

Recipe to deliver a “project based learning” STEM experience to high school students

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About this project



The objective of this project is to create a “hands on learning experience” for students .

Goals

- ❖ 1. Introduce Electronic components
 - a. Adafruit Gemma M0 microcontrollers
 - b. NeoPixel ring
- ❖ 2. Introduce Circuit Python and use it to write to Microcontroller with mu-editor
- ❖ 3. Create a complete electronic circuit with soldered connections

Stretch Goals

Design and create a product with the circuit

Electronic Components

A microcontroller is a mini-computer that is integrated on one circuit. The Gemma M0 (Figure 1) is a small microcontroller that has many useful features. It can be used with Arduino IDE and CircuitPython, and it can contain up to 256 kilobytes of flash memory and up to 32 KB of random access memory (RAM).

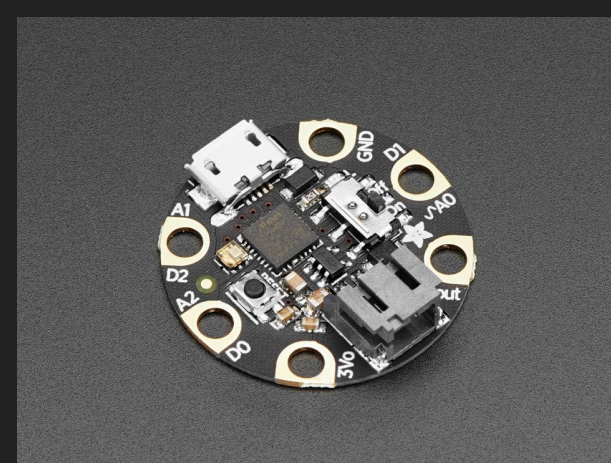


Figure 1

NeoPixel Ring (Figure 2) consists of sixteen ultra bright light-emitting diode (LED) lights set up in a circle. In order for it to function, it must be connected to a microcontroller, such as the Gemma M0.



Figure 2

Python and CircuitPython by Anay Pant

We used [Python3](#) to program our microcontroller. Python is a programming language that lets you work quickly and efficiently.

We used a library called [Circuit Python](#) (Figure 3) that allows controlling the Gemma M0 via modules such as keyboard, bus-device etc.

<https://learn.adafruit.com/welcome-to-circuitpython/what-is-circuitpython>

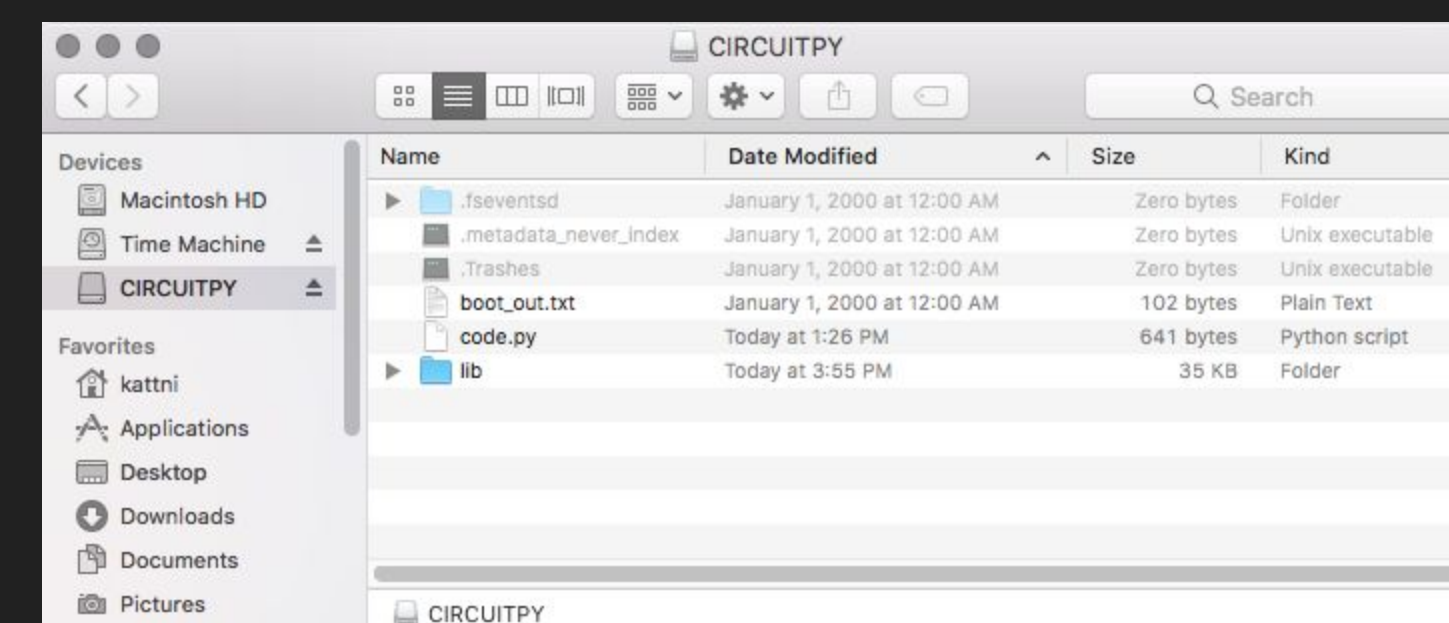


Figure 3

Mu-editor

[Mu editor](#) is a simple editor for Python beginners. (Figure 4)

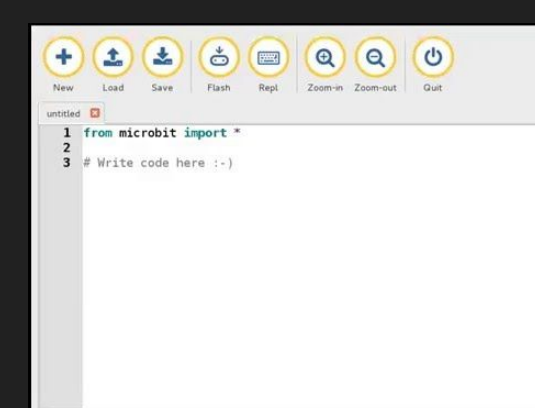


Figure 4

It can be used to write code to Gemma M0 (Figure 5)

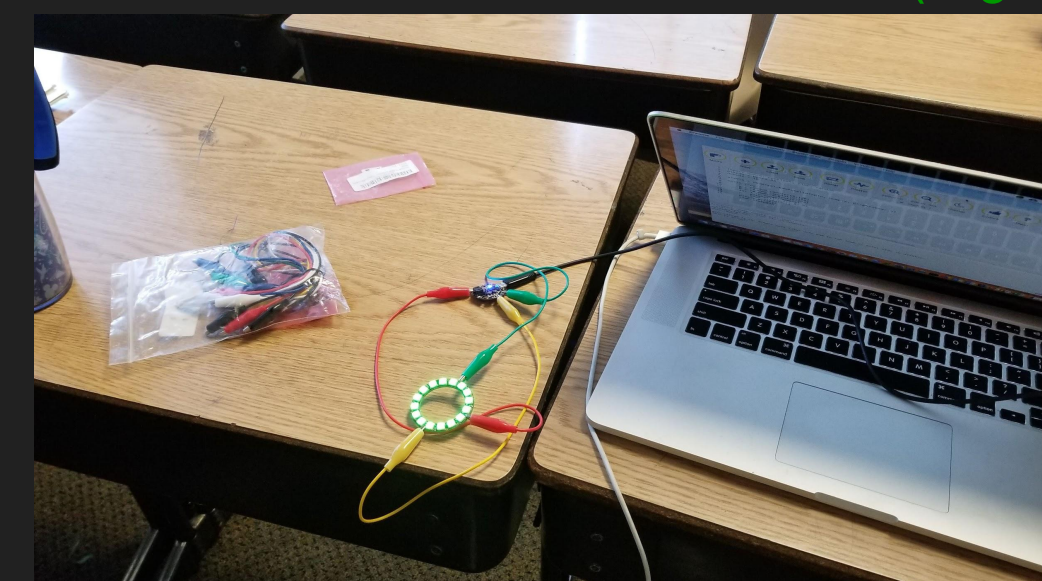


Figure 5

Writing to Gemma M0

1. Connect a USB to mini cable from the Gemma M0 to the computer.
2. Once connected, a folder named CIRCUITPY should show up on the computer.
3. A file named main.py should be found in the folder.
4. Write your code in the main.py file
5. Press save, code in main.py is updated

We wrote simple lines python code that control the 16 LEDs on the neopixel ring and color them every few seconds with a random RGB values. (Figure 6)



Figure 6

Building the circuit

We made an electrical circuit between Gemma M0 and neopixel ring . We followed [instructions from Adafruit](#) and created a circuit as shown (Figure 7 & 8)

We used a stranded-core wire , soldering iron , solder wire, wire strippers and wire cutter to build the circuit.

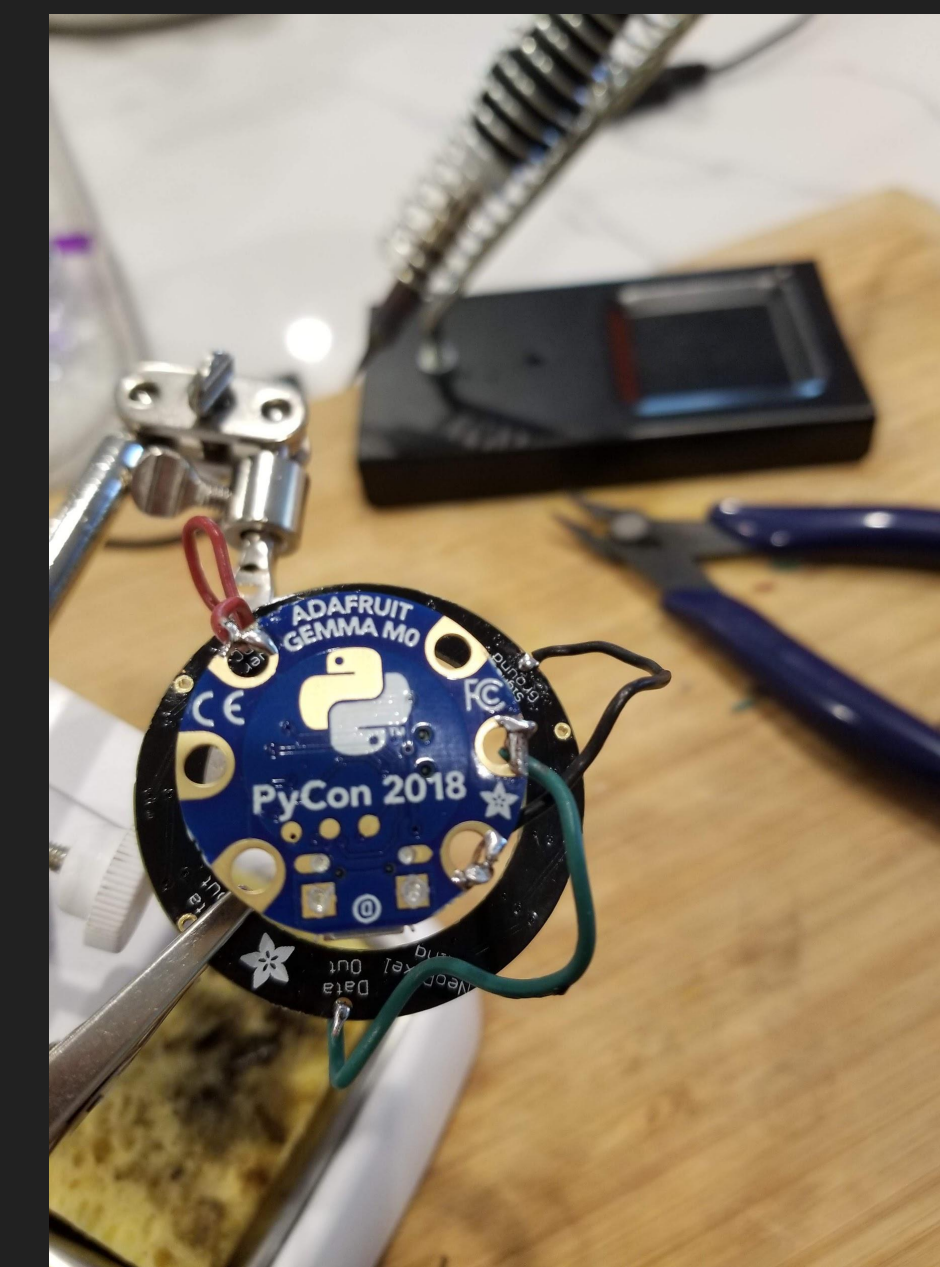


Figure 7

We used AAA battery holder with on-off pin and a 2-pin JST to power the circuit.

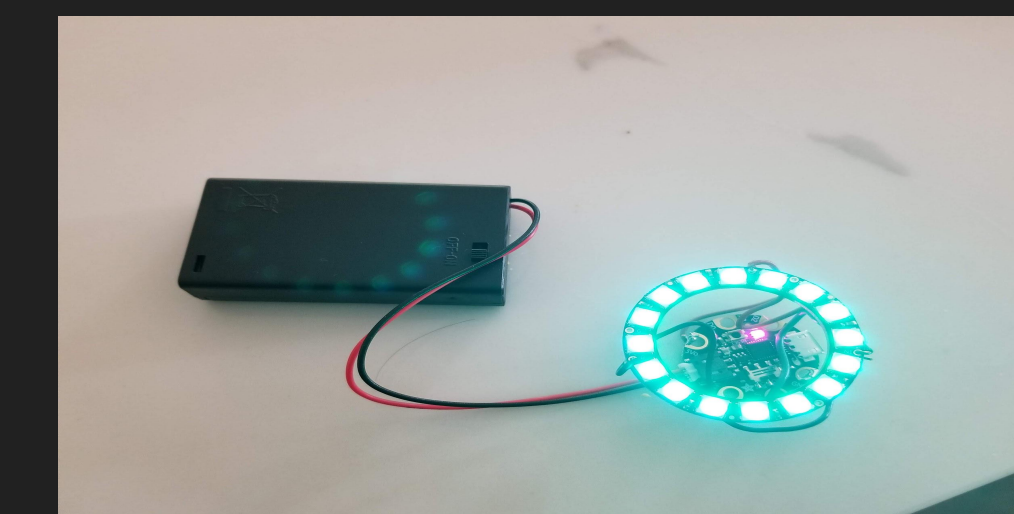


Figure 8

3D print design by Aarav Pant

The goal is to create a Christmas ornament. Using tools like Tinkercad and Autodesk , a star shaped ornament was designed. (Figure 10)

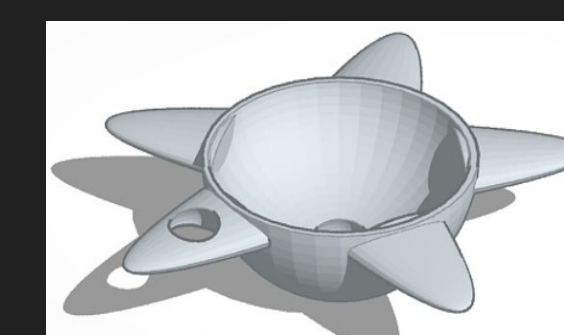


Figure 10

Steps:

1. Take measurements and draw out a sketch on paper to scale.
2. Use semicircle shapes and grouping techniques to create a solid shape
3. Create holes for battery wire and for hanging the ornament

Printing

We used a Robo 3D printer and software to print out our star! (Figure 11)

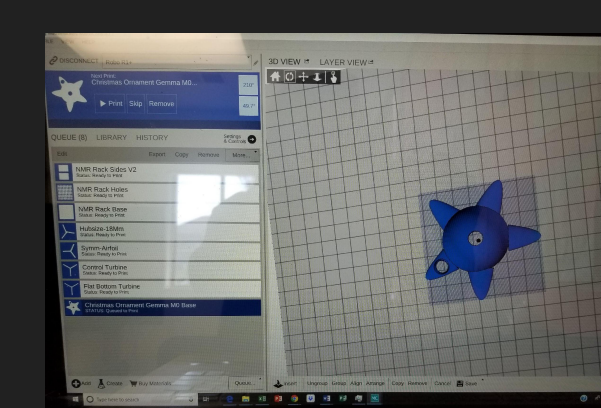


Figure 11



Outcome

We met our stretch goal of creating a product with coding and electronics. We learnt “maker” skills through this project.

Below are some pictures:



Press and News

1. <https://twitter.com/Hexnub/status/1036663128354942976>
2. <https://medium.com/pykids/pykids-partners-with-asdrp-18358669384242>
3. <https://blog.adafruit.com/2018/08/30/pykids-learn-electronics-with-circuitpython-and-microcontrollers-circuitpython-gemma-adafruit/>

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<https://www.fremontstem.org/asdrp>