout'. A large black text box with white text reads: 'NPR One is 21st-century radio: a personalized news listening experience that gets better every day.' Below this, there are two main sections: 'REQUEST ACCESS' with a key icon and the text 'Sign up to become an authorized NPR One developer.', and 'DEVELOPER GUIDE' with a document icon and the text 'Learn how to build an NPR One application.' At the bottom, there are links for 'News & Updates' and 'Current Platforms'. Blue arrows point from the text 'Click on the account dropdown menu, and select the Request API Access button.' to the user profile icon and the 'Request API Access' option in the dropdown menu.

Home : NPR One Developer Center x

dev.npr.org

Todd

NPR One Developer Center

HOME DESIGN DEVELOP API REFERENCE

todd@...
Request API Access
Logout

**NPR One is 21st-century radio:
a personalized news listening experience
that gets better every day.**

**Click on the account
dropdown menu, and
select the Request API
Access button.**

REQUEST ACCESS
Sign up to become an authorized
NPR One developer.

DEVELOPER GUIDE
Learn how to build an NPR One
application.

News & Updates

Current Platforms

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



Register for NPR One API access

Your Developer Center account will be associated with

Todd Treece (todd@...)

If you need to change this information or use a different account, please do that [here](#).

All form fields are required.

NPR One API account type

☒ Personal

For non-commercial use only

☐ Business

For current or potential NPR partner stations.

☒ By requesting access, I acknowledge and agree to the [Terms of Use](#).

I'm not a robot



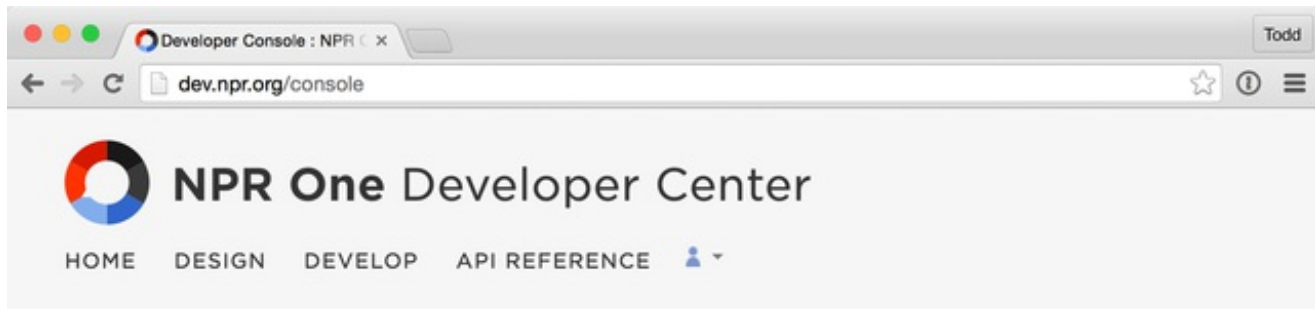
REGISTER

Request personal access, agree to the terms of use, confirm you are not a robot, and click register.

NPR One Developer Center

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.



Applications for Todd Treece

You currently have no applications on this account. Create a new application to get started.

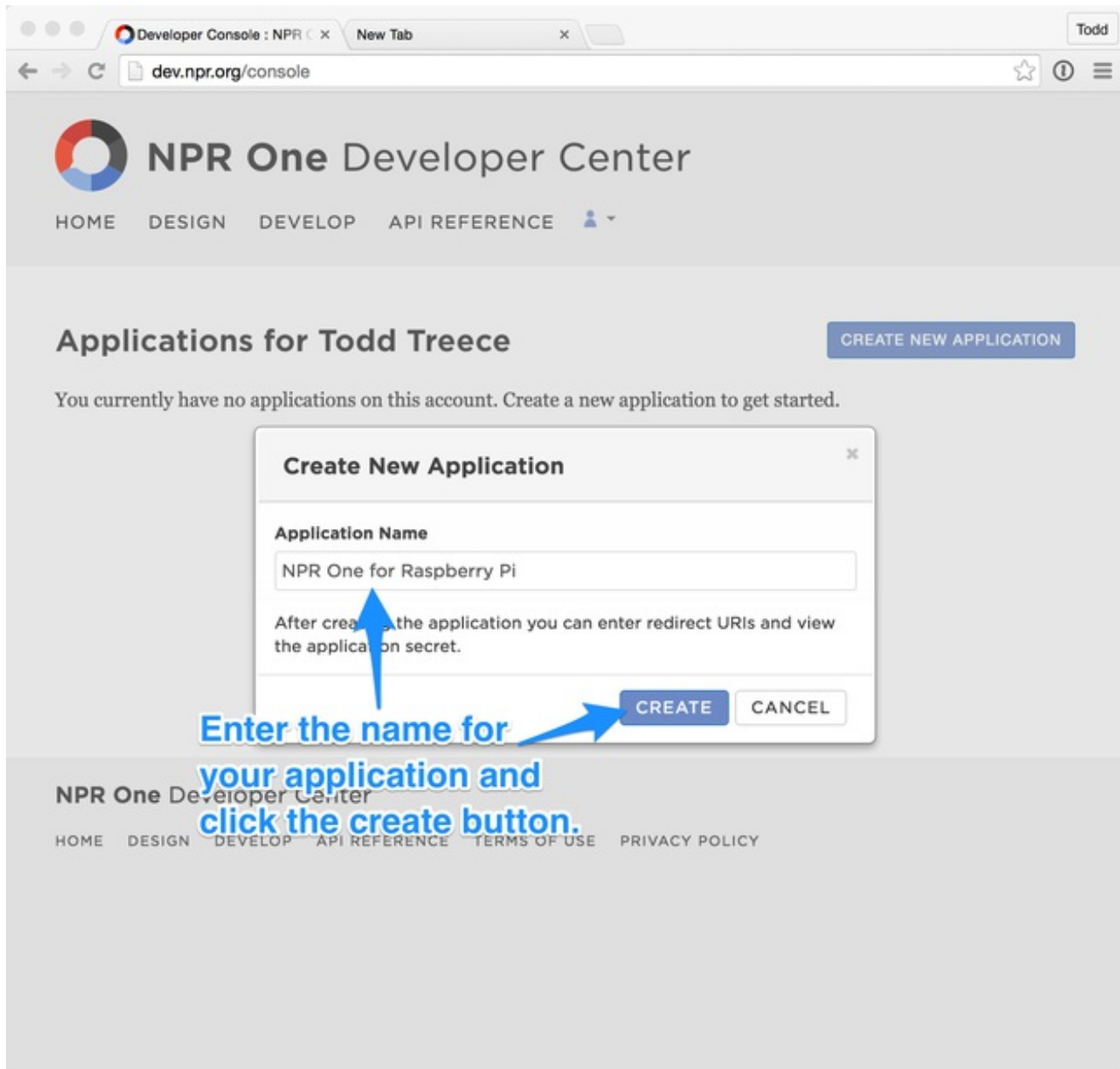
CREATE NEW APPLICATION



**Click the create new
application button.**



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.

NPR One for Raspberry Pi x

dev.npr.org/console/application/331

Todd

NPR One Developer Center

HOME DESIGN DEVELOP API REFERENCE

Applications > NPR One for Raspberry Pi

Application Name
NPR One for Raspberry Pi

Redirect URIs
Add an additional URI here. Always include the protoc... +

Application ID
[Redacted]

Application Secret
[Redacted]
GENERATE NEW SECRET

Daily Rate Limit
300

Today's Usage
0

Resets
in 15 hours

UPDATE

DELETE

Save the Application ID and Secret in a safe place. We will need them later.

NPR One Developer Center

HOME DESIGN DEVELOP API REFERENCE TERMS OF USE PRIVACY POLICY

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 \(http://adafru.it/dDL\)](http://adafru.it/dDL) for more info about the process.

NPR One Raspbian Image

<http://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=pi-zero

# default wireless network configuration
wlan0 wlan0 wlan0 wlan0 wlan0
wlan0 wlan0 wlan0 wlan0 wlan0
wlan0 wlan0 wlan0 wlan0 wlan0
```

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@pi-zero
```

If you are unfamiliar with SSH, you can use the Terminal feature of [our Pi Finder \(http://adafru.it/iDP\)](http://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> (<http://adafru.it/obO>) when the CLI presents your device code.

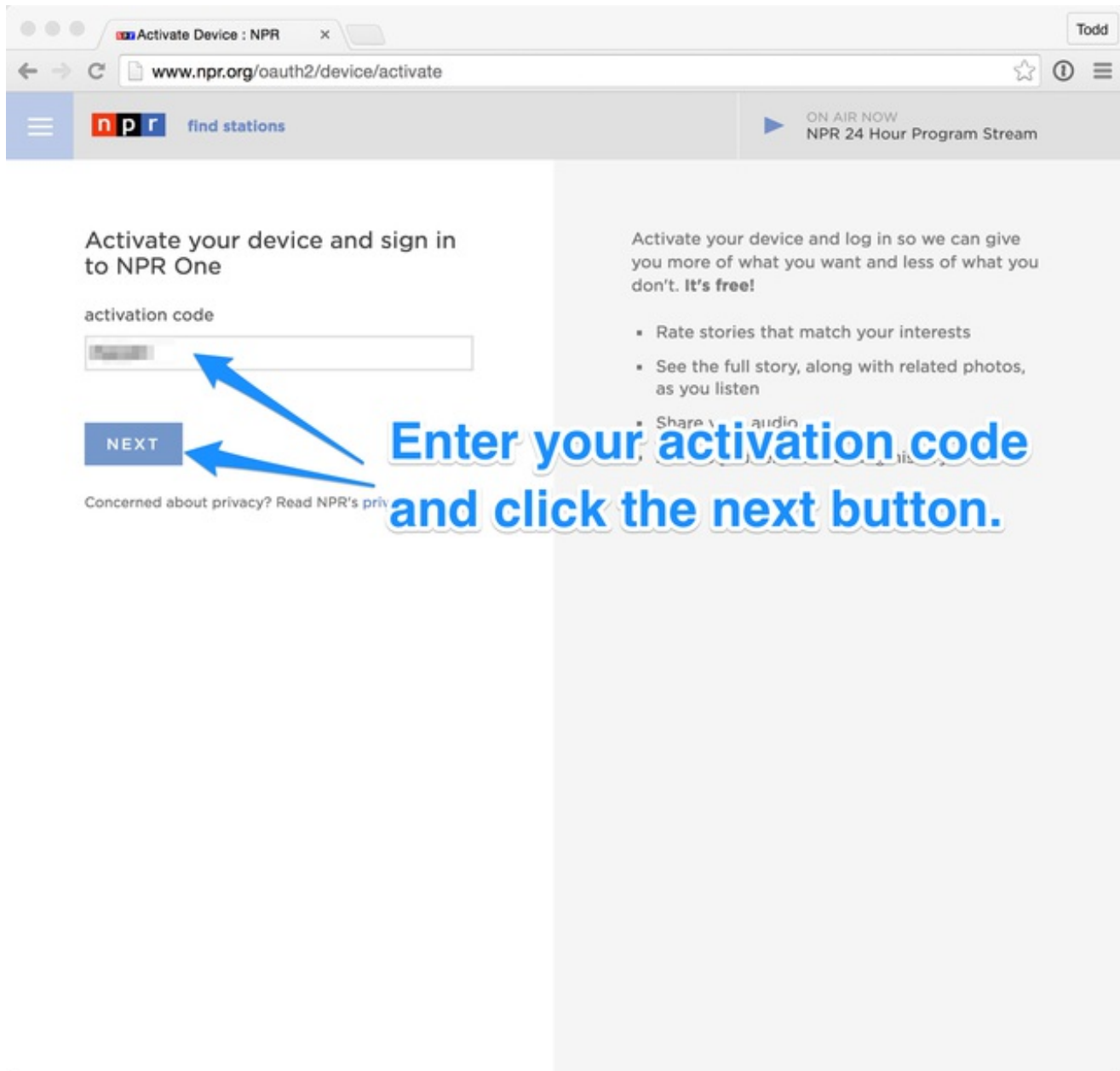
Do not select the complete option until you have authorized the app
at <http://www.npr.org/device> (<http://adafru.it/obO>).

```
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

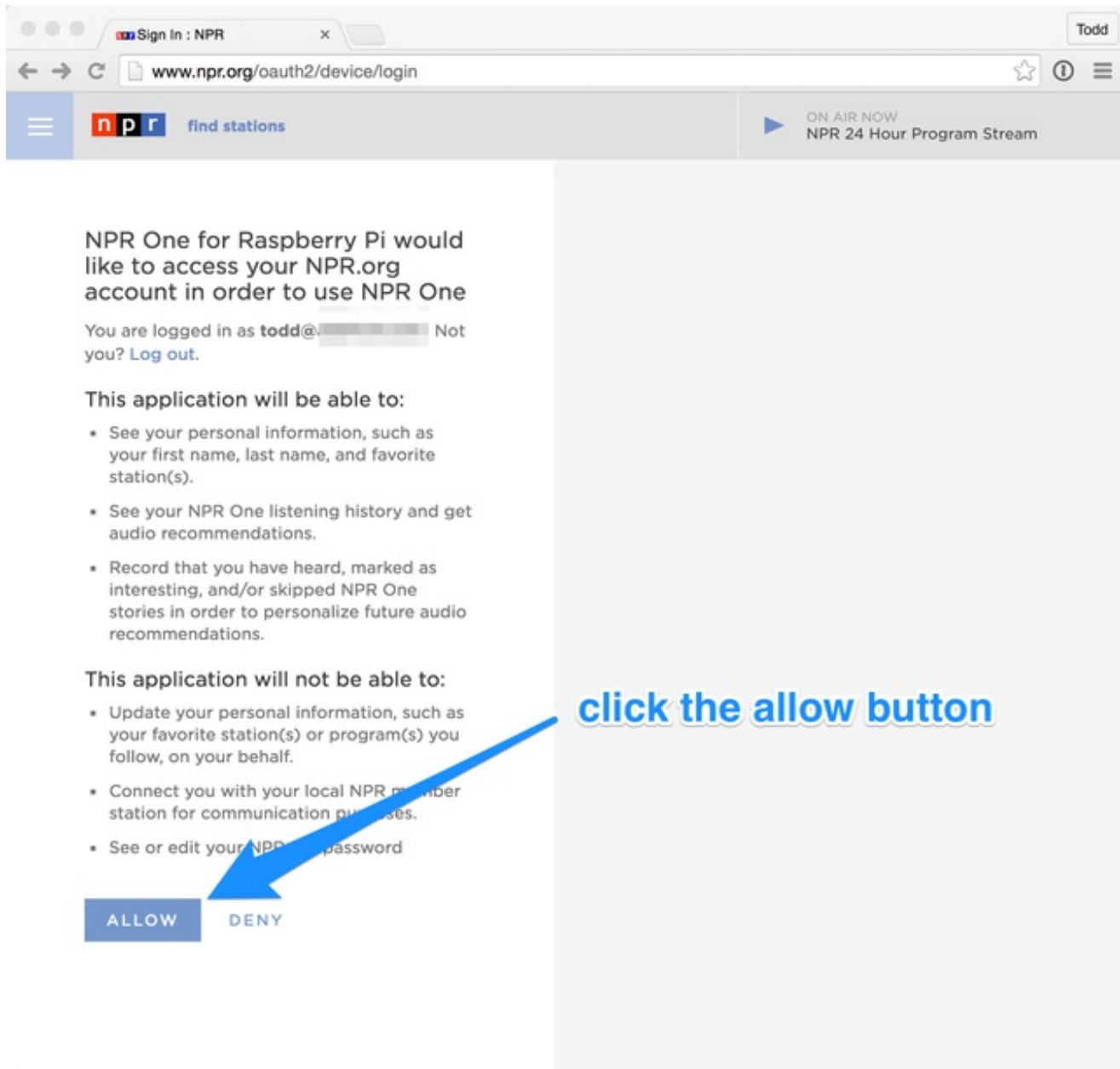




connecting to npr one...
? NPR Application ID 
? NPR Application Secret 
? Authorize the NPR One CLI @ http://www.npr.org/device using code:  (Use
arrow keys)
> Complete
Exit
```

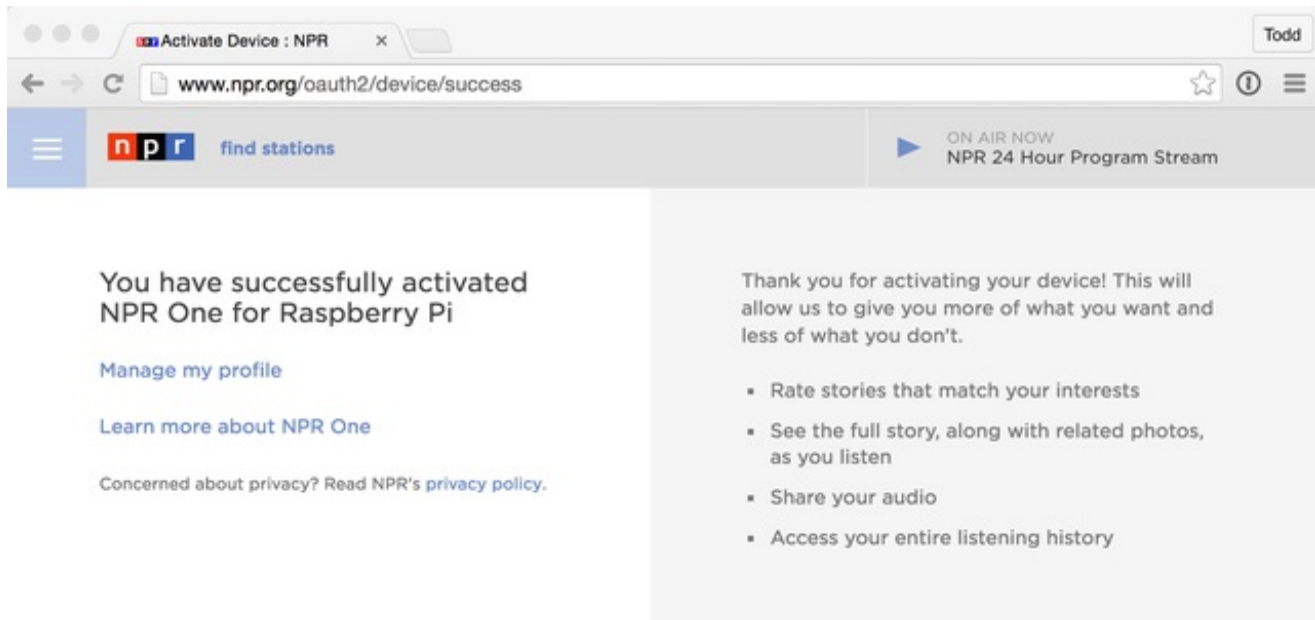
Enter your activation code on the NPR website, and press the *Next* button.



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.

```
$ pi2 start npr-one && pi2 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.

```
$ pi2 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](#)

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