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## AdaBox 004

Created by Tyler Cooper



Last updated on 2017-08-29 03:37:41 PM UTC

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# Introduction

## Hi there!

[If you're looking to buy AdaBox001 click here!](http://adafru.it/3193)(<http://adafru.it/3193>)

[If you're looking to buy AdaBox002 click here!](http://adafru.it/3235)(<http://adafru.it/3235>)

[If you're looking to subscribe to AdaBox, click here!](http://adafru.it/tNC)(<http://adafru.it/tNC>)

If you're here, it's because you were given the gift of electronics with an AdaBox! You are a beginner who is getting started with your AdaBox or you just want to relive what it's like being a beginner at electronics again. But most of all, you want to learn how to build and make stuff with electronics! ([If, rather than learn electronics, you'd like to look at pictures of cats instead, please check https://www.adafruit.com/galleries/cats-of-engineering](https://www.adafruit.com/galleries/cats-of-engineering) (<http://adafru.it/oAd>))

And, you're in luck: there's *never* been a better time.

Gone are the days where you need thousands of dollars of equipment and lots physics/math background. Nowadays, if you want to learn to work with electronics, you can jump right in for \$100 or less, and any sort of computer. And we're talking about learning *a lot* of electronics - from the basics of analog to the complexities of firmware. With a good pack of parts, you can build a base of knowledge that will take you from your first blinking LED to someone who can start prototyping and inventing custom products.

## Who is this for?

Anyone with a computer they can install software on, an Arduino or compatible and the ability to type and click a mouse. That's pretty much the minimum. Remember, this guide is specifically for people who have purchased or received an AdaBox subscription!

**You don't need to know a lot of physics or math** and just like an Art Degree isn't required for making art and being creative, **you *don't* need to have a computer science degree** It helps if you're comfortable using computers but that's a skill most people pick up through life.

**If you know how to program already - great! If not, don't worry, we'll teach you enough to be dangerous.**



# Who isn't this for?

While you can follow along without an AdaBox, it will not make as much sense unless you have *all* of the components and more which either came as a gift or purchased yourself - remember, the goal is helping beginners!

If you're an expert, please visit our hundreds other tutorials and jump right in at [learn.adafruit.com](http://adafruit.com) (<http://adafruit.com>)

# Who are you?

Great question. This is me:

I'm Ladyada, and I love to teach people how to build stuff and how they can be creative with technology.

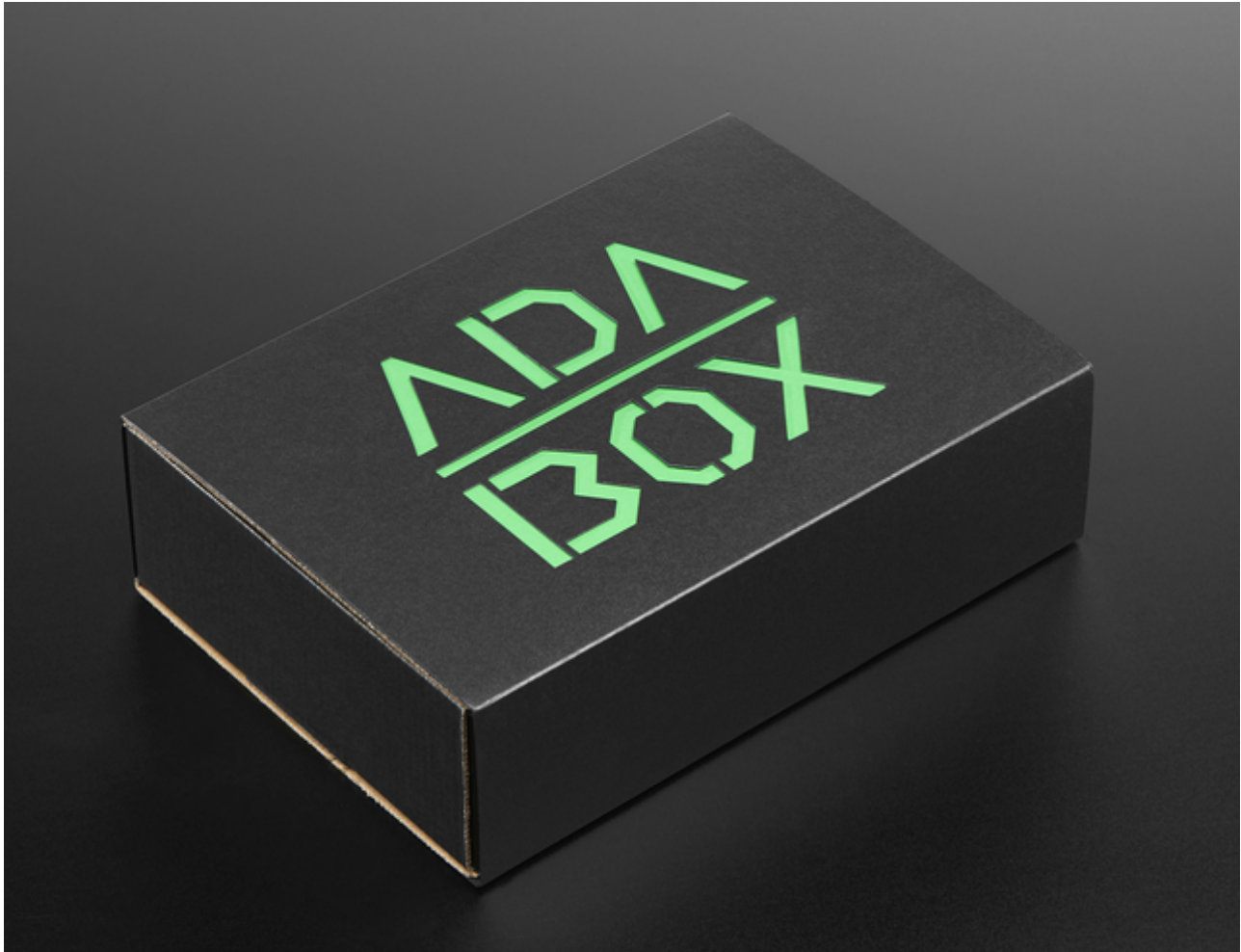
So, are you ready?

Let's do this thing!



extras you need, ready to rock!

- [MusicMaker FeatherWing with Amplifier - pre-soldered](http://adafru.it/w0f) (<http://adafru.it/w0f>) - It's a fun-size version of our [Music Maker shield for Arduino](http://adafru.it/tbM) (<http://adafru.it/tbM>), and similar to [our other Music Maker FeatherWing](http://adafru.it/3357) (<http://adafru.it/3357>), but this one is even better - **with an on-board 3 Watt amplifier!**
- 3W 4 ohm Speaker with wires stripped and tinned
- [Mini Remote Control](http://adafru.it/xck) (<http://adafru.it/xck>) - This little remote control would be handy for controlling a robot or other project from across the room. It has 21 buttons and a layout we thought was handy: directional buttons and number entry buttons.
- [IR Sensor](http://adafru.it/xcl) (<http://adafru.it/xcl>) - IR sensor tuned to 38KHz, perfect for receiving commands from a TV remote control. Runs at 3V to 5V so it's great for any microcontroller.
- [Premium Male/Male Jumper Wires](http://adafru.it/sd3) (<http://adafru.it/sd3>) - Handy for making wire harnesses or jumpering between headers. Essential for most electronics projects.
- [USB Cable - A/MicroB](http://adafru.it/iia) (<http://adafru.it/iia>)
- [Half Size Breadboard](http://adafru.it/keP) (<http://adafru.it/keP>) - This is a cute half size breadboard, good for small projects. Also essential for most electronics projects.
- [10K Breadboard Potentiometer](http://adafru.it/tba) (<http://adafru.it/tba>) - use this to control your volume and more.
- [SPDT Switch](http://adafru.it/drN) (<http://adafru.it/drN>) - perfect for adding an on/off switch to your music box
- [5V1A USB Power Supply](http://adafru.it/iia) (<http://adafru.it/iia>) - power your little music box with this, or connect batteries to take your music box on the go.
- AdaBox004 component bag - This is really just a single resistor :) We wanted to keep this project simple and easy to make!
- A blank box - with which imagination is your only limitation



## Bonus parts (for subscribers only!)

- Digikey's Corner - Our good friends at Digikey threw in a wonderful micro SD card for your listening pleasure!
- Adafruit Collectible Pin - Meet BOOMY the loveable boombox. BOOMY's one of our favorite companions whenever we start putting together a project since the songs that come out of him helps keep our projects moving and grooving. His favorite artists are Young Thug, deep album Yazoo, and the genre of cantu a tenore - a traditional Sardinian folk music!
- Signed copy of Make Magazine - have you ever signed 3500 autographs? Because ladyada has!



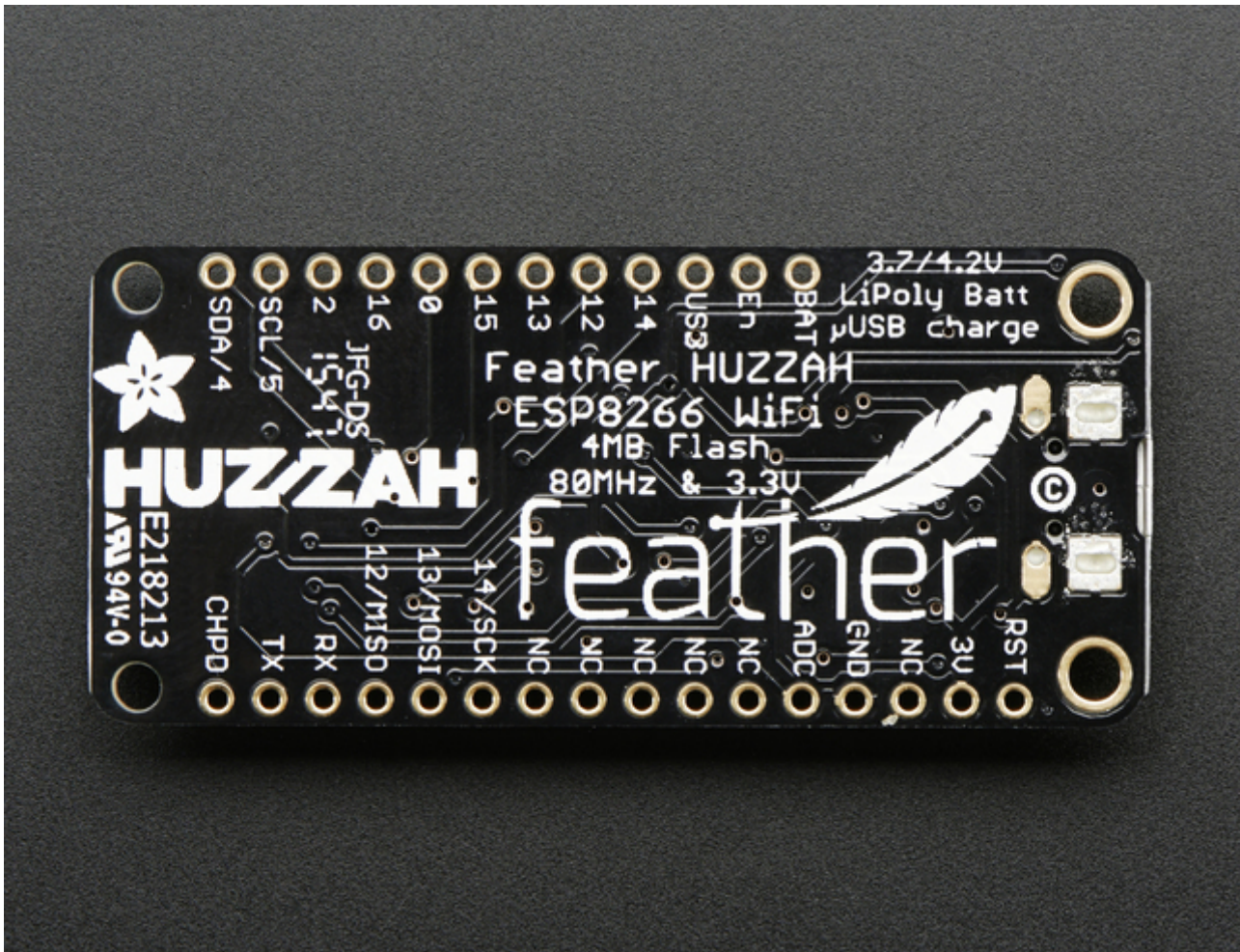
# Getting started with your new AdaBox



The first thing we are going to do is get your new HUZDAH Feather and MusicMaker FeatherWing working with your computer and the Arduino IDE. Then we will show you how to load up music onto the included SD card, and start playing that music through the included speaker.

From there we can take things to the next level by streaming music over the internet, using the IR remote to control music, connecting to Adafruit IO and making a WiFi Music Alert Box, and building a sweet 3D printed Boomy the Boombox speaker!

# The HUZZAH ESP8266 Feather



If you have received our previous AdaBoxes, you should be pretty familiar with the HUZZAH ESP8266 Feather. This is the board that you will plug your MusicMaker FeatherWing into. This little board packs a big punch:

Feather is the new development board from Adafruit, and like its namesake it is thin, light, and lets you fly! We designed Feather to be a new standard for portable microcontroller cores.

This is the **Adafruit Feather HUZZAH ESP8266** - our take on an 'all-in-one' ESP8266 WiFi development board with built in USB and battery charging. Its an ESP8266 WiFi module with all the extras you need, ready to rock! [We have other boards in the Feather family, check'em out here \(http://adafru.it/jAQ\)](http://adafru.it/jAQ).

At the Feather HUZZAH's heart is an ESP8266 WiFi microcontroller clocked at 80

MHz and at 3.3V logic. This microcontroller contains a Tensilica chip core as well as a full WiFi stack. You can program the microcontroller using the Arduino IDE for an easy-to-run Internet of Things core. We wired up a USB-Serial chip that an upload code at a blistering 921600 baud for fast development time. It also has auto-reset so no noodling with pins and reset button pressings.

To make it easy to use for portable projects, we added a connector for any of our 3.7V Lithium polymer batteries and built in battery charging. You don't need a battery, it will run just fine straight from the micro USB connector. But, if you do have a battery, you can take it on the go, then plug in the USB to recharge. The Feather will automatically switch over to USB power when its available.

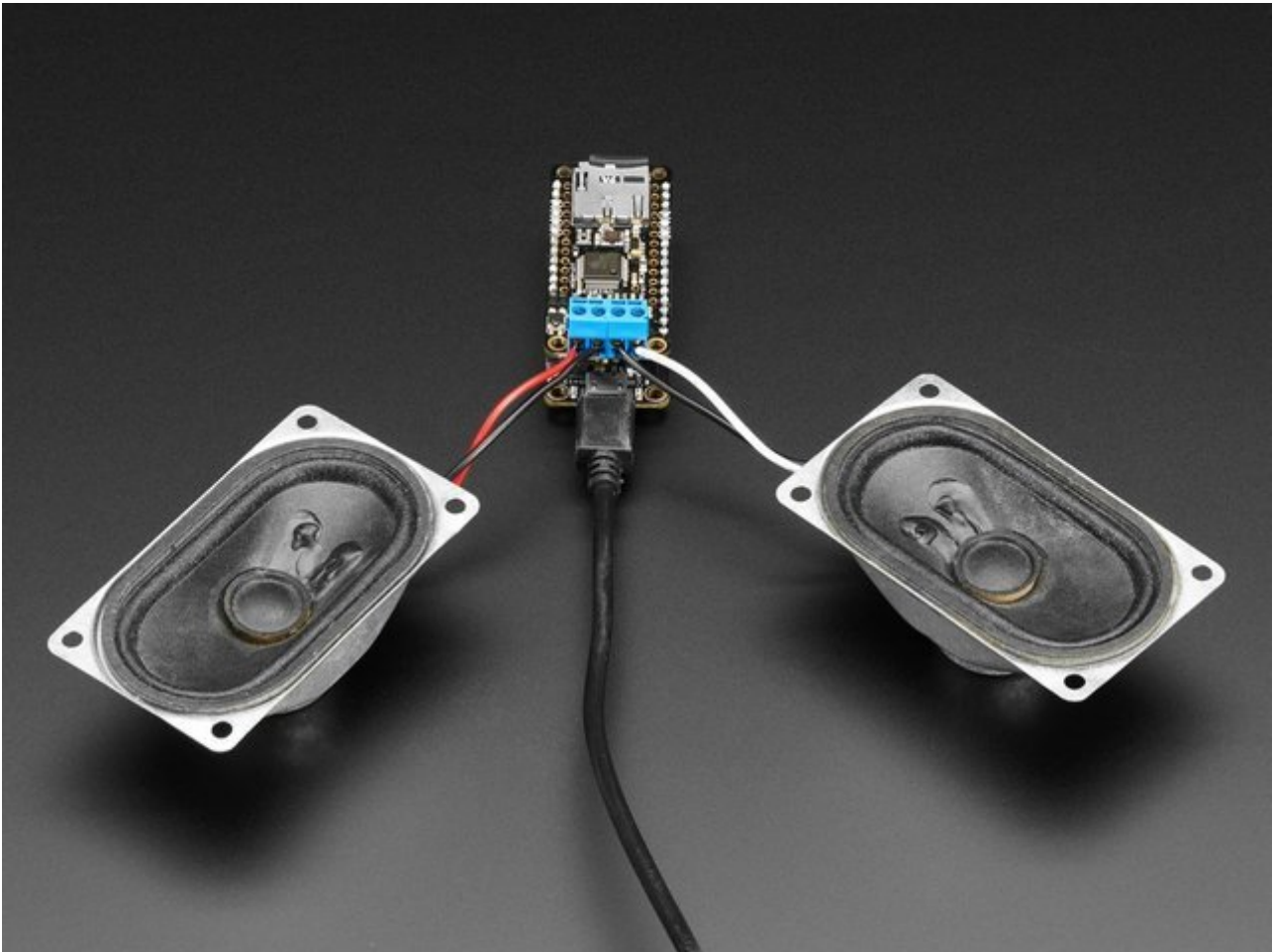
Head over to the HUZDAH Feather guide to learn more about this board and how to get it connected to the internet.

[Click here for the HUZDAH Feather Guide](#)

<http://adafruit.it/kD3>



# The MusicMaker FeatherWing



Now that you have played around with your HUZDAH Feather, you are going to want to get acquainted with the star of the show, the MusicMaker FeatherWing:

Bend all audio files to your will with the **Adafruit Music Maker FeatherWing + Amplifier!** It's a fun-size version of our [Music Maker shield for Arduino](http://adafru.it/tbM) (<http://adafru.it/tbM>), and similar to [our other Music Maker FeatherWing](http://adafru.it/3357) (<http://adafru.it/3357>), but this one is even better - **with an on-board 3 Watt amplifier!** This powerful wing features the VS1053, an encoding/decoding (codec) chip that can decode a wide variety of audio formats such as MP3, AAC, Ogg Vorbis, WMA, MIDI, FLAC, WAV (PCM and ADPCM). You can do all sorts of stuff with the audio as well such as adjusting bass, treble, and volume digitally.

All this functionality is implemented in a light-weight SPI interface so that any Feather Board can play audio from an SD card. There's also a special MIDI mode

that you can boot the chip into that will read 'classic' 31250Kbaud MIDI data from the UART TX pin and act like a synth/drum machine - there are dozens of built-in drum and sample effects!

What a great musical add-on to your Feather! That's why we spun up this super FeatherWing, perfect for use with any of our Feather Boards! Music playback testing working with ATmega32u4, ATSAMD M0, ESP8266, WICED Teensy 3, and nRF52 Feathers. MIDI playback works with all Feathers but you may need to remove the 'Wing during programming and also for USB-Serial Feathers like the ESP8266 and nRF52 you'll end up re-using the main Serial console for MIDI which can be confusing.

Here are some specs:

- Features the VS1053B codec chip - decodes Ogg Vorbis, MP3/MP2/MP1, MP4, AAC, WMA, FLAC, WAV/PCM, MIDI
- Stereo audio out to any 4ohm speakers (3W max) or 8 ohm speakers (1W max), class D output
- MicroSD card socket, for any FAT16/FAT32 formatted SD card from 64MB or greater
- Built in MIDI synth/drum machine with dozens of instruments

Start by heading over to the MusicMaker FeatherWing guide to learn how to get your MusicMaker FeatherWing to play music and make noises.

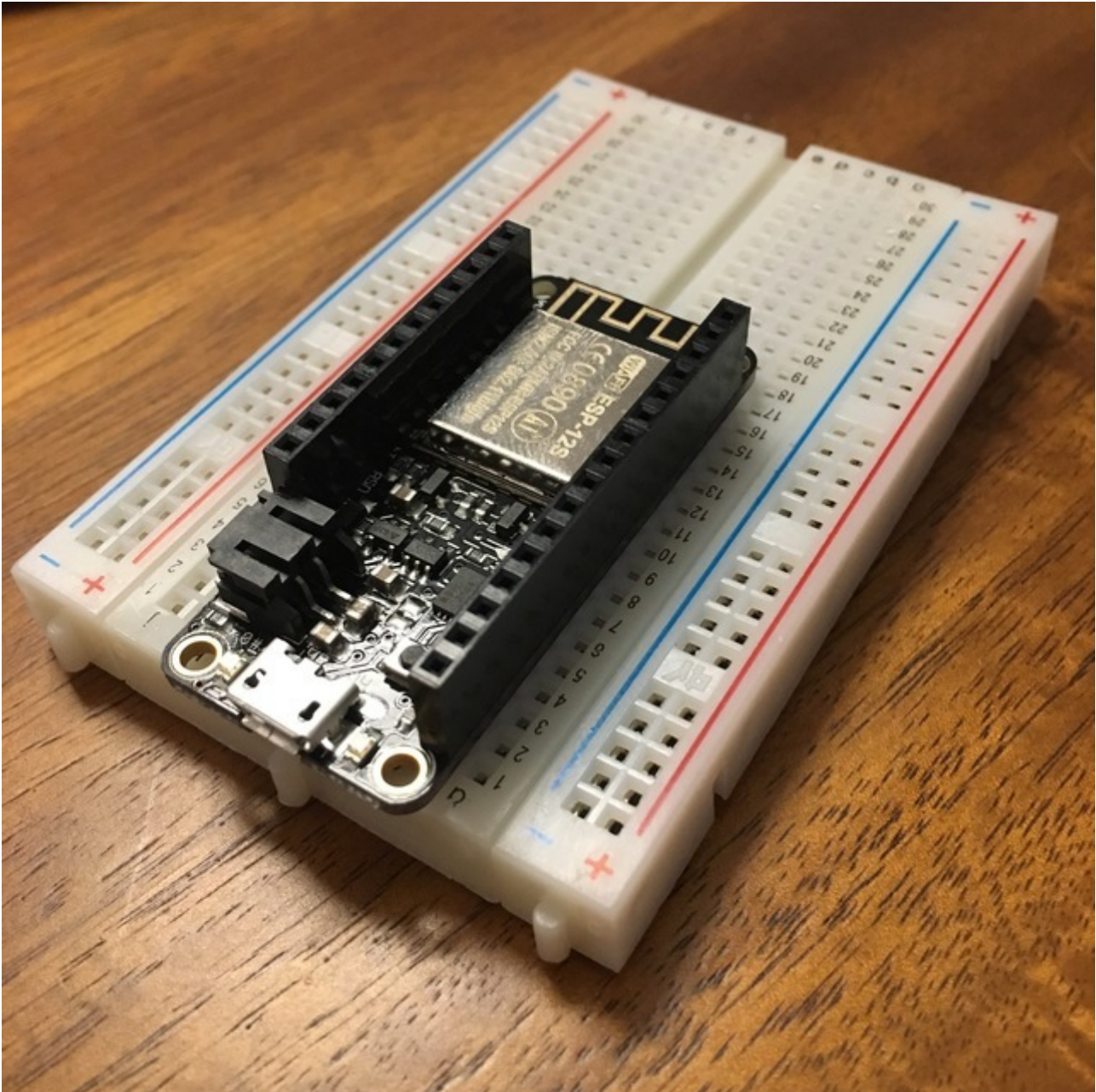
[Click here for the MusicMaker FeatherWing Guide](#)

<http://adafruit.it/xcm>



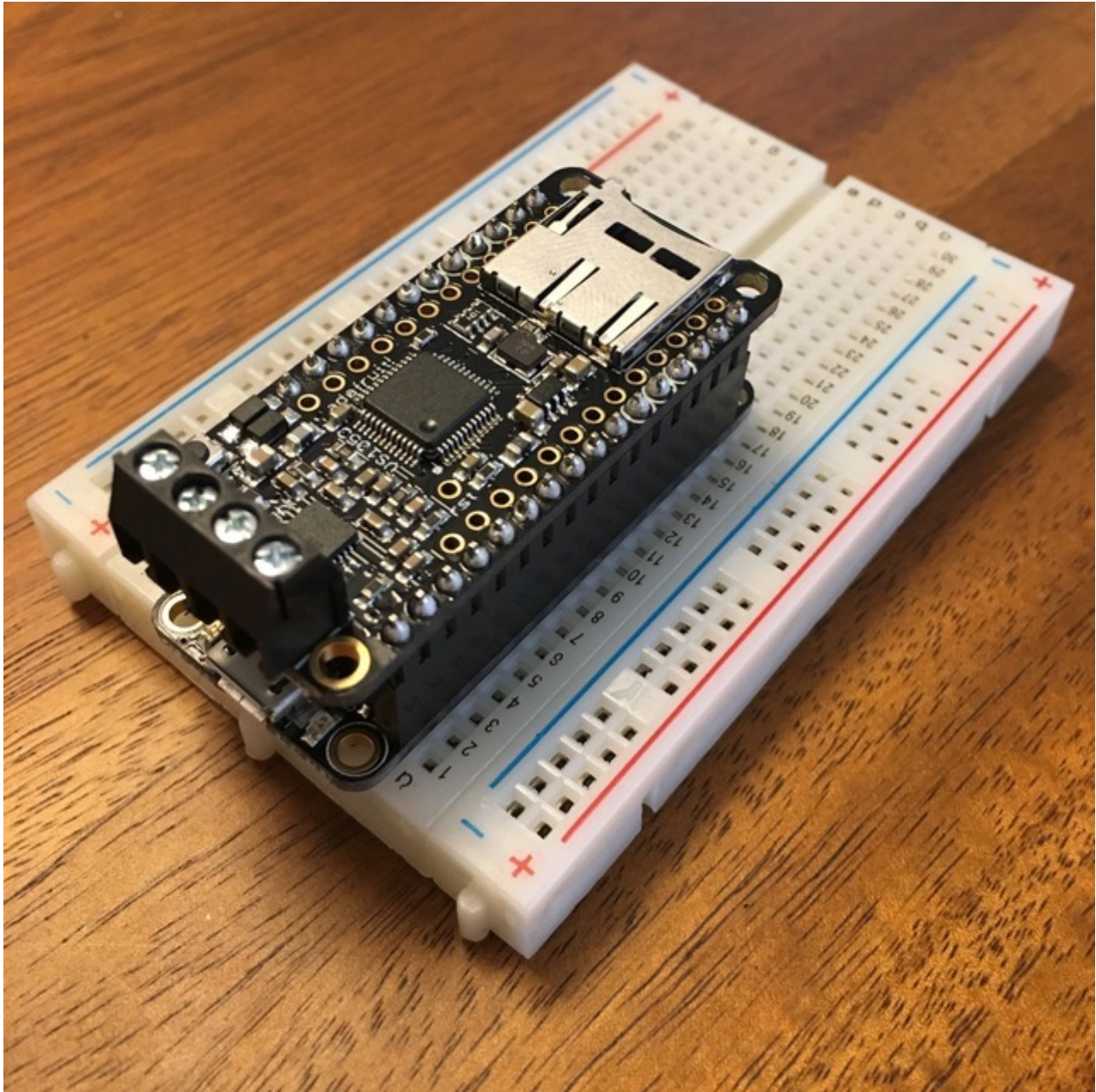
# Building your music player

We are going to build this music player right on the included breadboard. Start by plugging your HUZAZH Feather directly into the breadboard like this:



Then take your MusicMaker FeatherWing and plug it into the HUZAZH Feather:

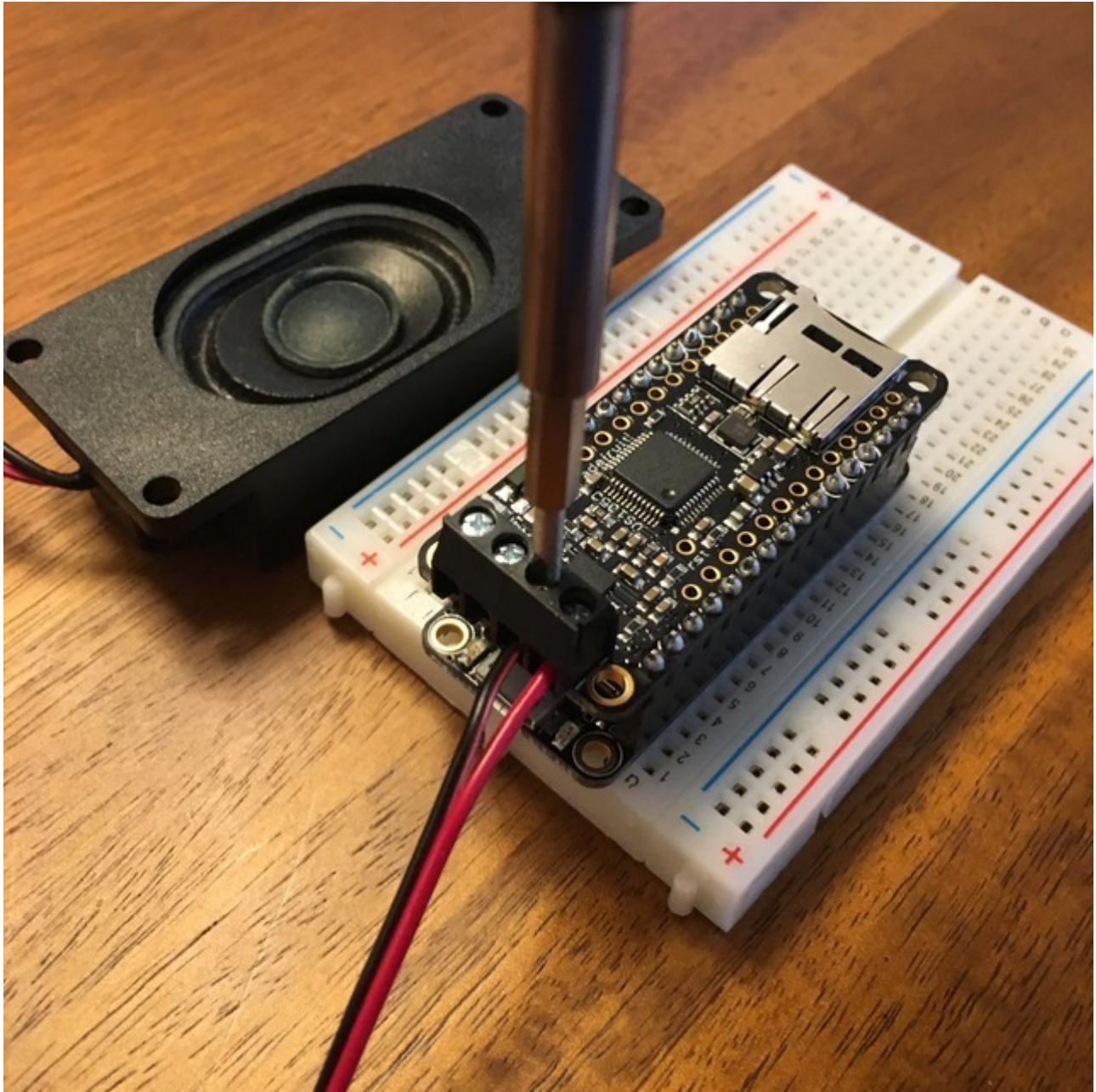




Now, grab a small screwdriver and attach the speaker wires to the MusicMaker FeatherWing terminals. We are only going to use the one speaker, so it really doesn't matter which speaker channel you choose. You can put it in the right, or left side. Just make sure to connect the red (positive) wire to one of the outside terminals, and the black (negative) wire to one of the inside terminals.

In the picture below, you can see I attached the wires to the left channel with the red wire in the outside position.





Tighten the screws and we are ready to load some music onto the SD card.

# Loading music onto the SD card

For this step you will need an SD card reader. These are often built into computers, or you can pick one up from Adafruit below.



## USB MicroSD Card Reader/Writer - microSD / microSDHC / microSDXC

PRODUCT ID: 939

This is the cutest little microSD card reader/writer - but don't be fooled by its adorableness! It's wicked fast and supports up to 64 GB SDXC cards! Simply slide the card into the edge...

<http://adafru.it/ree>

\$5.95

OUT OF STOCK

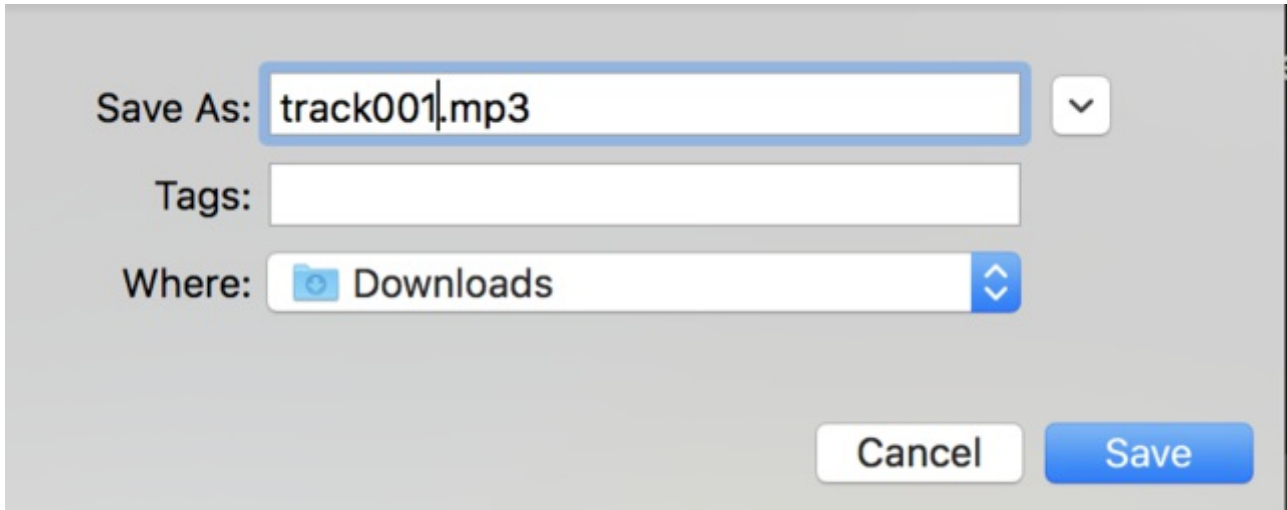
We are going to start by just uploading a single mp3 file. If you don't already have one, don't worry! BartleBeats created a custom AdaBox 004 soundtrack for you to enjoy on your new MusicMaker.

Right click on the button below and click 'Download Linked File'

[ADABOX004 - Bartlebeats.mp3](#)

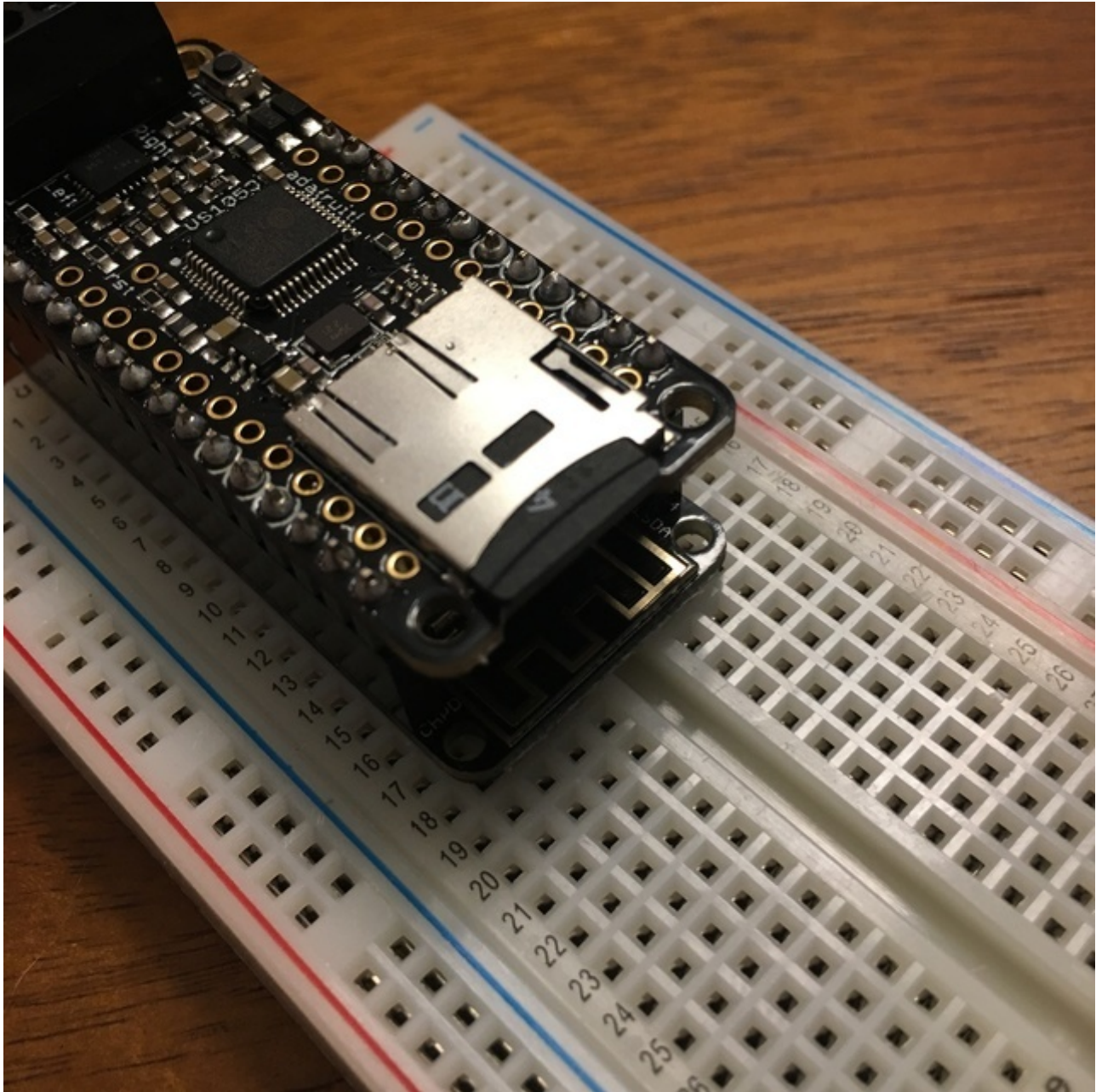
<http://adafru.it/xdm>

This will download an mp3 file called ADABOX004\_-\_Bartlebeats.mp3. In order to get this file to play on the MusicMaker FeatherWing, we need to change the file name to an 8.3 file name. This means 8 letters dot 3 letters. So, lets rename it track001.mp3



Now, copy this track to your SD card. Once it has transferred over, you can install the SD card into the MusicMaker FeatherWing. Push the Micro SD card into the MusicMaker until it clicks into place.





Now we can load some code onto the HUZAZH Feather and start playing some music.

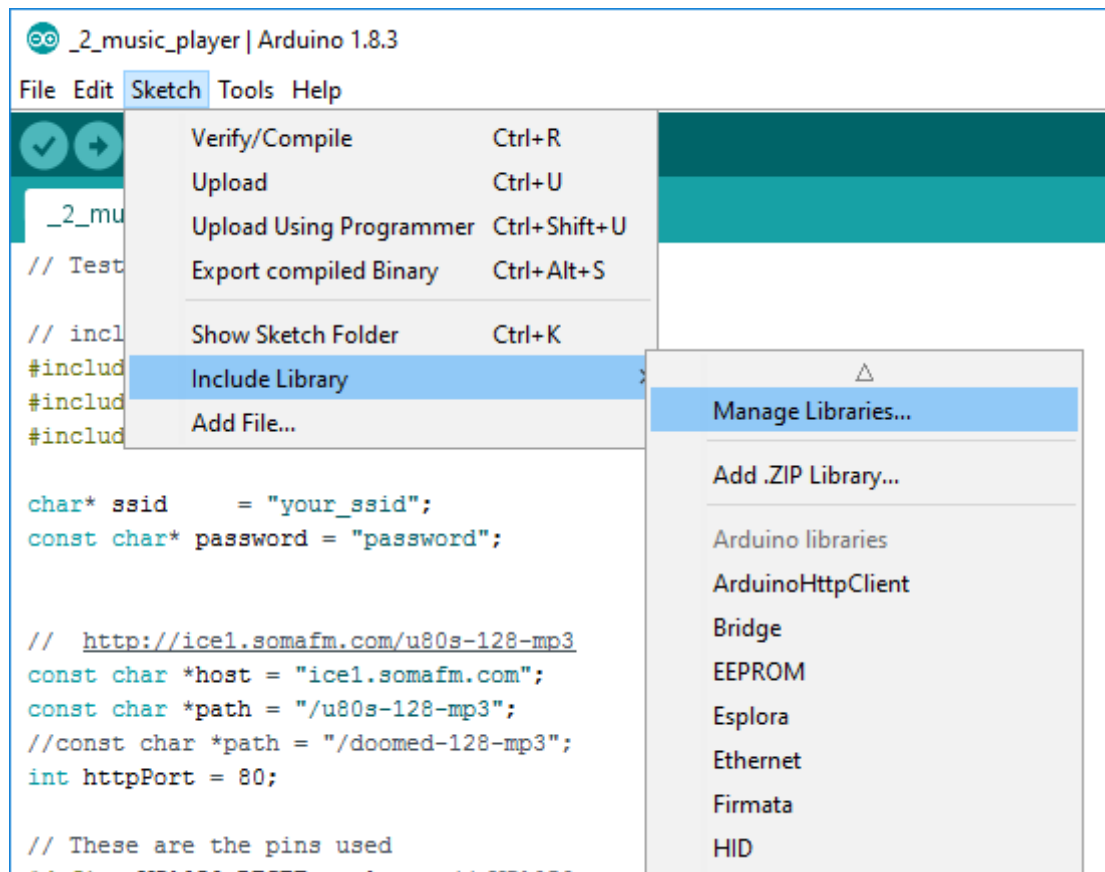
# Arduino IDE and Installing New Libraries

We aren't going to get into too much detail about the Arduino IDE and how to install new libraries, as we have plenty of those on the Adafruit Learning System already.

[Learn about the Arduino IDE here](http://adafru.it/xdn)  
<http://adafru.it/xdn>

The next few pages are going to go over some basic code you can use to get your new HUZDAH Feather and MusicMaker FeatherWing to play nice together. All of them will require some special libraries. You can either use this guide on installing libraries manually, or you can use the latest Arduino IDE Library Manager to do the work for you.

Go to Sketch > Include Library > Manage Libraries...



Then, search for the library you want to install, and click on the correct library name. Then click install. That's it!

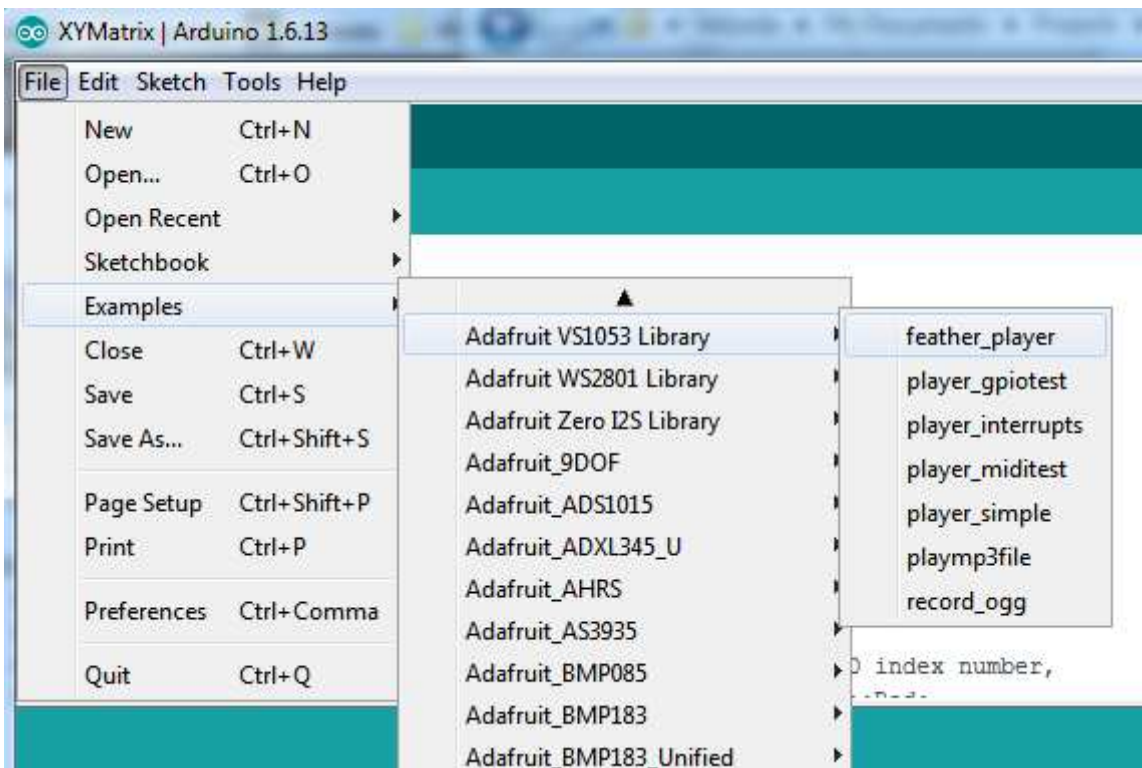


Each of the next pages will tell you which libraries you will need to install. Here we go...

# Playing your first mp3

For the first sketch, we are going to need the Adafruit\_VS1053 library, as well as the SD library. Using the library manager like shown in the previous step, make sure both are installed.

With the VS1053 library installed, we can use the example sketch. Select **File->Examples->Adafruit\_VS1053->feather\_player** to load the example code.



All you need to do is upload that sketch to your Feather and the mp3 should start playing. You can open the serial console to check on the status. It should say something like this (you may need to press the reset button on the MusicMaker FeatherWing with the serial console open to see this):

```
VS1053 found
SD OK!
TRACK001.MP3 14005206
Playing full track 001
```

if you have more files on the SD card, those will also appear. Note the 8.3 naming shows up with the size of the file. Our file is there, and is called **TRACK001.MP3**

# Streaming Internet Radio

This bit of code is going to allow you to stream music over the internet right to your MusicMaker FeatherWing. You will need to have access to WiFi for this to work.

First up, you will need to install two libraries. Check out the previous page for tips on installing libraries. The first library is the Adafruit\_VS1053 library, and the second is the ESP8266WiFi library.

At the top of the code you will see where to enter your WiFi SSID (the name of your WiFi network), and the password. Make sure to leave the quotation marks, and only replace the text between them.

```
char* ssid = "your_ssid";  
const char* password = "password";
```

Below that you will see where you can enter radio stations. For this example, we are using SomaFM to get live, free streaming radio. They're awesome, please donate if you like the streams! The station we are using in the code is an 80's station, but you can just go to [SomaFM.com \(http://adafru.it/xCQ\)](http://adafru.it/xCQ) and pick your own station. When you click on a station, in the left sidebar click on '**Direct Stream Links**' and copy the direct server link info for **MP3 128kb**. Make sure to use the same formatting as shown in the code:

```
// http://ice1.somafm.com/u80s-128-mp3  
const char *host = "ice1.somafm.com";  
const char *path = "/u80s-128-mp3"; //this is the part you need to change  
//const char *path = "/doomed-128-mp3";  
int httpPort = 80;
```

Of course you can use any mp3-streaming service. Just put in the domain name **irhost**, the path to the mp3 stream in **path** and change the **httpPort** if necessary

Here is the full code. Upload this code to your MusicMaker setup and open the serial console. You should see it connect to your network and start playing some music. You will notice that there is a bit of code in there for adding in a potentiometer and on/off switch. We will add these next.

Don't worry if the audio seems to sounds weird - we haven't added an essential potentiometer part so as long as you hear *\*something\** keep going!

```
// Tested: ESP8266, ESP32, M0+WINC1500
```

```
// include SPI, MP3 and SD libraries  
#include <SPI.h>
```



```

#include <Adafruit_VS1053.h>
#include <ESP8266WiFi.h>

char* ssid = "your_ssid";
const char* password = "password";

// http://ice1.somafm.com/u80s-128-mp3
const char *host = "ice1.somafm.com";
const char *path = "/u80s-128-mp3";
//const char *path = "/doomed-128-mp3";
int httpPort = 80;

// These are the pins used
#define VS1053_RESET -1 // VS1053 reset pin (not used!)
#define VS1053_CS 16 // VS1053 chip select pin (output)
#define VS1053_DCS 15 // VS1053 Data/command select pin (output)
#define VS1053_DREQ 0 // VS1053 Data request, ideally an Interrupt pin

#define VOLUME_KNOB A0
#define ON_OFF_SWITCH 4

int lastvol = 30;

Adafruit_VS1053 musicPlayer = Adafruit_VS1053(VS1053_RESET, VS1053_CS, VS1053_DCS, VS1053_DREQ);

// Use WiFiClient class to create HTTP/TCP connection
WiFiClient client;

void setup() {
  Serial.begin(115200);

  Serial.println("\n\nAdafruit VS1053 Feather WiFi Radio");

  /****** INITIALIZE MP3 WING */
  if (!musicPlayer.begin()) { // initialise the music player
    Serial.println(F("Couldn't find VS1053, do you have the right pins defined?"));
    while (1) delay(10);
  }

  Serial.println(F("VS1053 found"));
  musicPlayer.sineTest(0x44, 500); // Make a tone to indicate VS1053 is working

  // Set volume for left, right channels. lower numbers == louder volume!
  musicPlayer.setVolume(lastvol, lastvol);

  // don't use an IRQ, we'll hand-feed

  pinMode(ON_OFF_SWITCH, INPUT_PULLUP);
  /****** INITIALIZE WIFI */
  Serial.print("Connecting to SSID "); Serial.println(ssid);
  WiFi.begin(ssid, password);

  while (WiFi.status() != WL_CONNECTED) {

```

```

    delay(500);
    Serial.print(".");
}

Serial.println("WiFi connected");
Serial.println("IP address: "); Serial.println(WiFi.localIP());

/***** INITIALIZE STREAM */
Serial.print("connecting to "); Serial.println(host);

if (!client.connect(host, httpPort)) {
    Serial.println("Connection failed");
    return;
}

// We now create a URI for the request
Serial.print("Requesting URL: ");
Serial.println(path);

// This will send the request to the server
client.print(String("GET ") + path + " HTTP/1.1\r\n" +
             "Host: " + host + "\r\n" +
             "Connection: close\r\n\r\n");
}

// our little buffer of mp3 data
uint8_t mp3buff[32]; // vs1053 likes 32 bytes at a time

int loopcounter = 0;

void loop() {
    if (!digitalRead(ON_OFF_SWITCH)) {
        yield();
        return;
    }

    loopcounter++;

    // wait till mp3 wants more data
    if (musicPlayer.readyForData()) {
        //Serial.print("ready ");

        //wants more data! check we have something available from the stream
        if (client.available() > 0) {
            //Serial.print("set ");
            // yea! read up to 32 bytes
            uint8_t bytesread = client.read(mp3buff, 32);
            // push to mp3
            musicPlayer.playData(mp3buff, bytesread);

            //Serial.println("stream!");
        }
    }
}

```

```
}  
} else {  
  if (loopcounter >= 1000) {  
    loopcounter = 0;  
    // adjust volume!  
    int vol = 0;  
    vol = analogRead(VOLUME_KNOB);  
    vol /= 10;  
    if (abs(vol - lastvol) > 3) {  
      Serial.println(vol);  
      lastvol = vol;  
      musicPlayer.setVolume(lastvol, lastvol);  
    }  
  }  
}  
}  
}
```