



VU Stick

By: Naked Ninja



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The Product

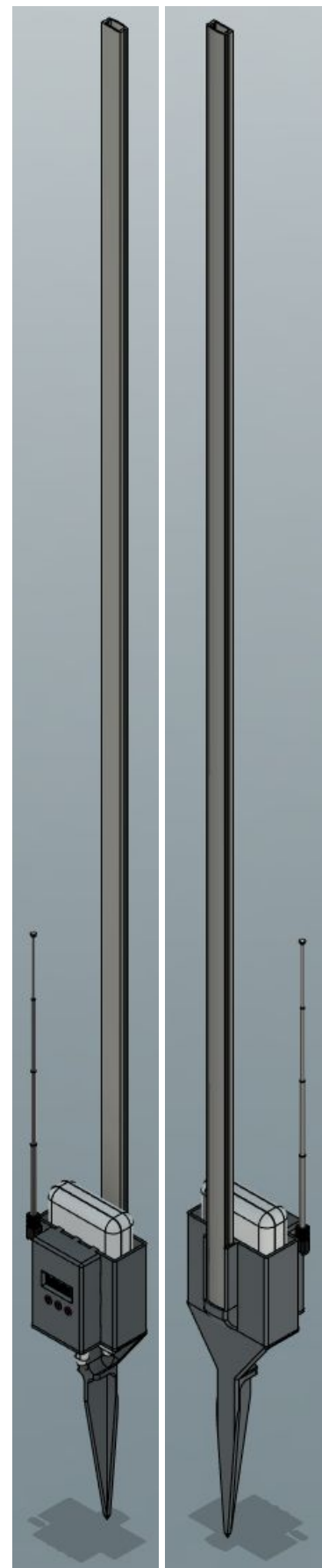


If you have soldering experience and are not intimidated by soldering tiny pins in tight spaces, then this build level should be appropriate for you. Make sure to use the proper soldering iron, solder wire, and solder paste for this project. Check the orientation of components before you solder them to the board. **The wrong orientation may damage the components, the board, etc!**

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When you have a garden party, wouldn't it be fun to have several VU meters spread throughout the garden with RGB LEDs dancing to the music you are playing? That's what the Party VU Stick is all about.

The Party VU Stick can connect to any FM radio station and dance along with the music. Want the VU Stick to dancing along with your music? It's simple! Just add an FM transmitter to your phone and set the frequency on the VU Stick and you are done.



Bill of Materials

We have no affiliation with AliExpress, Banggood, RS-Online, or any other supplier of components. You can use any source you like. If you want to order from another supplier, you can use the links listed below as a source for the specifications of the components.

Naked Ninja VU Stick PCB

[Naked Ninja webshop](#)

I2C 0.91 Inch Oled Display (with PCB)

<https://aliexpress.com/item/32672229793.html>

3 x Tactile Push Button 6x6x4.3mm

<https://aliexpress.com/item/32960657626.html>

2.54mm 3Pin Angled Male JST connector & Female Cable JST Connector (for RGB strip)

<https://aliexpress.com/item/4000120545240.html>

5V 16MHz Arduino Pro mini

Pay attention to the A4 and A5 pin locations if you buy it from a different supplier!

<https://www.digikey.nl/product-detail/en/sparkfun-electronics/DEV-11113/1568-1055-ND/5140820>

TEA5767 FM Stereo Radio Module

Pay attention to the pin locations if you buy it from a different supplier!

<https://aliexpress.com/item/4000279468853.html>

Micro USB breakout board

<https://aliexpress.com/item/4000385426649.html>

Powerbank with a micro USB cable

<https://aliexpress.com/item/4000731178541.html>

RGB LED Strip - 1M 60 IP30 option (60 LEDs)

<https://aliexpress.com/item/32966375934.html>

5 x Self-tapping Screw M3 8mm

<https://aliexpress.com/item/32596628894.html>

Resistors (2x 4.7k Ohm, 2x 10k Ohm, 1x 100k Ohm, 1x 470 Ohm)

<https://aliexpress.com/item/32636020144.html> (Set of resistors)

<https://aliexpress.com/item/32847096736.html> (Individual resistors)

Capacitors (1x 10uF, 1x 100uF)

<https://aliexpress.com/item/32500862928.html> (Set of capacitors)

<https://aliexpress.com/item/32887486570.html> (Individual capacitors)



PCB Assembly Instructions

The following paragraphs will explain how to assemble the VU Stick PCB. Follow each step precisely to ensure everything will work properly.

1. Start with the VU Stick PCB (photo 1 & 2) and the required components named in the bill of materials.

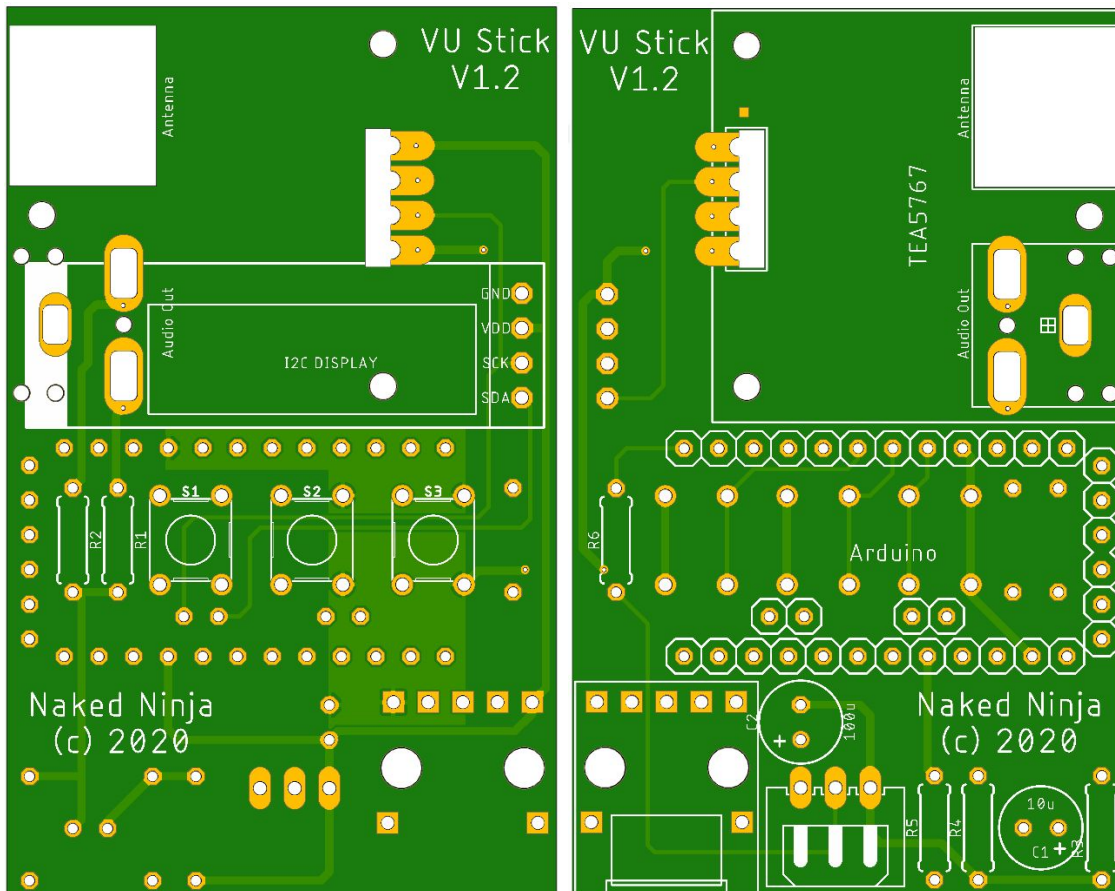


Photo 1 & 2: Front and back view of the VU Stick V1.2 PCB

2. Place and solder the three tactile buttons on the PCB

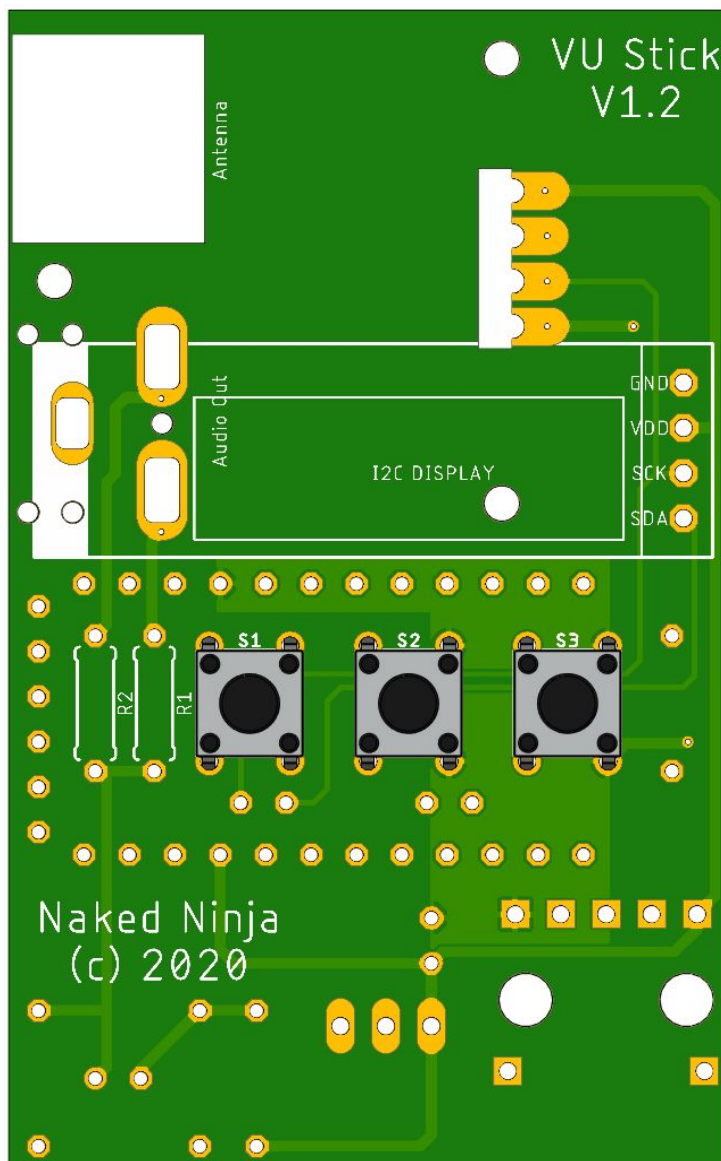


Photo 3: Front view of the VU Stick V1.2 PCB with tactile buttons placed and soldered.

3. Shorten the pins of the tactile buttons after they are soldered.

Note: This is done to prevent the button pins of touching the microcontroller board that will be soldered in future steps.



Photo 4: Back view of the VU Stick V1.2 PCB with tactile buttons pins sticking out of PCB.

4. Place and solder two 4.7k ohm resistors in the R1 and R2 slots next to the tactile buttons as illustrated in photo 5.

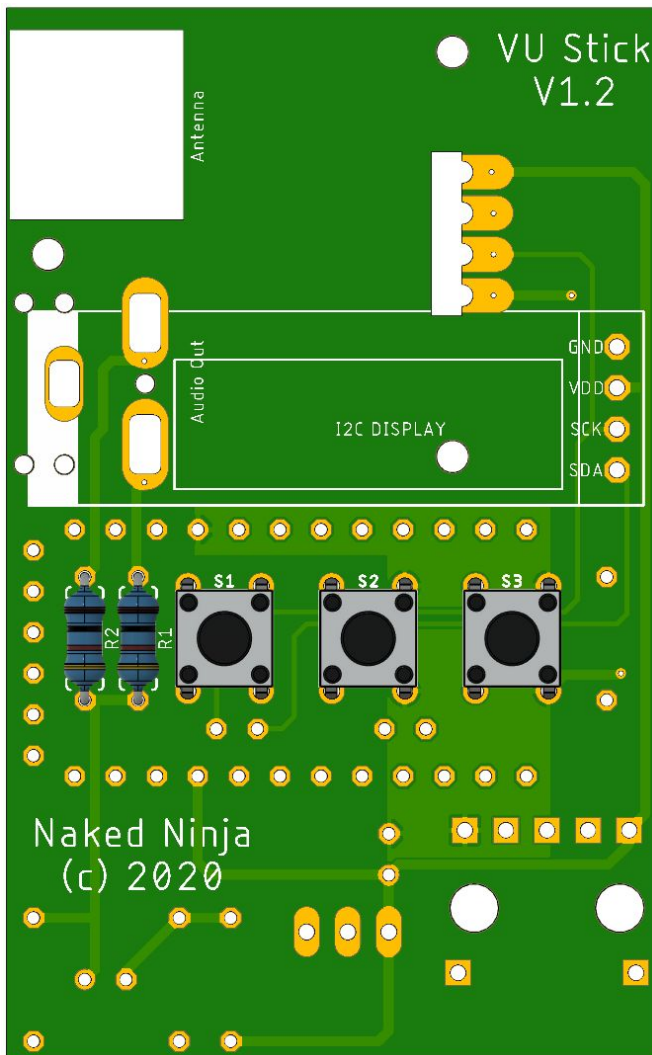


Photo 5: Front view of the VU Stick V1.2 PCB with resistor R1 and R2 placed and soldered.

5. Shorten the pins of the two resistors after they are soldered.
Note: This is done to prevent the resistor pins of touching the microcontroller board that will be soldered in future steps.

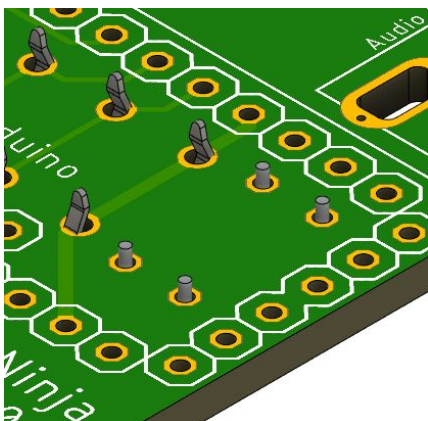


Photo 6: Back view of the VU Stick V1.2 PCB with shortened soldered resistor R1 and R2 pins.

6. Place and solder the TEA576 module on the PCB

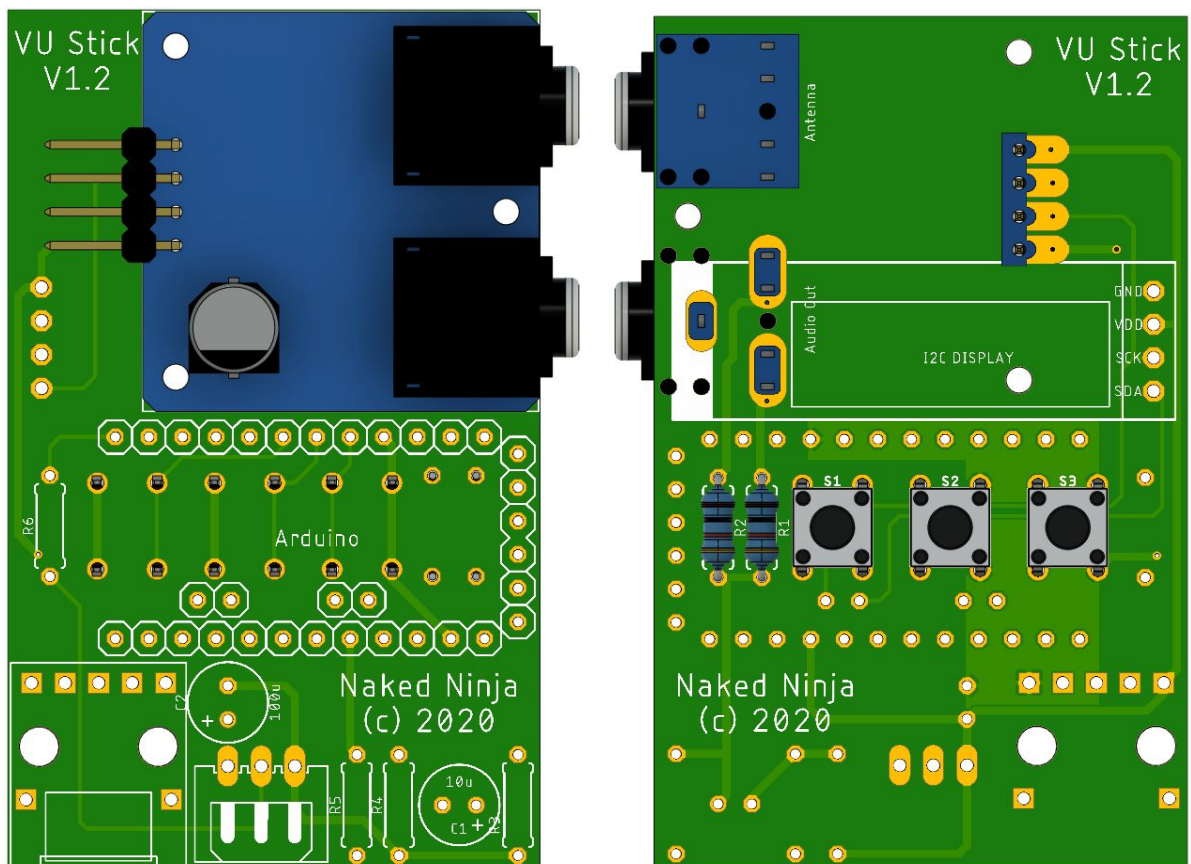


Photo 7 & 8: Back and front view of the VU Stick V1.2 PCB with TEA576 module.

Note: Use enough solder to ensure a good connection on the TEA576 module pins!

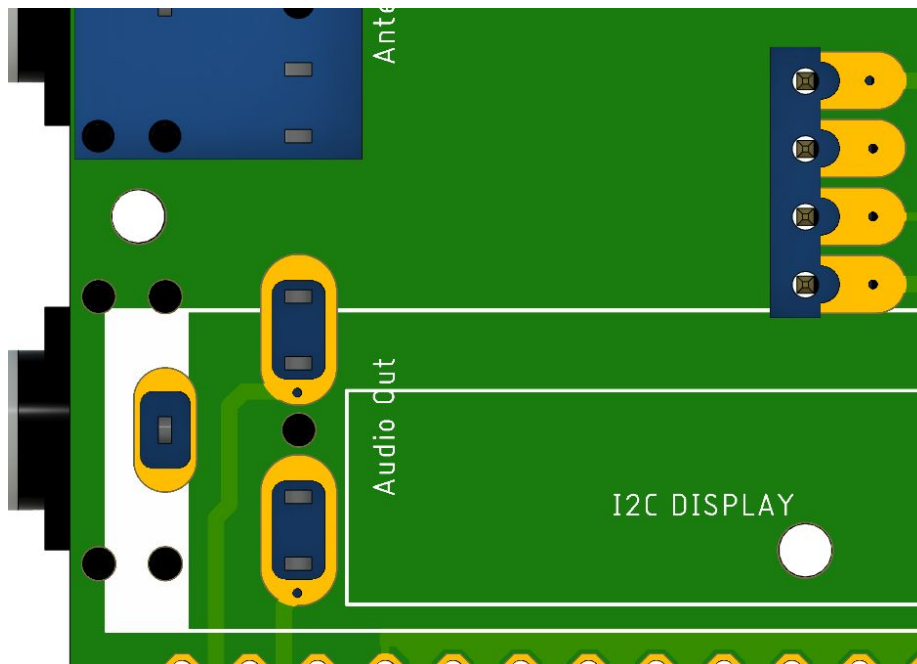


Photo 9: Front view of VU Stick V1.2 PCB zoomed in on the TEA576 connections

7. Place and solder resistors in the R3, R4, R5 and R6 slots as illustrated in photo 10 with the following values per slot:

R3: 100k ohm

R4: 10k ohm

R5: 10k ohm

R6: 470 ohm

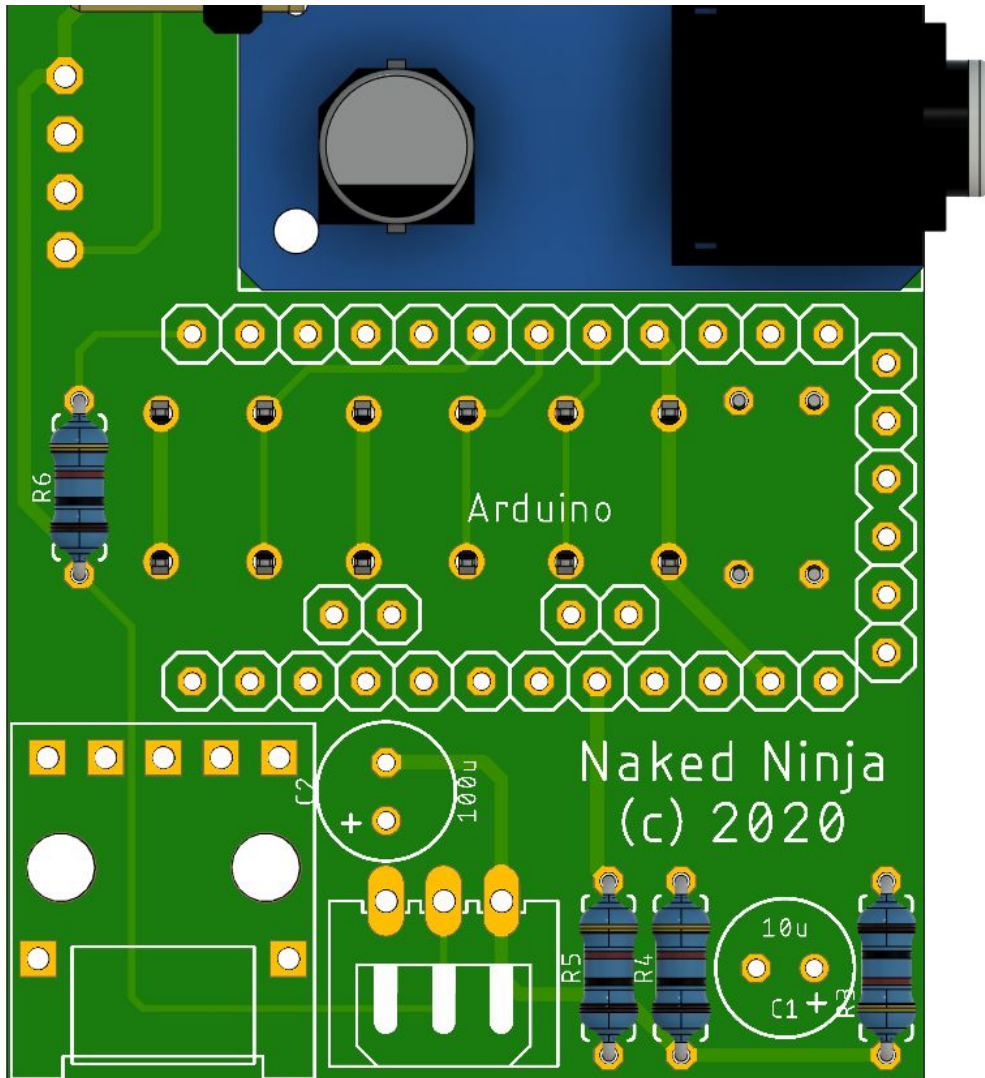


Photo 10: Back view of VU Stick V1.2 PCB with resistor R3, R4, R5 and R6 placed and soldered

8. Place and solder the capacitors in the C1 and C2 slots as illustrated in photo 11 and 12 with the following values per slot:

C1: 10uF

C2: 100uF

Note: Be sure to solder the plus terminal of the capacitor to the marked + on the PCB.

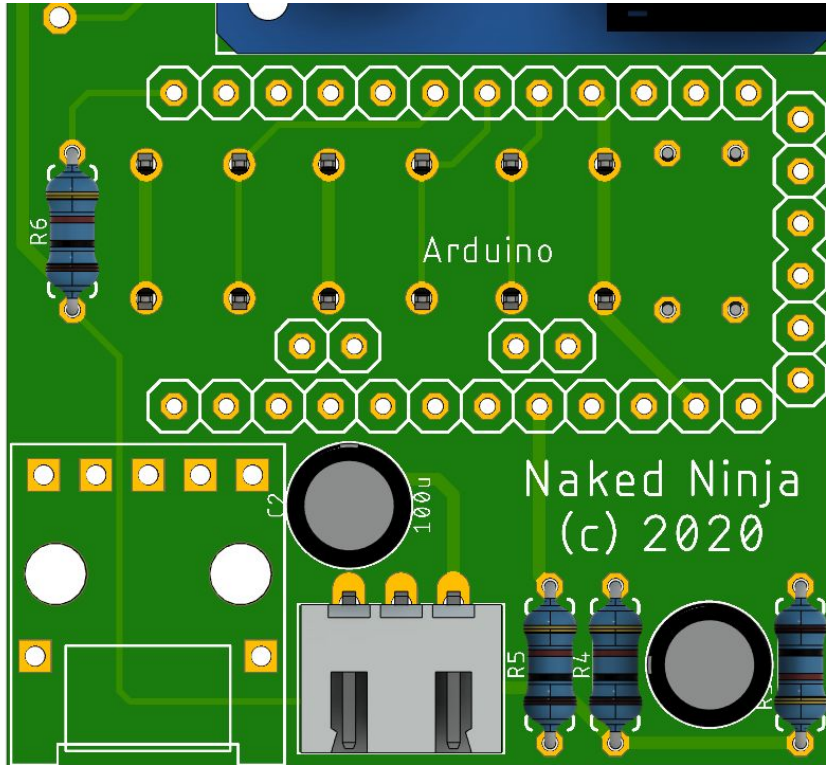


Photo 11: Back view of VU Stick V1.2 PCB with capacitor C1 and C2 placed and soldered

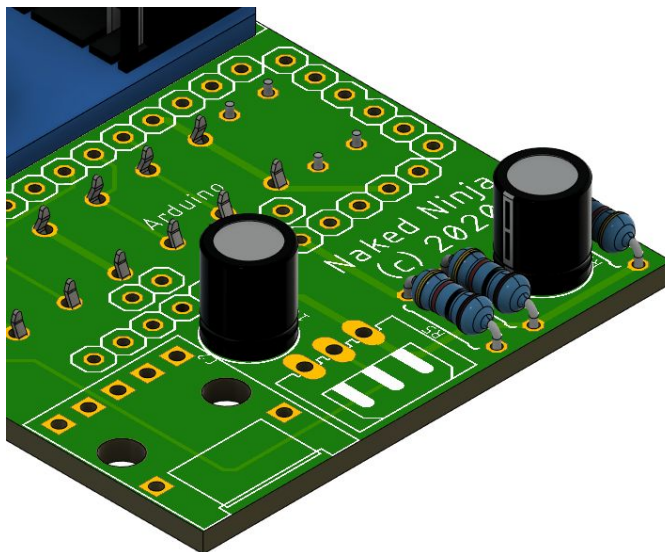


Photo 12: Angled back view of VU Stick V1.2 PCB with capacitor C1 and C2 placed and soldered

9. Place male pin header in the slots for the Arduino Pro Mini as illustrated in photo 13.

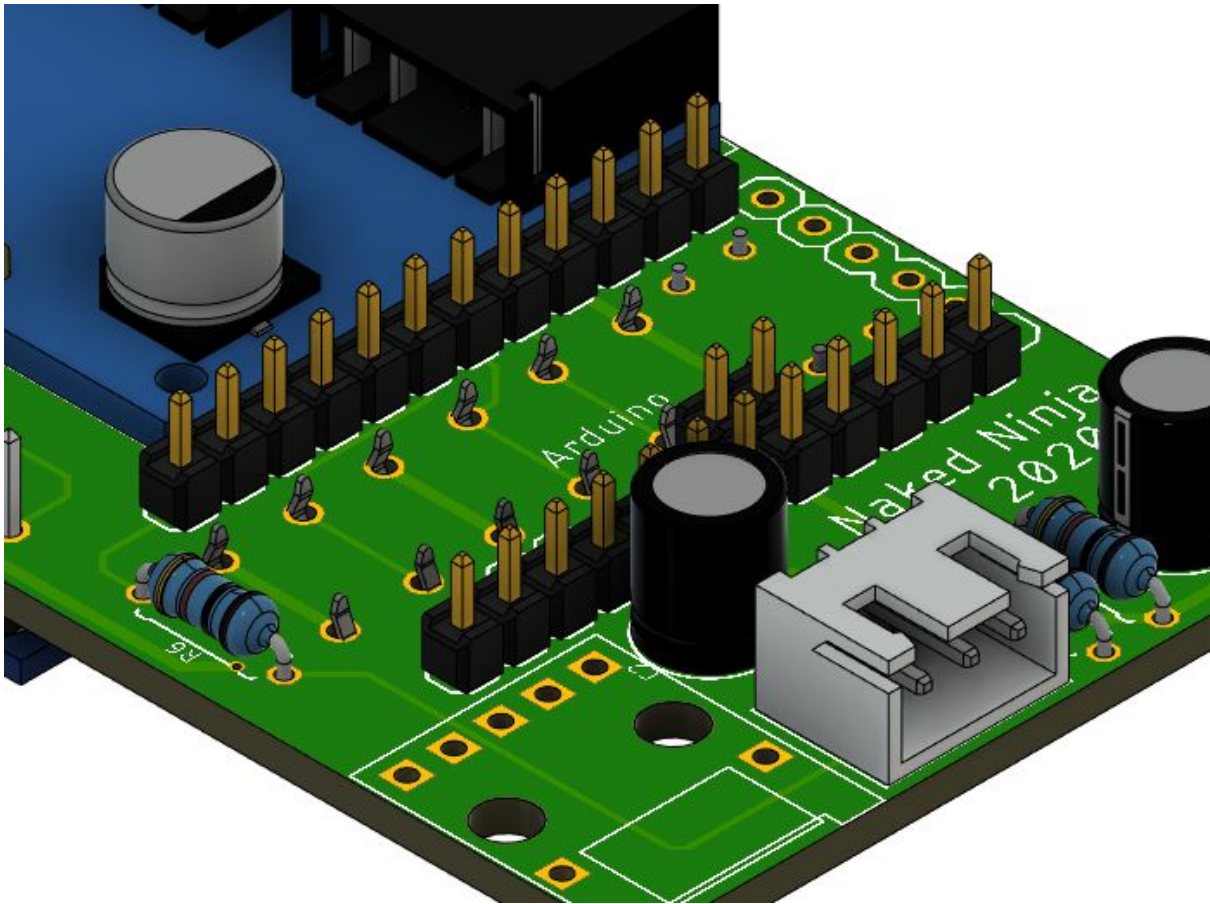


Photo 13: Angle back view of VU Stick V1.2 PCB with male headers

Note:

If you are using a different type of the Arduino Pro Mini, make sure the following pins are connected: A3, A4(SDA), A5(SCL), D2, D3, D4, and D9.

10. Place the Arduino Pro Mini on the male headers and solder the male headers to the Arduino Pro Mini.

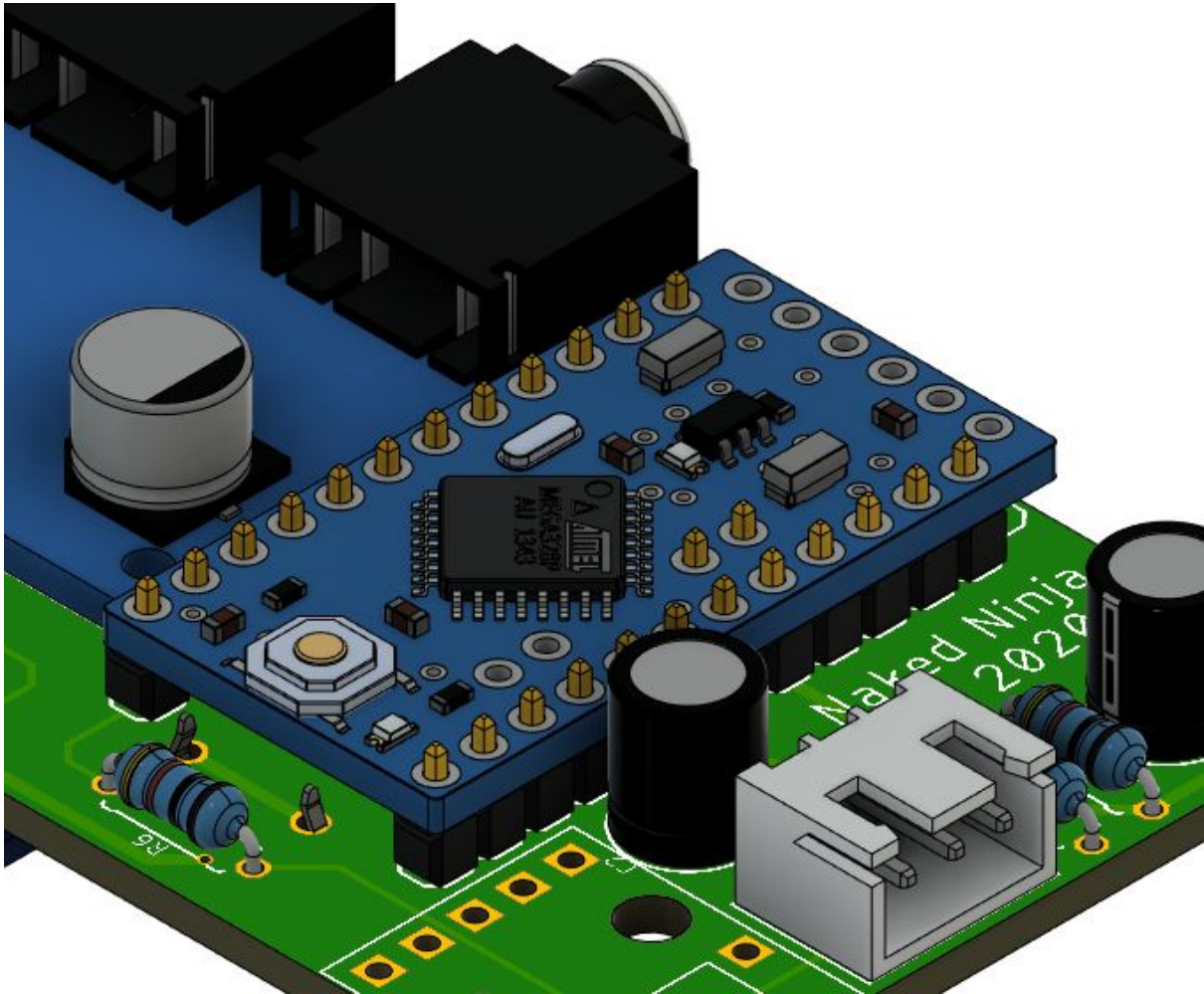


Photo 14: Angle back view of VU Stick V1.2 PCB with Arduino Pro Mini soldered to male headers.

11. Solder the male headers to the PCB.

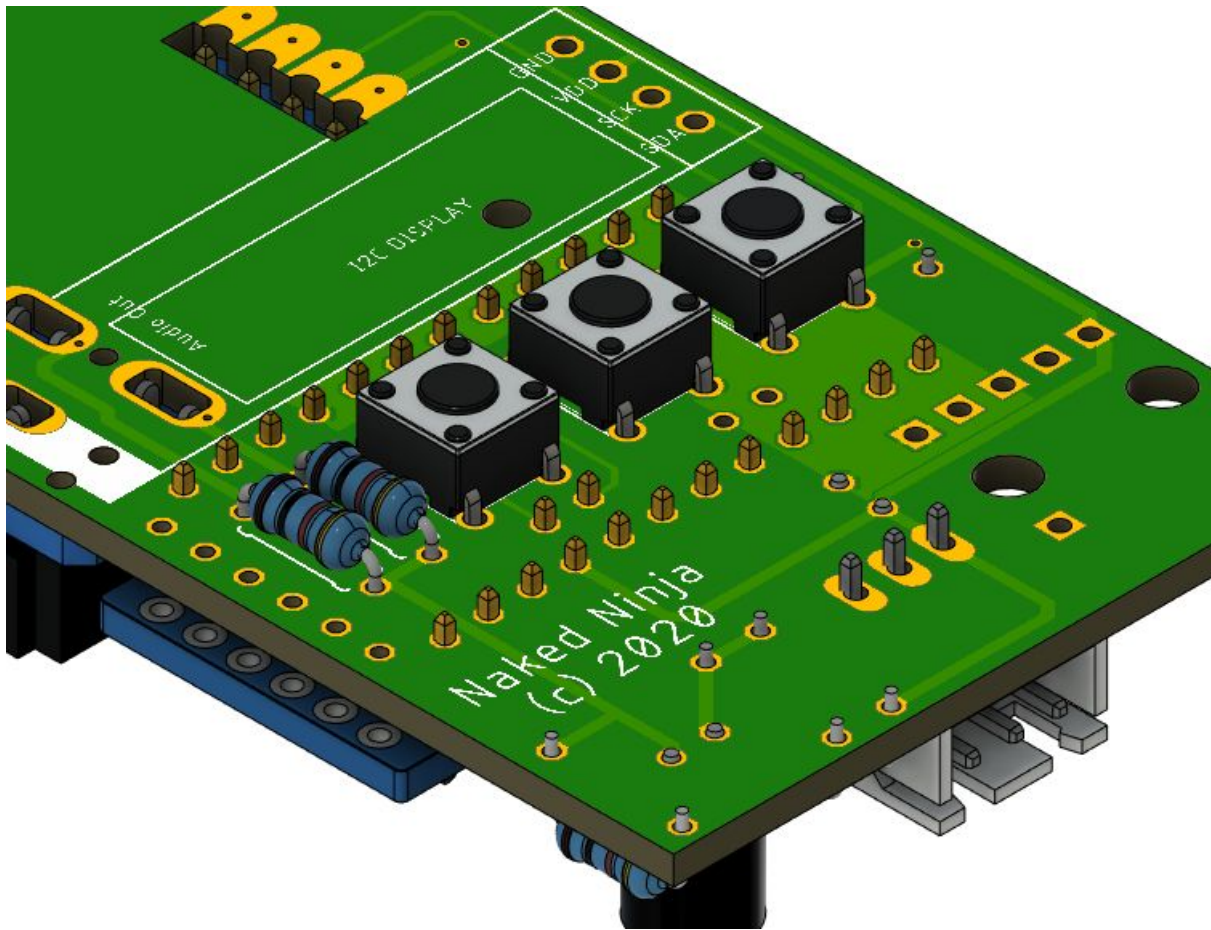


Photo 15: Angle top view of VU Stick V1.2 PCB with soldered male headers.

12. Place and solder the micro USB module on the PCB and put some pins through it as illustrated in photo 16, 17 and 18.

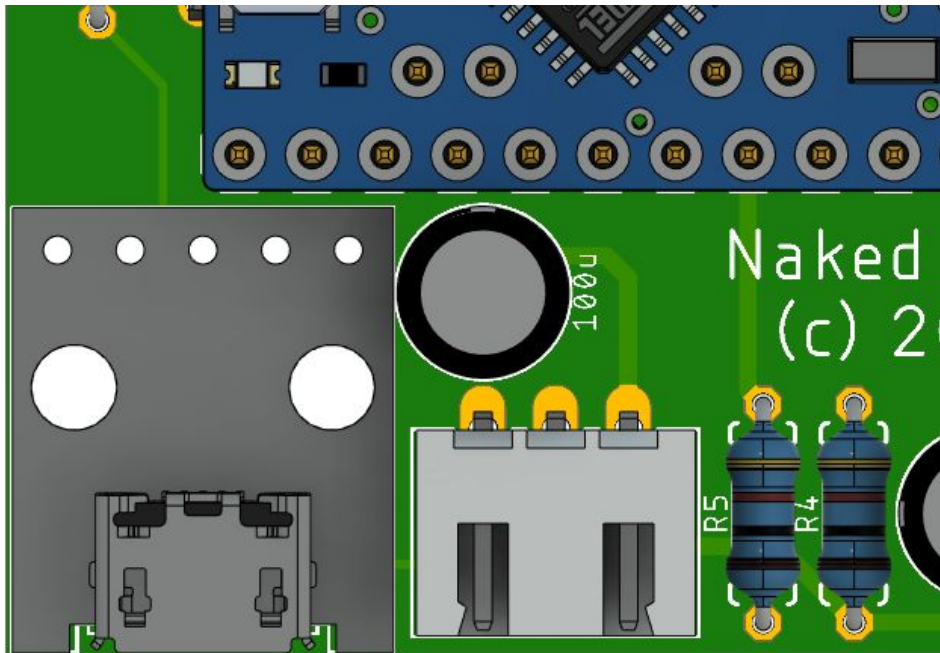


Photo 16: Bottom view of VU Stick V1.2 PCB with micro USB module.

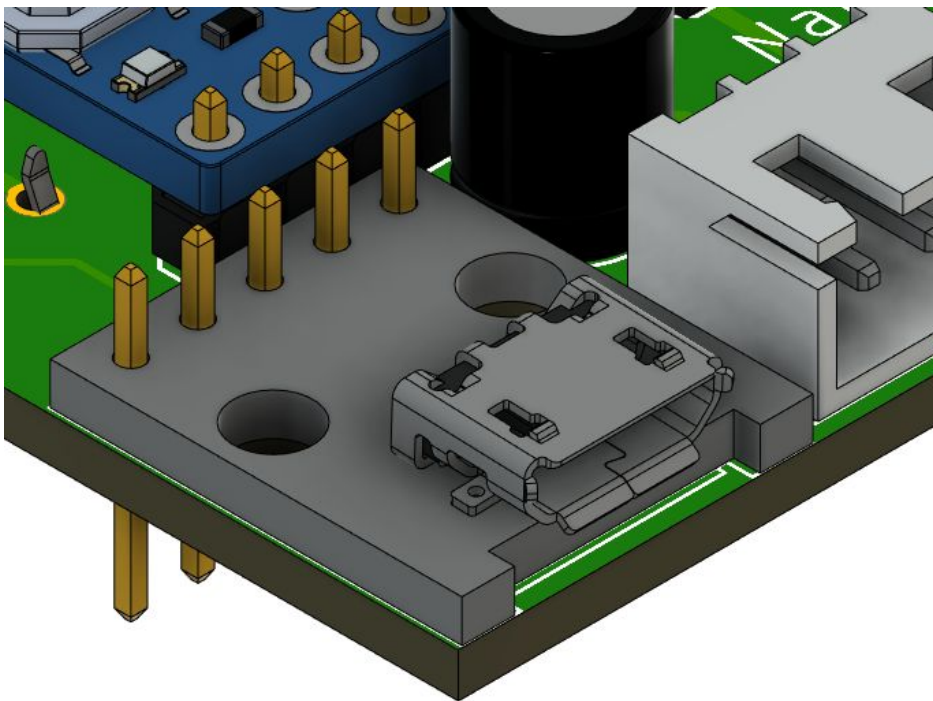


Photo 17: Angled bottom view of VU Stick V1.2 PCB with micro USB module and pins.

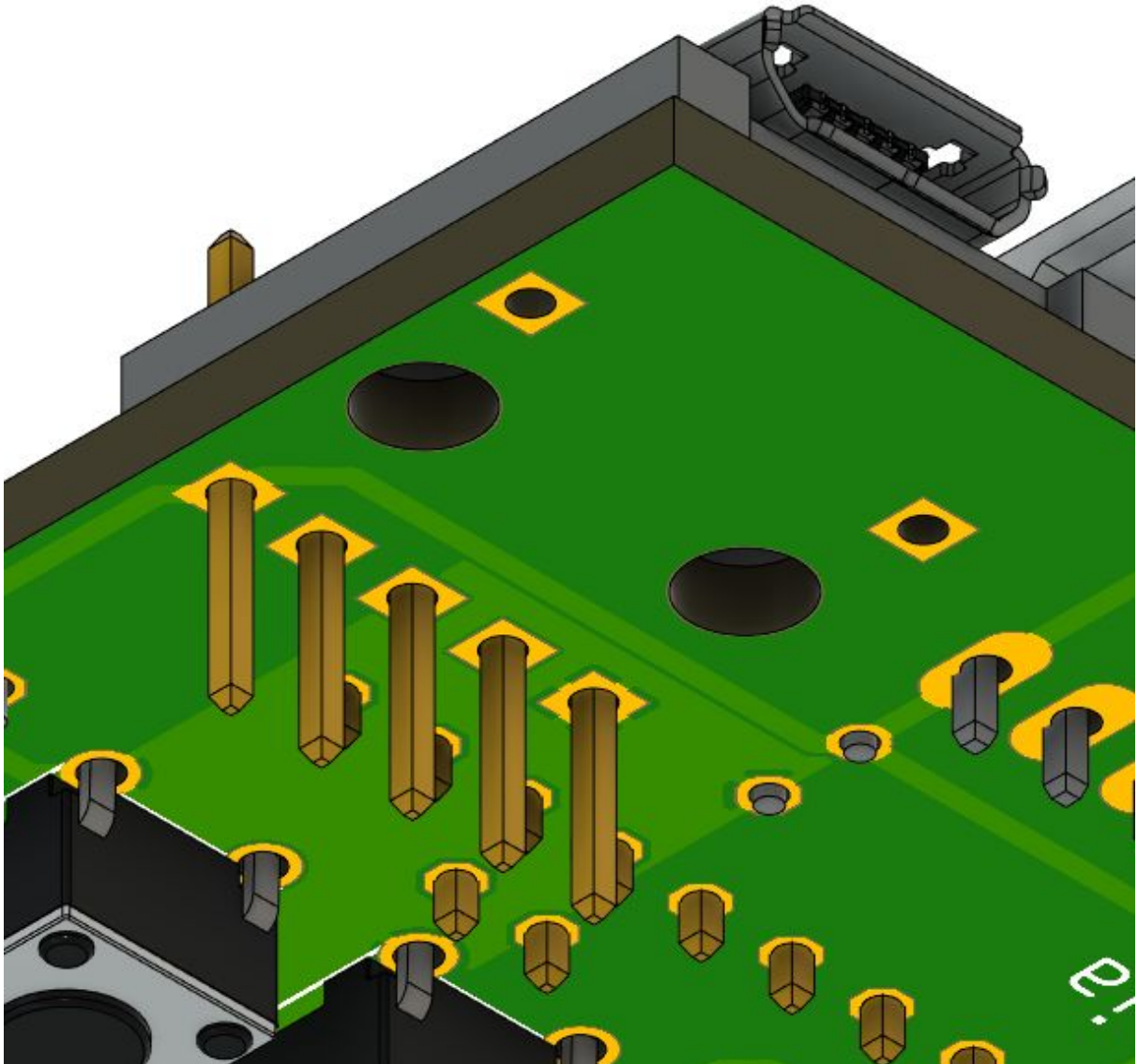


Photo 18: Angled top view of VU Stick V1.2 PCB with micro USB module and pins.

13. Shorten the pins on the micro USB as illustrated in photo 19 and 20 after they are soldered.



Photo 19: Angled top view of VU Stick V1.2 PCB with shortened pins on the micro USB module connection.

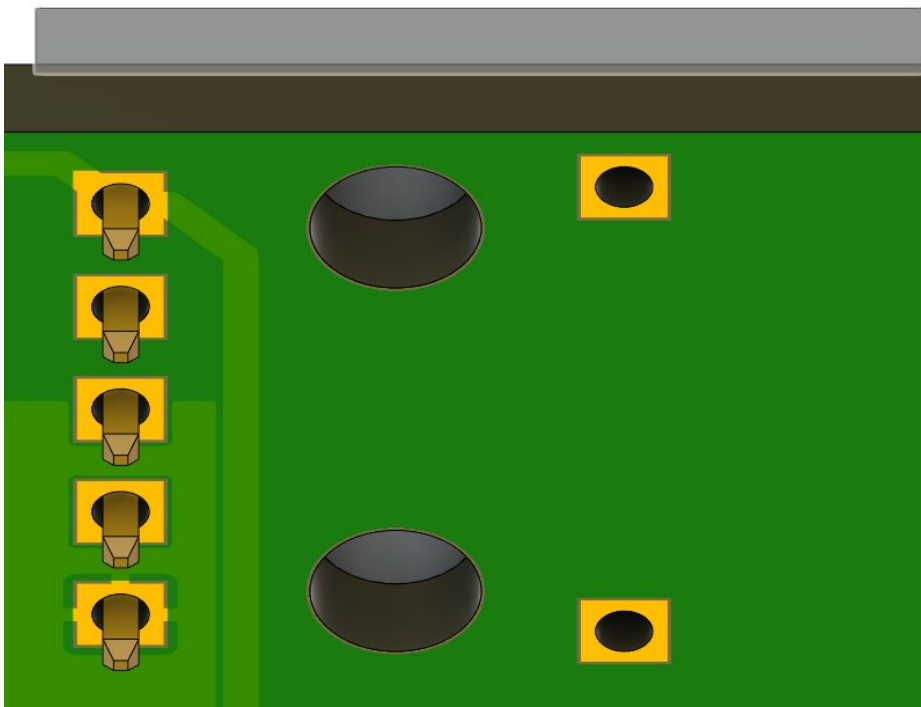


Photo 20: Angled top view of VU Stick V1.2 PCB with shortened pins on the micro USB module connection.

14. Place and solder the display on the PCB.

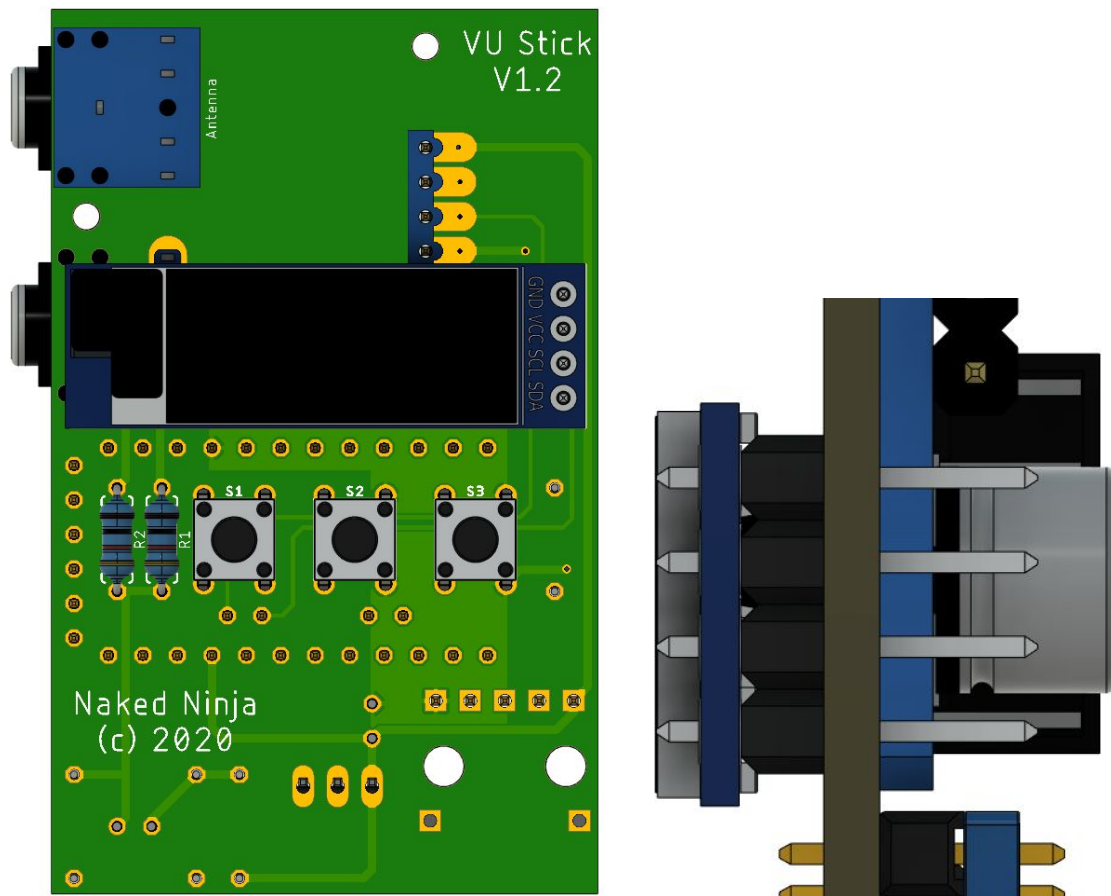


Photo 21 & 22: Top and side view of VU Stick V1.2 PCB with a display.

15. Connect the RGB via the JST connector:

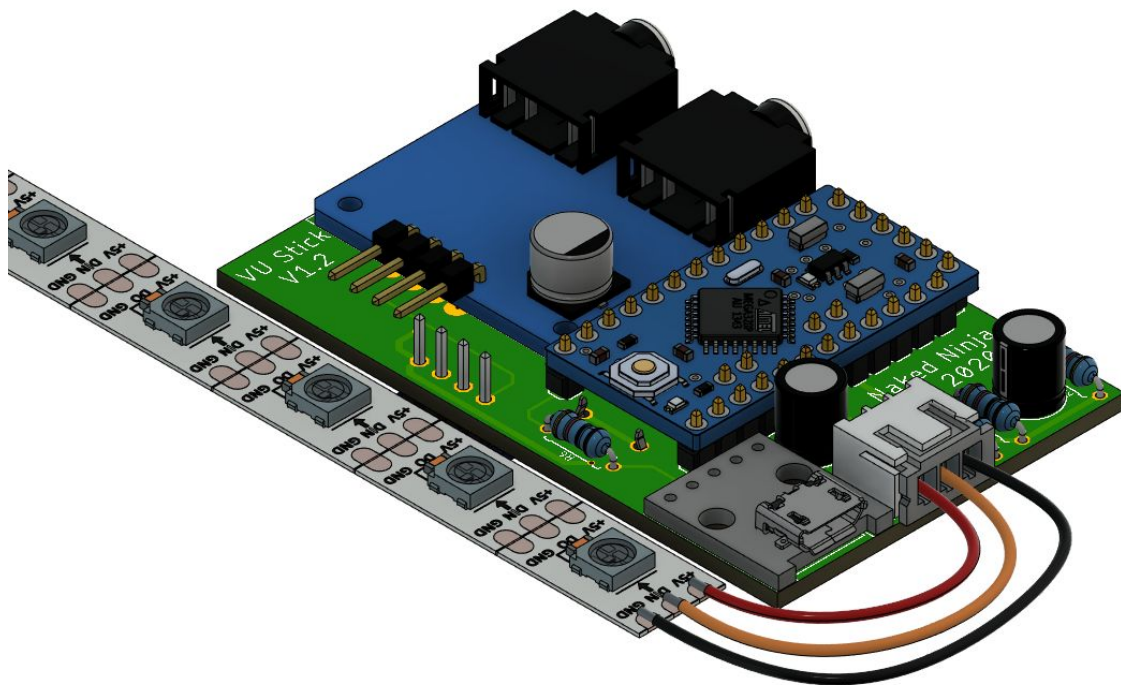


Photo 23: Angled bottom view of VU Stick V1.2 PCB with RGB LED strip connected.

Software Assembly & Testing

The following paragraphs will explain how to program the VU Stick and how to configure the preset FM radio stations.

Before continuing you must acquire the following items:

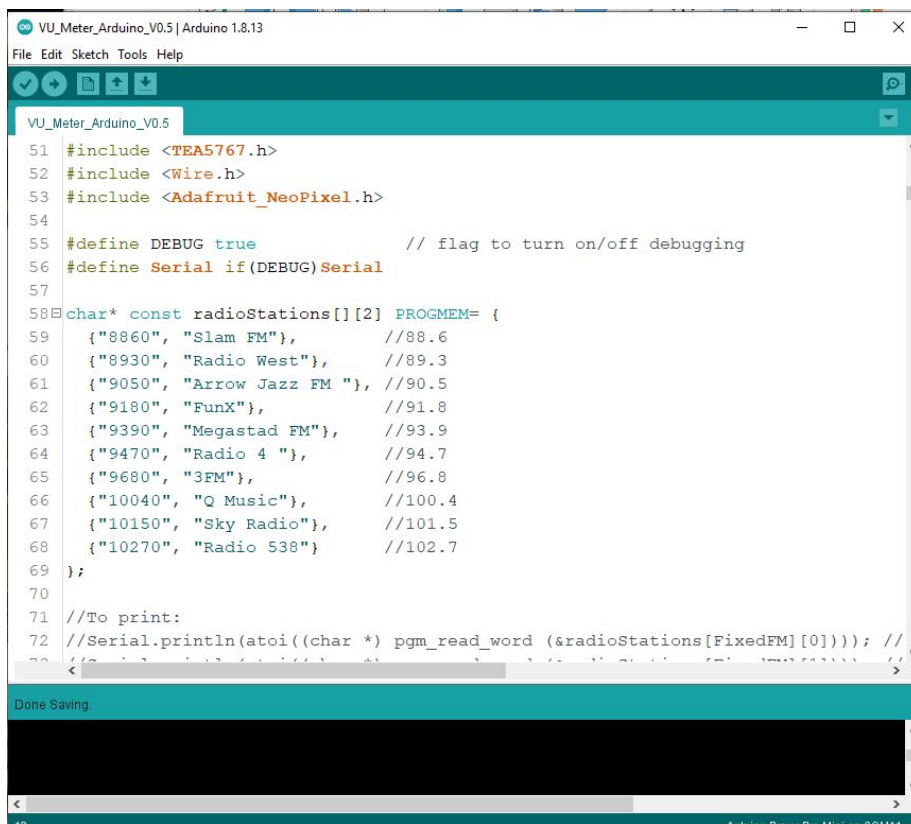
- PC or laptop with the Arduino IDE
- USB to TTL converter
- USB cable (to connect the converter to the PC/laptop)
- The Arduino sketch from the Naked Ninja GitHub.

After acquiring all items follow the following steps to program and configure the VU Stick:

1. Download the Arduino sketch for the VU Stick from the Naked Ninja product page or Github.
2. Open sketch in the Arduino IDE.
3. **[OPTIONAL]** Replace the FM stations in the array radioStations with your preferred stations.

Notes / Warnings:

1. Max of 10 stations can be given. More than this will result in memory problems.
2. The first value is the frequency of the station (example: 10270 = 102.7 MHz) and the second is the name that will show up on the display. This name must be kept short to avoid problems.



```
VU_Meter_Arduino_V0.5 | Arduino 1.8.13
File Edit Sketch Tools Help

VU_Meter_Arduino_V0.5
51 #include <TEA5767.h>
52 #include <Wire.h>
53 #include <Adafruit_NeoPixel.h>
54
55 #define DEBUG true // flag to turn on/off debugging
56 #define Serial if (DEBUG) Serial
57
58 char* const radioStations[][2] PROGMEM= {
59   {"8860", "Slam FM"}, //88.6
60   {"8930", "Radio West"}, //89.3
61   {"9050", "Arrow Jazz FM "}, //90.5
62   {"9180", "FunX"}, //91.8
63   {"9390", "Megastad FM"}, //93.9
64   {"9470", "Radio 4 "}, //94.7
65   {"9680", "3FM"}, //96.8
66   {"10040", "Q Music"}, //100.4
67   {"10150", "Sky Radio"}, //101.5
68   {"10270", "Radio 538"} //102.7
69 };
70
71 //To print:
72 //Serial.println(atoi((char *) pgm_read_word (&radioStations[FixedFM][0]))); //
```

Photo 24: Arduino IDE programming screen



4. Connect the USB-TTL converter to the Arduino Pro Mini

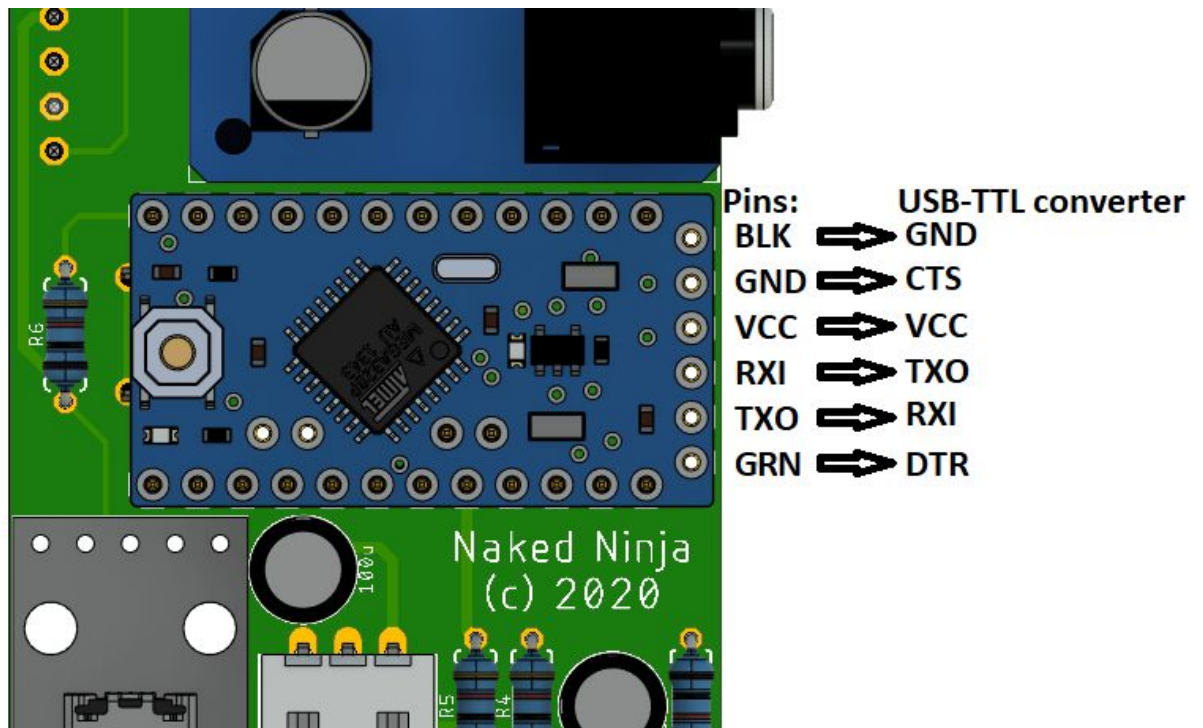


Photo 25: Arduino Pro Mini connection explanation

5. Connect the USB_TTL converter to the PC/Laptop.
6. Select the correct programming parameters.
Note: The programming parameters can be found in the top of the Arduino sketch
7. Program the Arduino Pro Mini.
8. Disconnect the USB-TTL converter from the Arduino Pro Mini after the programming is completed.
9. Connect the power bank through the micro USB connector and test the PCB using the "User Manual" from this document.

3D Printing & Assembly

The following paragraphs will explain how to assemble VU Stick into the designed enclosure. You can get the enclosure files to print from the Naked Ninja website under the description of the product.

* Note that you will need to have done the “PCB Assembly instructions”.

1. 3D print all required component for the VU Stick.

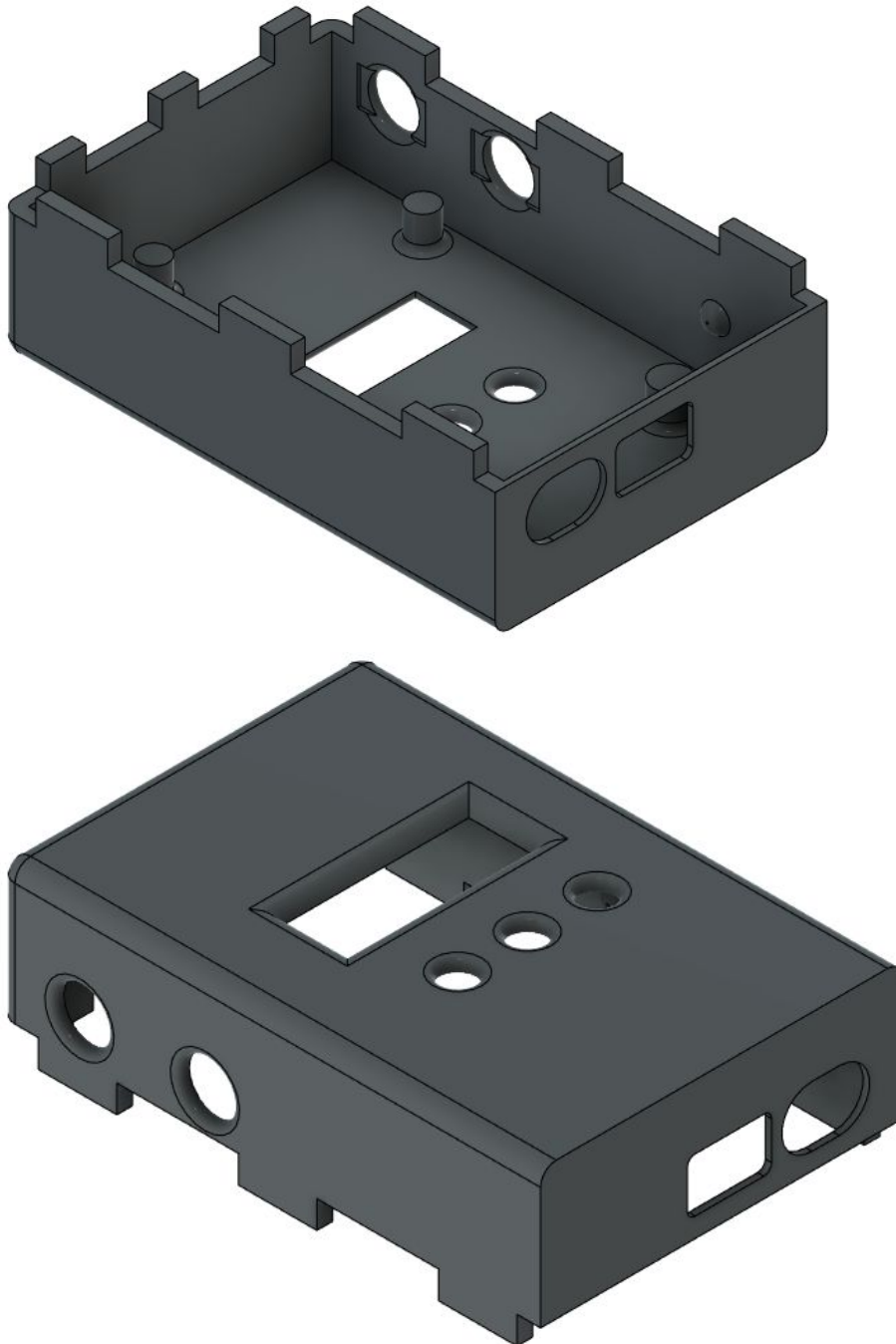


Photo 26: PCB enclosure.

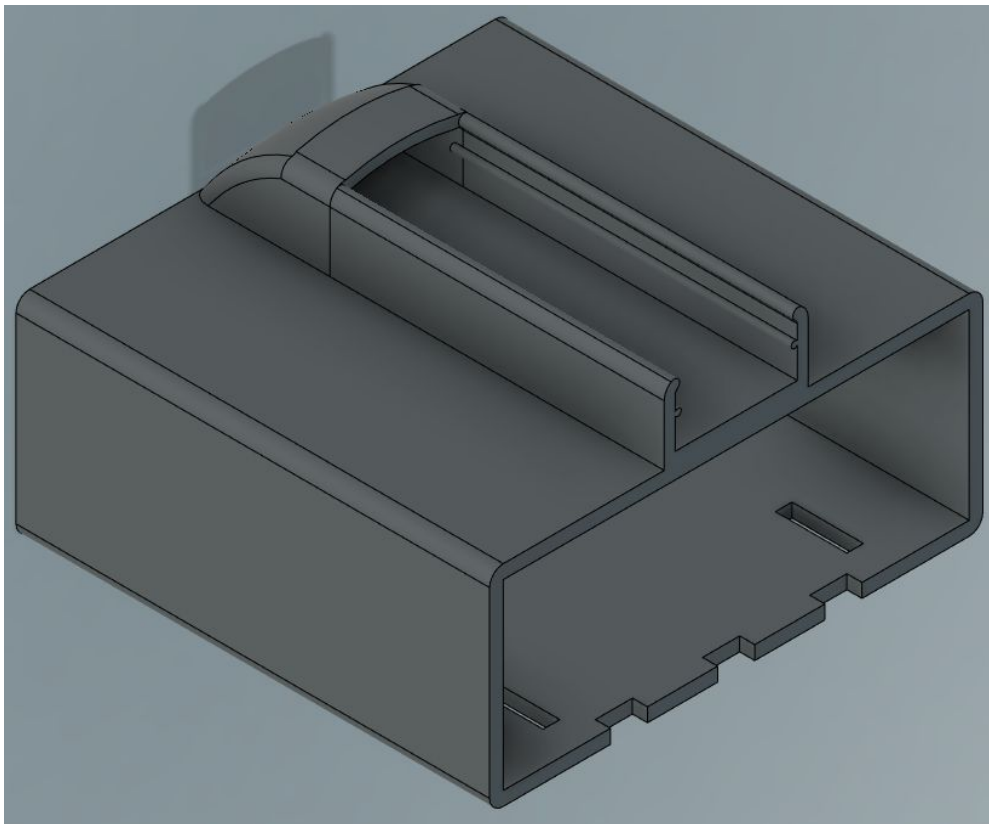
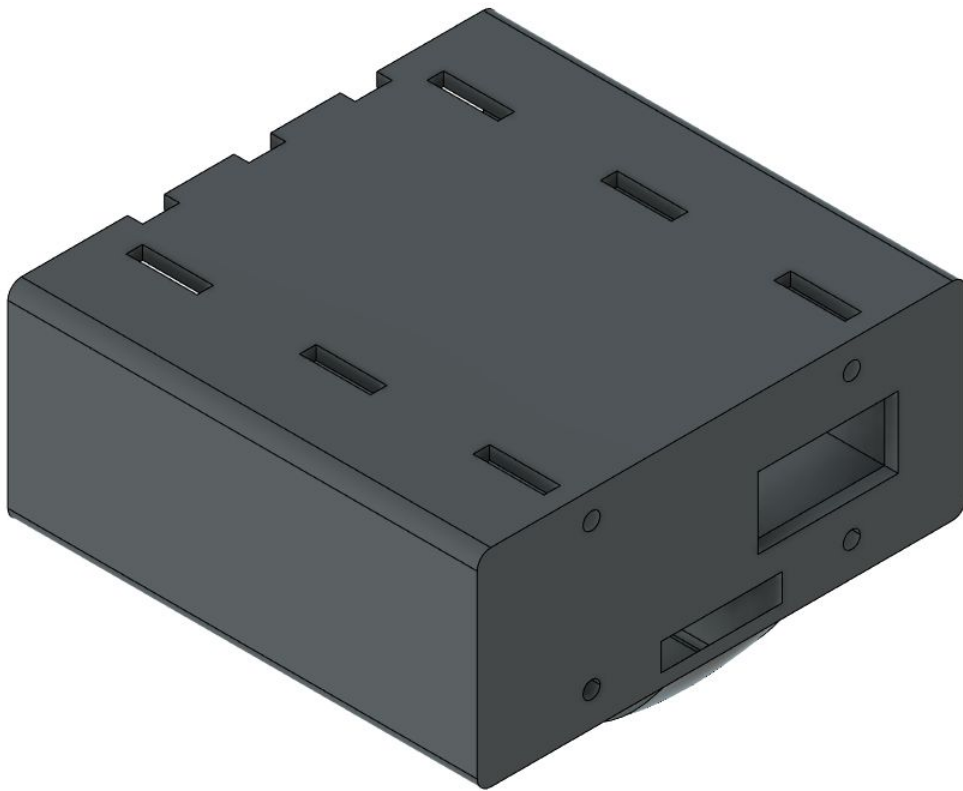


Photo 27: Battery and RGB profile enclosure.

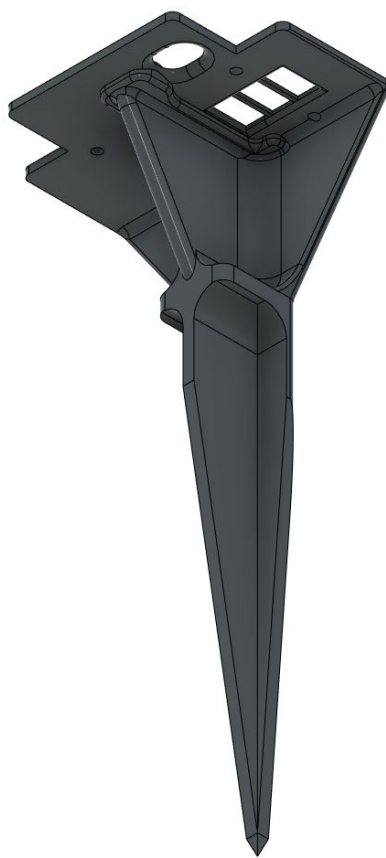
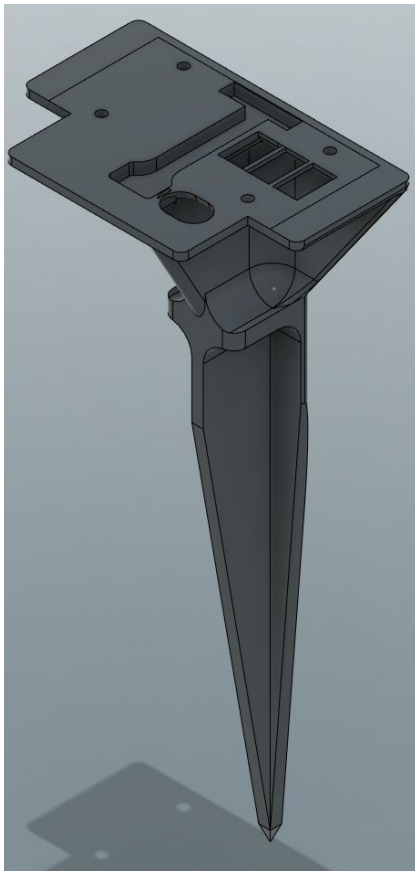


Photo 28: Spike enclosure.

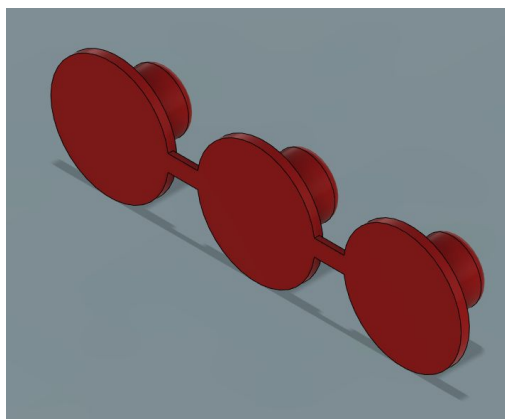
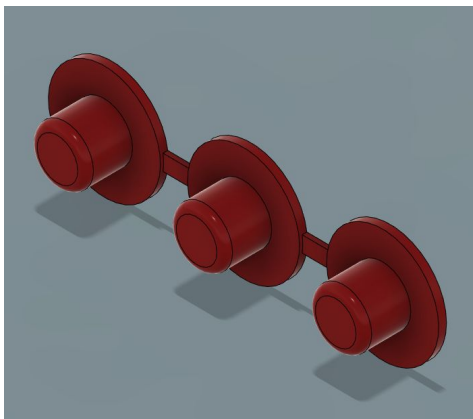


Photo 29: Button caps

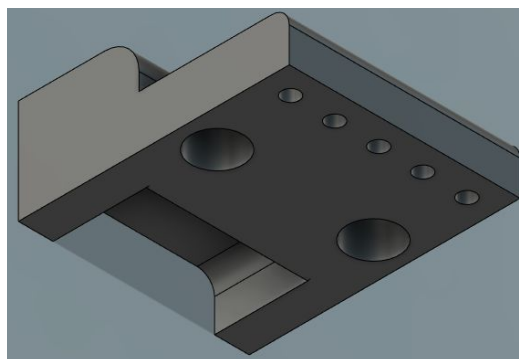
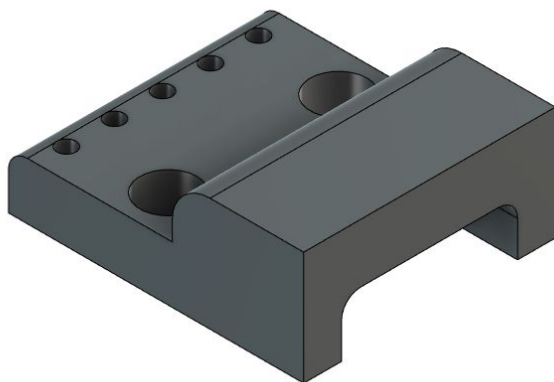


Photo 30: Micro USB cover.

2. Place the button caps inside the PCB enclosure.

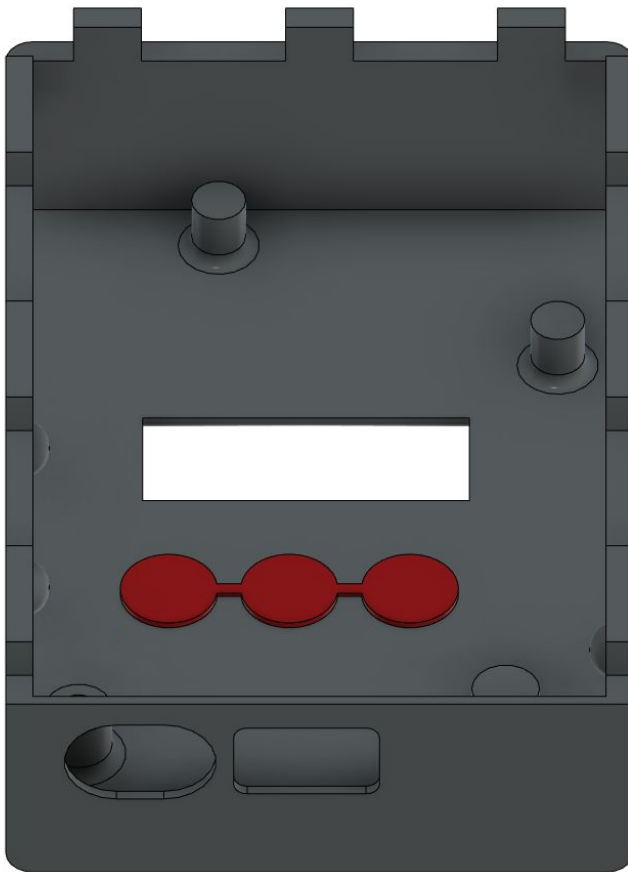


Photo 31: PCB enclosure with button caps

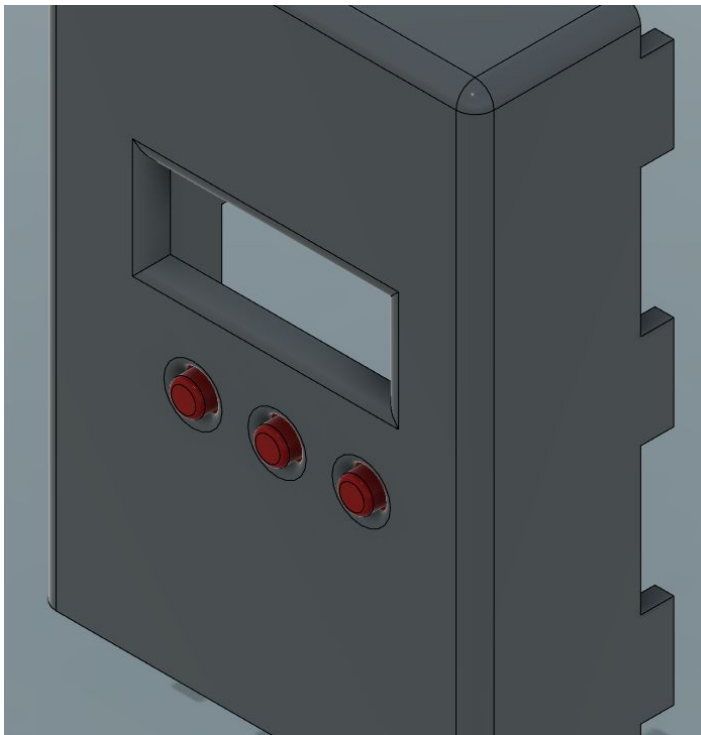


Photo 32: PCB enclosure with button caps

3. Place the PCB into the PCB enclosure as illustrated in photo 33 and 34.
Note: It's placed this way so the audio jacks fall into place.

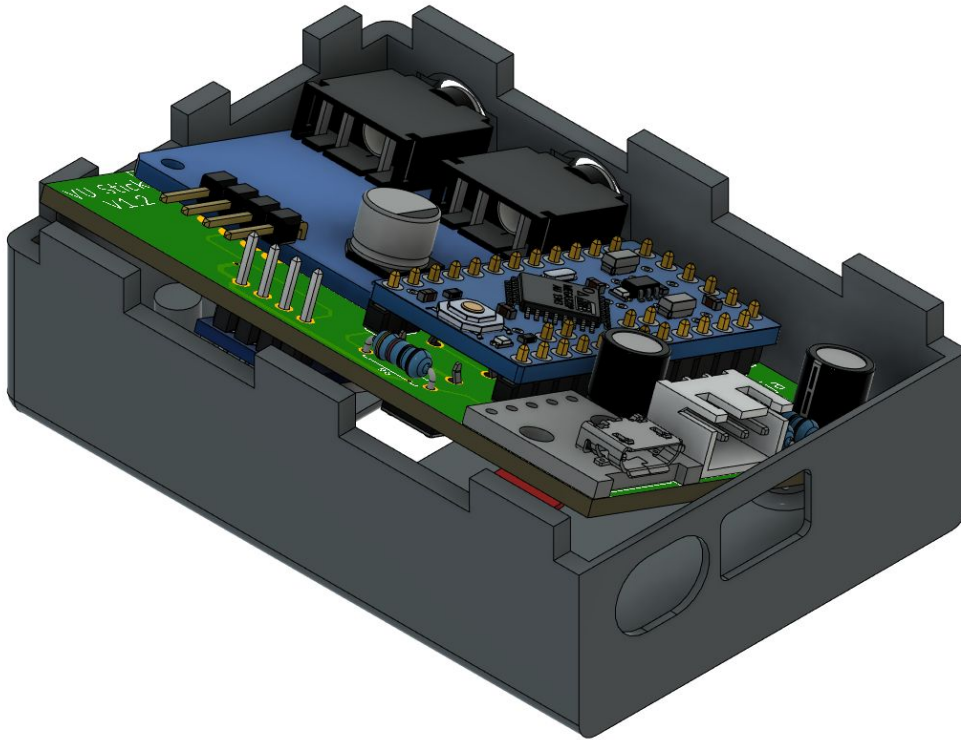


Photo 33: PCB enclosure with PCB partly placed

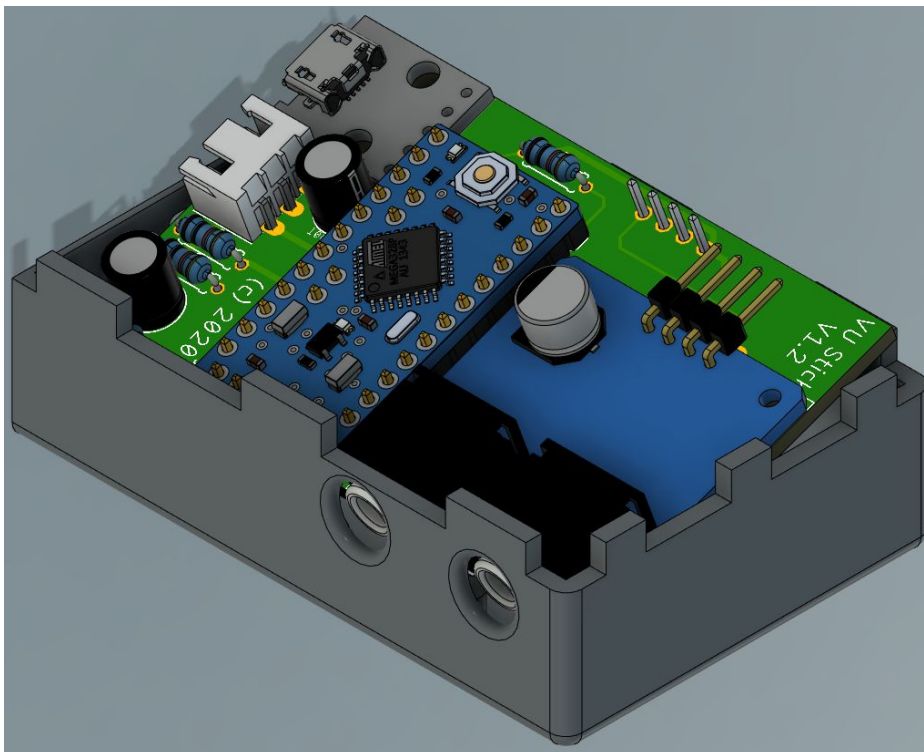


Photo 34: PCB enclosure with PCB partly placed

4. Press the PCB into place.

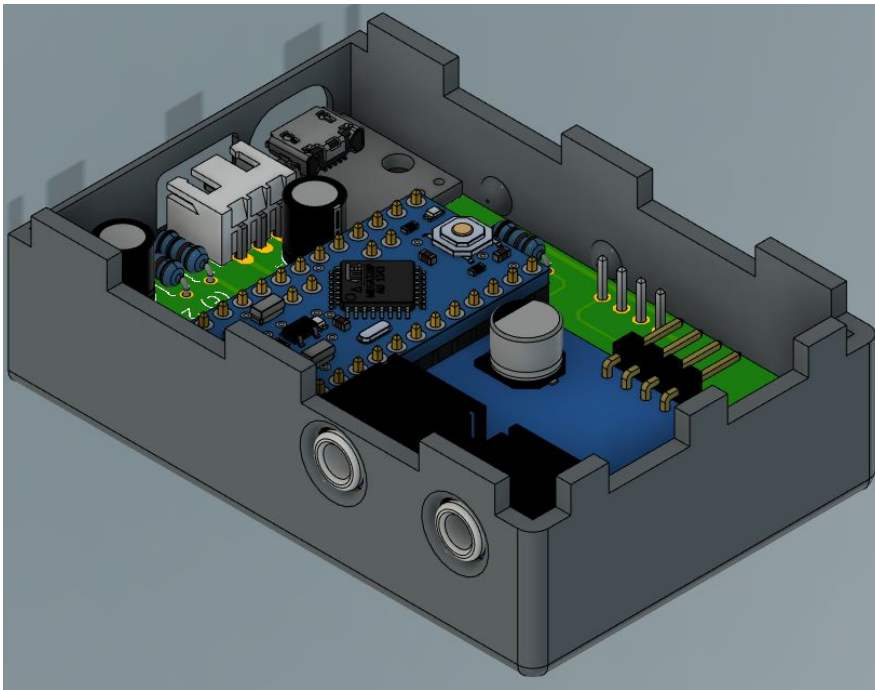


Photo 35: PCB enclosure with PCB.

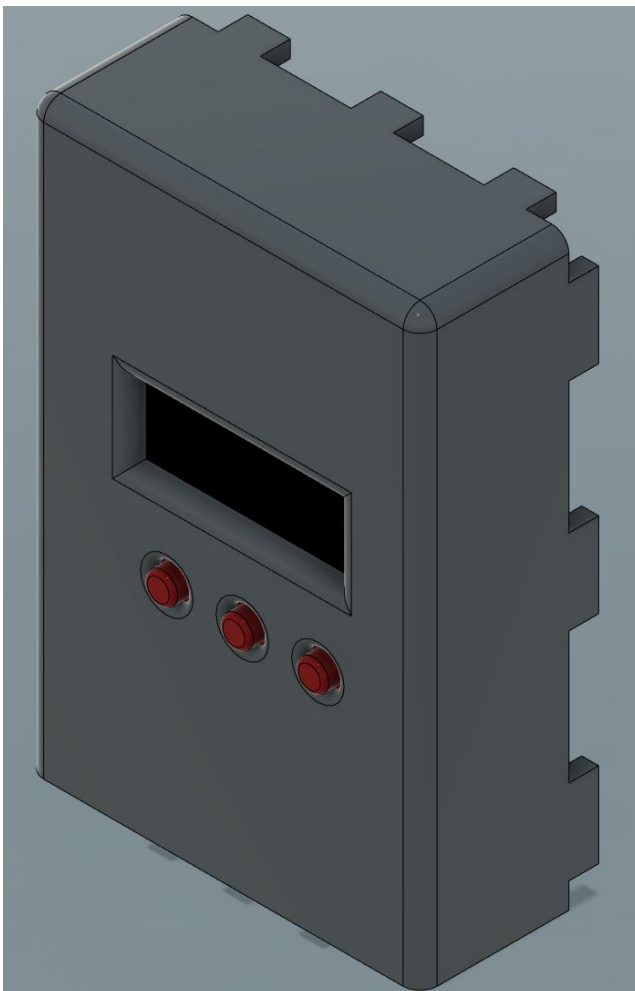


Photo 36: Front view of PCB enclosure with PCB.

5. Place the micro USB cover on the micro USB and screw it down with an M3 6mm screw.

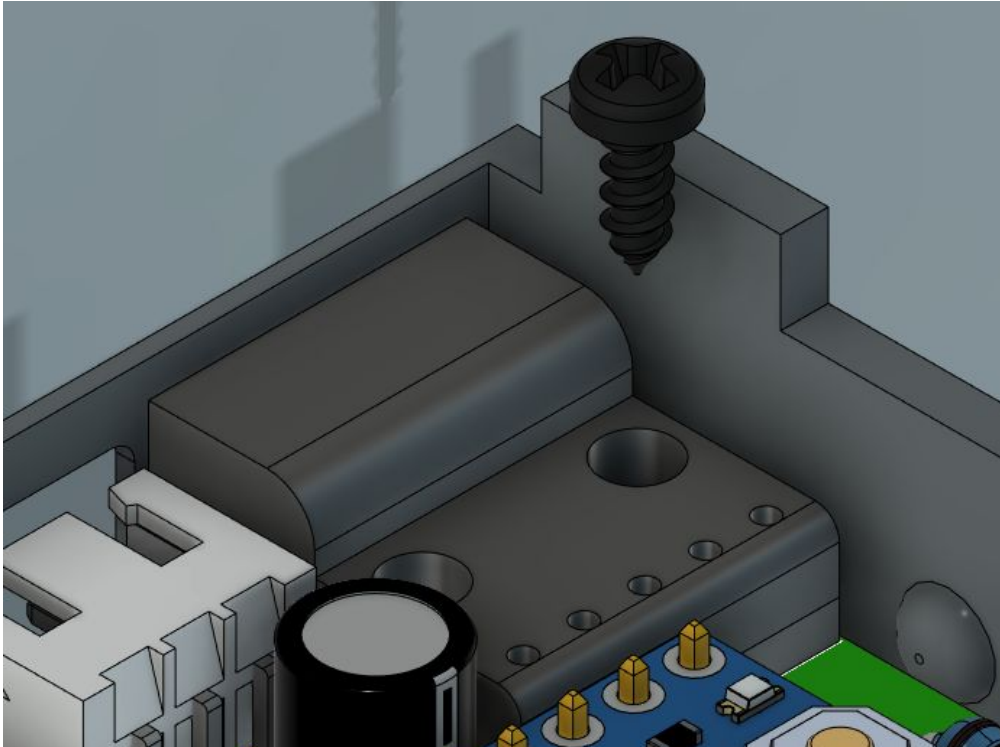


Photo 37: Micro USB cover PCB enclosure with PCB.

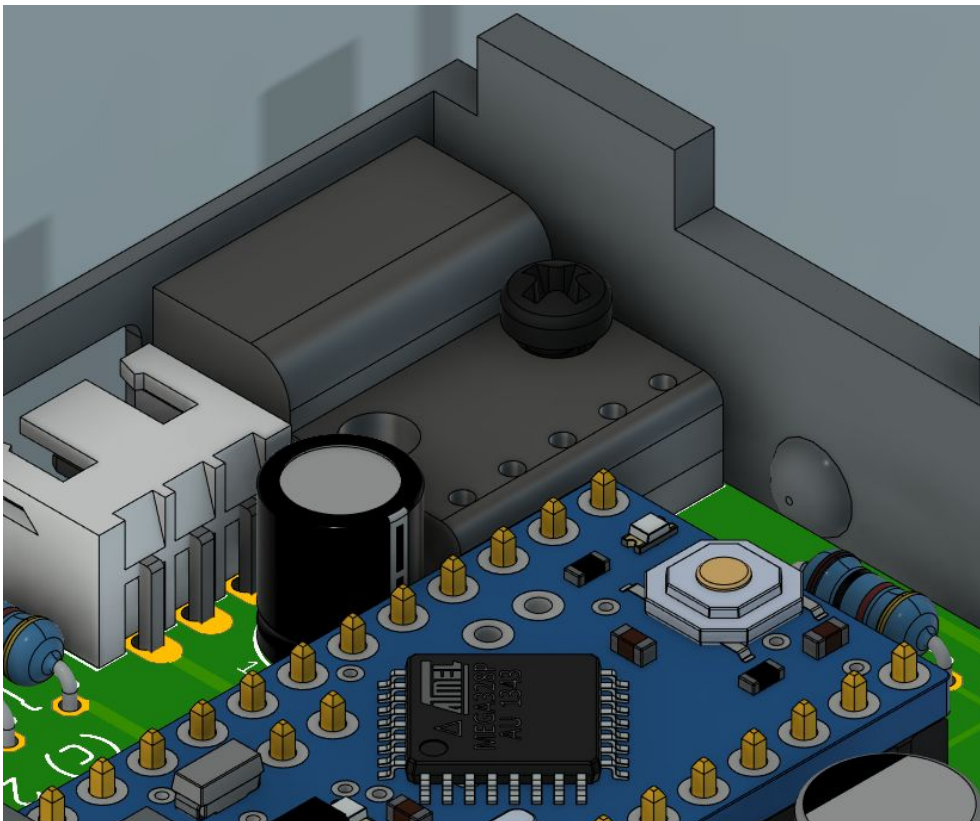


Photo 38: Front view of PCB enclosure with PCB.

6. Insert the PCB enclosure into the battery enclosure as illustrated in picture 39 and 40.

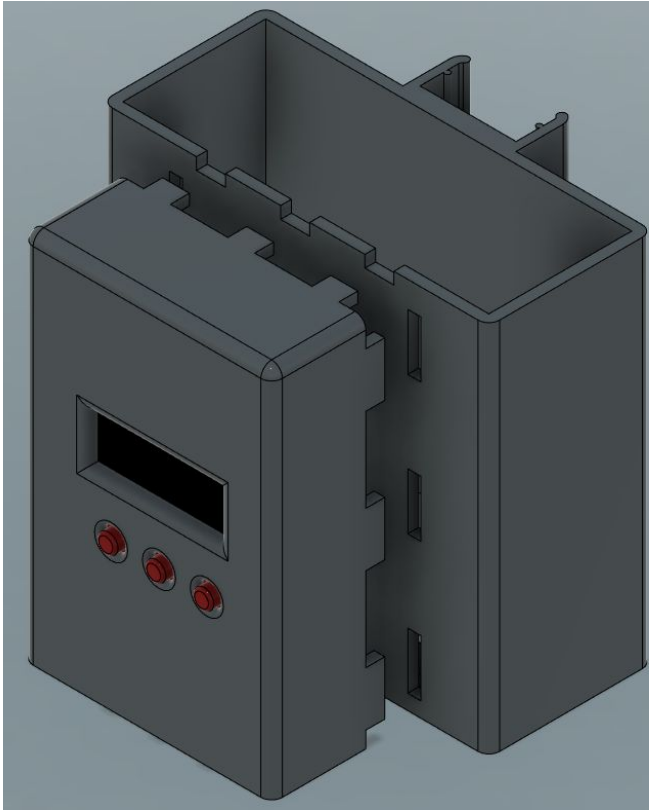


Photo 39: Front view of PCB enclosure with PCB.

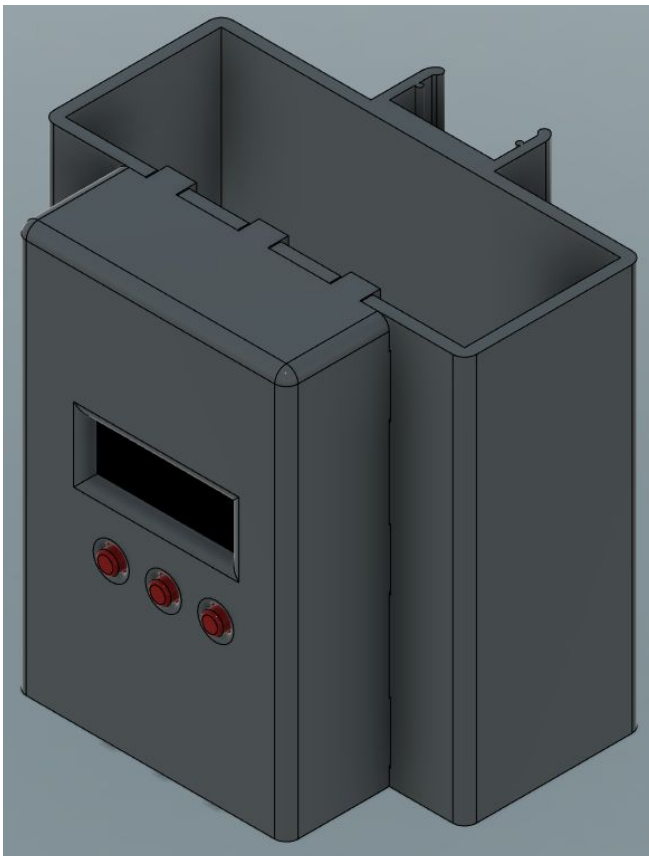


Photo 40: Front view of PCB enclosure with PCB.

7. Place the RGB connector cable through the opening in the battery enclosure as illustrated in photo 41.

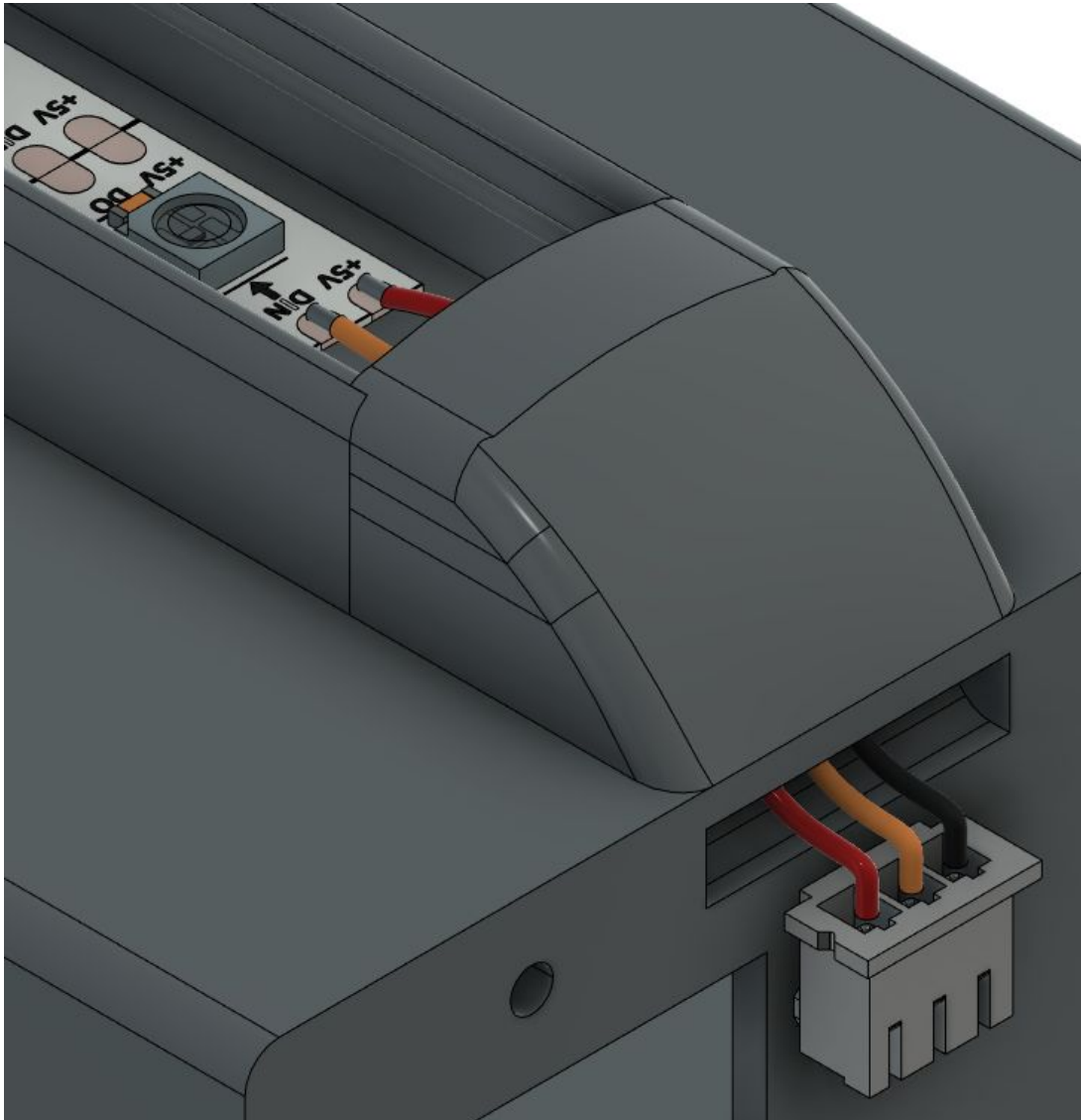


Photo 41: Angled view of RGB connector passed through battery enclosure.

8. Solder the cables to the RGB strip.

Note: Pay attention while soldering and connecting the cable!!

Make sure the +5V of the RGB strip is connected to the +5V (Vcc) on the PCB!

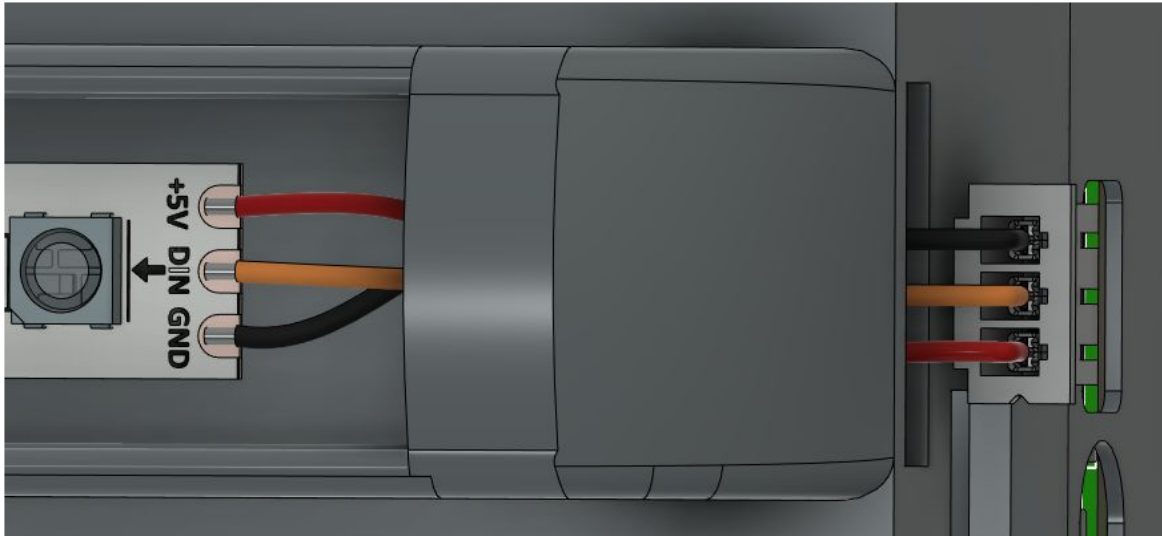


Photo 42: Angled view of RGB connector soldered to the RGB LED strip.

9. Connect the RGB connector cable to the JST connector on the PCB.

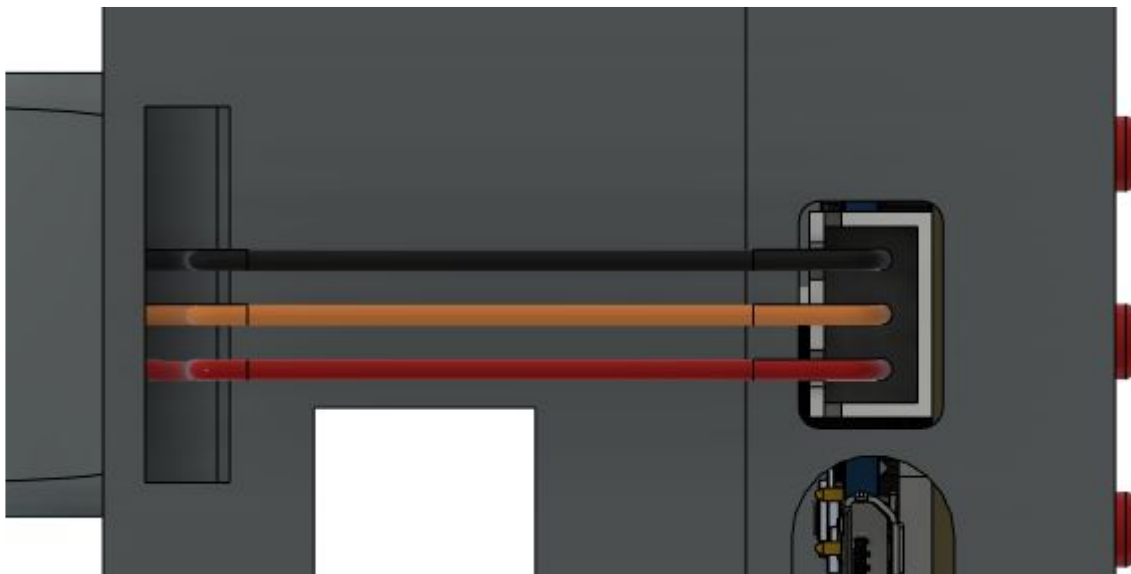


Photo 43: View of JST RGB connector connected to PCB.

10. Slide the RGB profile over the RGB LED strip as illustrated in photo 44 and 45.

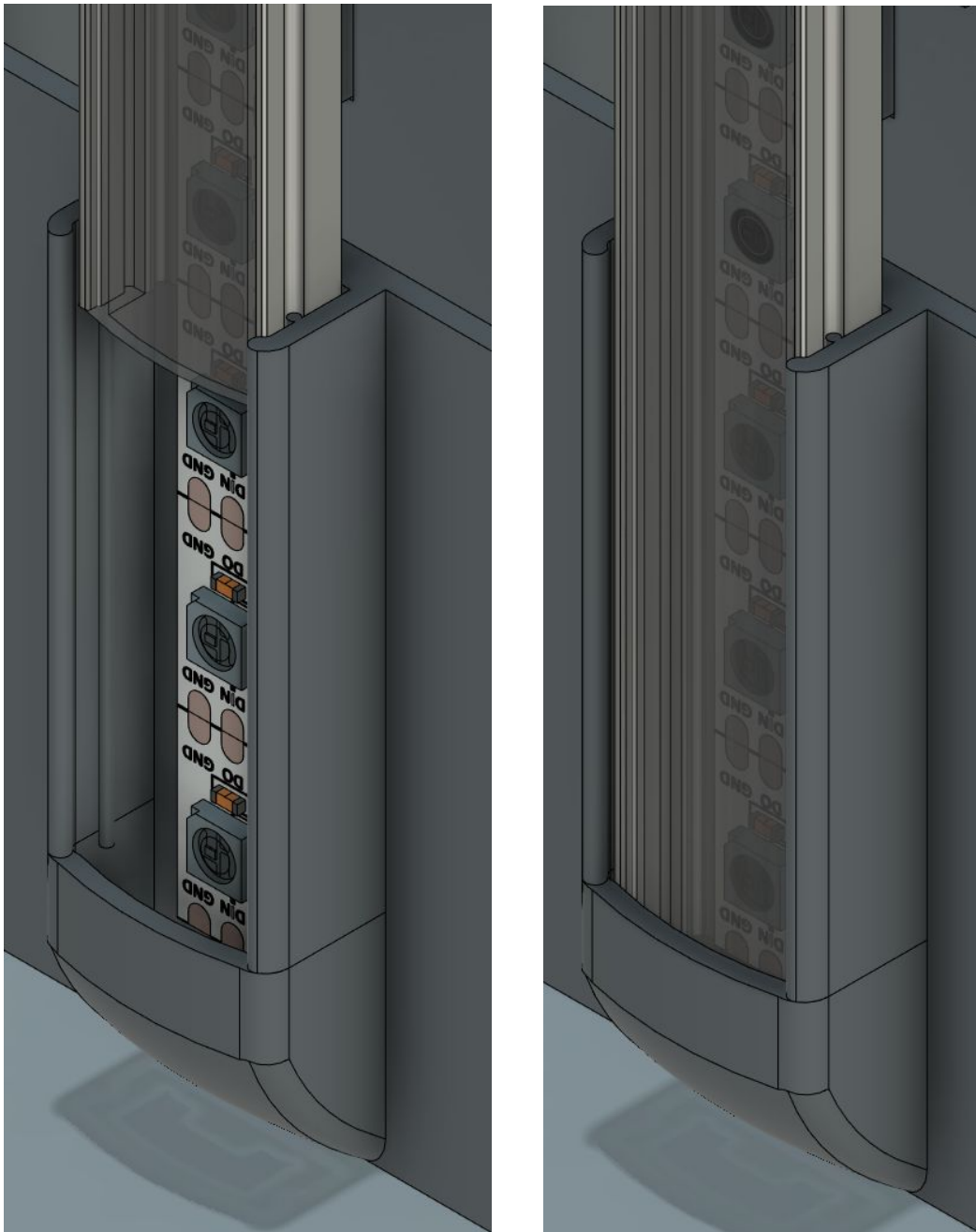


Photo 44 and 45: View of placing RGB strip into RGB profile.

11. Place the spike enclosure on the bottom of the battery and PCB enclosure as illustrated in photo 46.

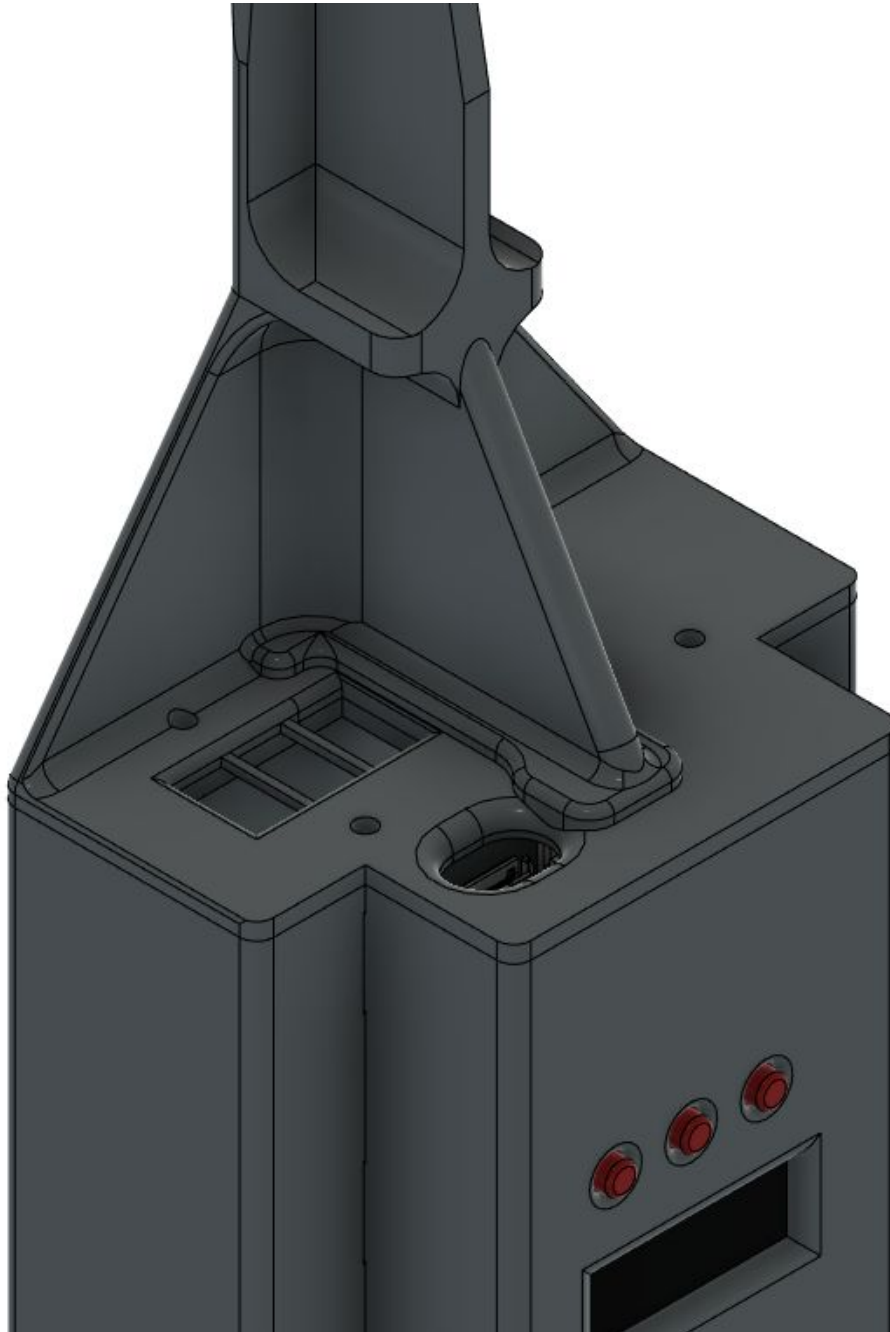


Photo 46: View of spike enclosure placed on battery and PCB enclosure.

12. Screw-in the spike enclosure.

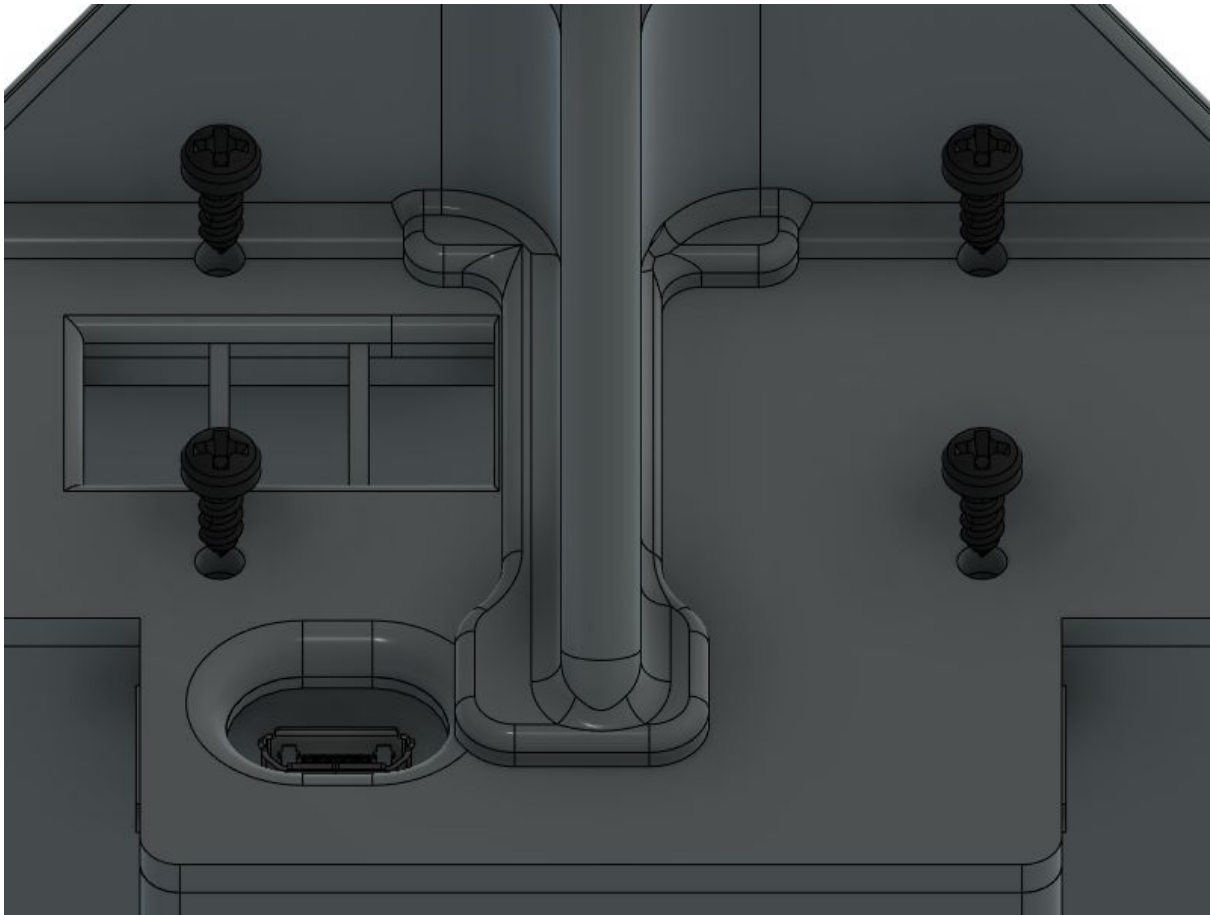


Photo 47: View of spike enclosure placed on battery and PCB enclosure with screws next to holes.

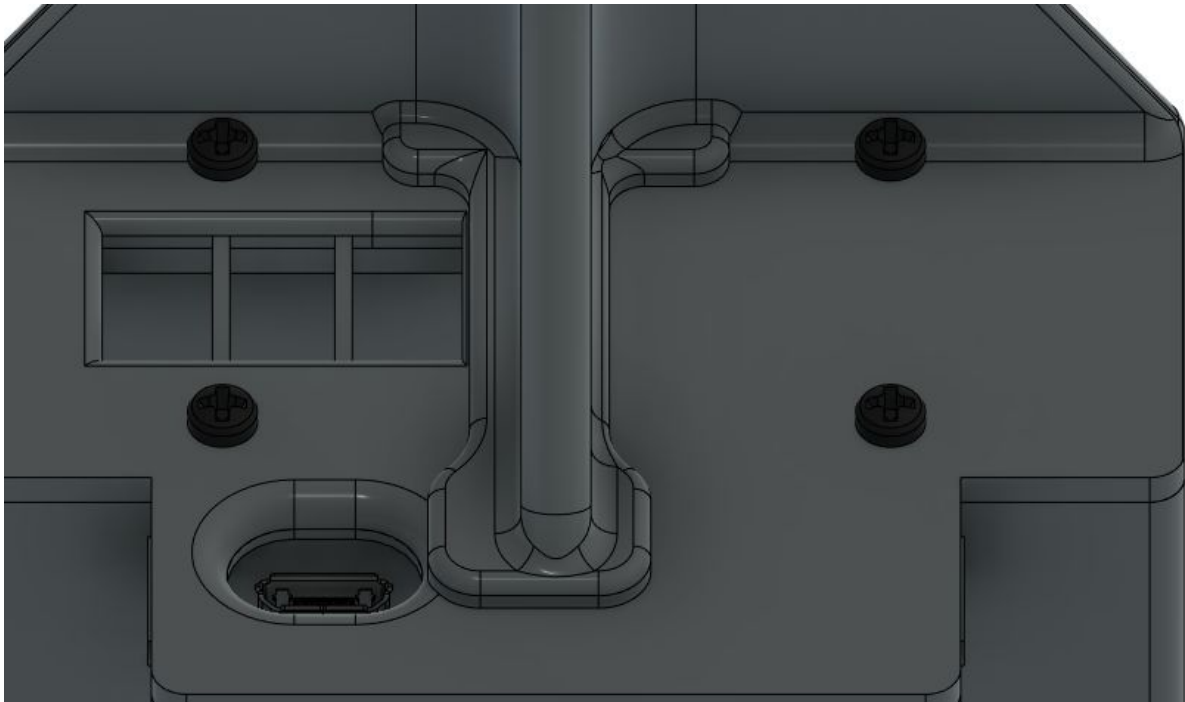


Photo 48: View of spike enclosure placed on battery and PCB enclosure with screws screwed in.

13. Press out the two bars in the spike enclosure marked in the red circle in photo 49

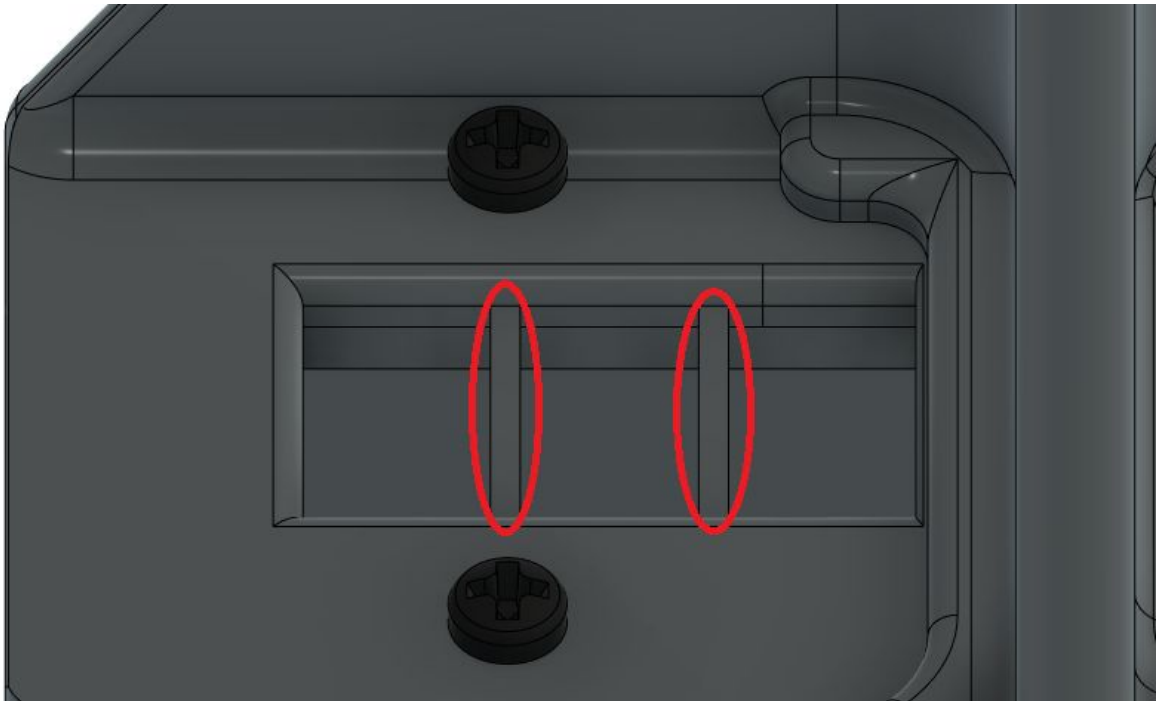


Photo 49: Photo of the two break-out bars marked.

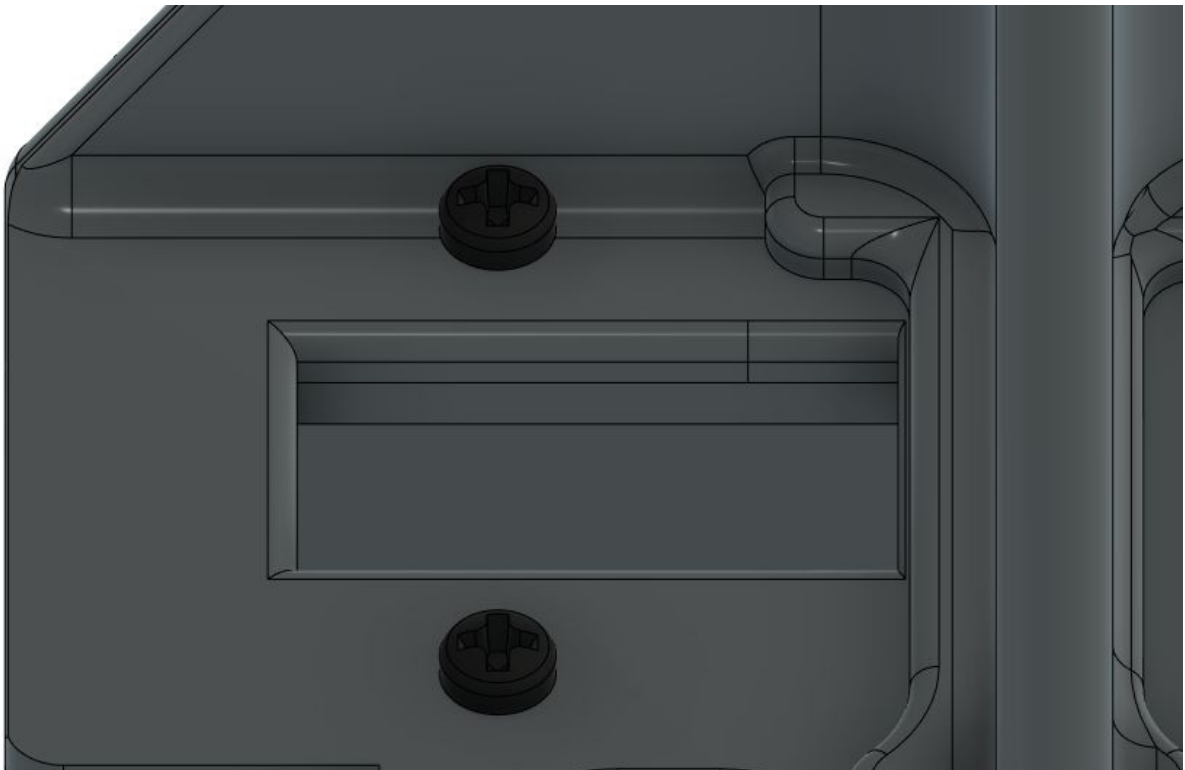


Photo 50: Photo of the two break-out bars removed.

User Manual

Basic Information

The following paragraphs will explain the basics of the VU Stick.

The VU Stick is a vertical LED VU meter you can stick in the ground. It listens to the FM radio channel you have set (10 presets or custom) and lights up a rainbow of colours that follow the dynamics of the music that is playing. Very easy to build and assemble, and an 8-year old child can set it up in the garden.

Because the device makes use of FM radio frequencies, you can also sync it with music on your phone by using a simple FM transmitter.



Button explanation:

The VU Stick has 3 buttons. These buttons are used to navigate the menu on the OLED display. The buttons, numbered in photo 51, have the following functions:

- Button 1: Select
- Button 2: Previous
- Button 3: Next

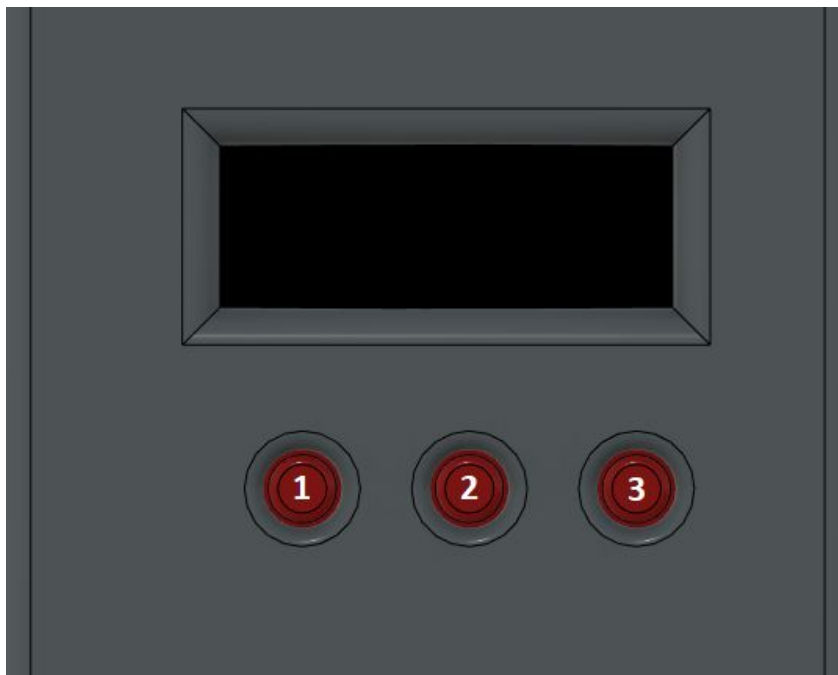


Photo 51: Front view of VU Stick with numbers marking the buttons.

Display explanation:

After powering on the VU Stick, it will display the default screen as illustrated in photo 52.

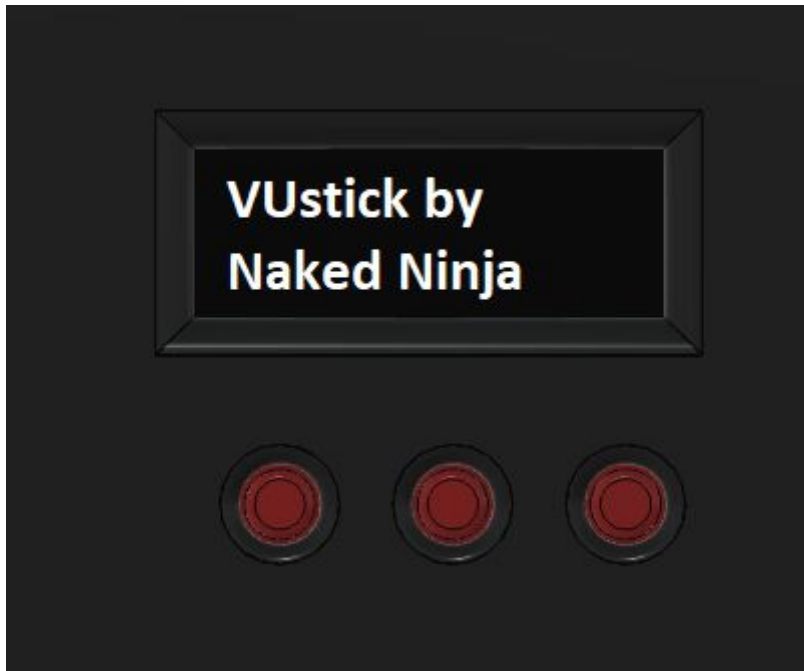


Photo 51: Default display screen.

To exit this default screen and enter the menu screen, press the “select” button.



Photo 52: Default display screen.

Here you can navigate through the menu by pressing the “previous” and “next” button.
To select one of the options in the menu, press the “select” button.

The menu has the following options:

- *Fixed FM*
- *Manual FM*
- *Calibrate*
- *Exit*

These options have the following functions:

Fixed FM: In the “Fixed FM” menu, the user can switch between the preset FM radio station by pressing the “previous” and “next” button. To select and exit this menu, the user must press the “select” button on the desired FM radio station.

Manual FM: In the “Manual FM” menu, the user manually set an FM frequency between 76 and 108MHz. To select and exit this menu, the user must press the “select” button on the desired FM frequency.

Calibrate: Selecting the “Calibrate” option in the menu will bring the user to a calibration sub-menu where the user can choose between:

- *Automatic:* Will automatically calibrate the RGB calculation value for the currently set FM radiofrequency or station.
- *Manual:* Allows manual change of the RGB calculation value.
- *Exit:* Reverts to the main menu.

Exit: Selecting the “Exit” option in the menu will revert the display to the default screen.

Connecting power

The following paragraphs will show you how to connect power to the VU stick

Note: Some power banks lack the required current output that is needed for the VU Stick. We recommend buying the power bank noted in the "Bill of Materials" to avoid this problem, or to buy a power bank that can at least supply 2+ amps.

Before connecting the power to the VU Stick, we recommend charging the power bank fully.

After this, follow the following steps:

1. Plug in the micro USB connector.
2. Pass the USB connector through the battery enclosure.

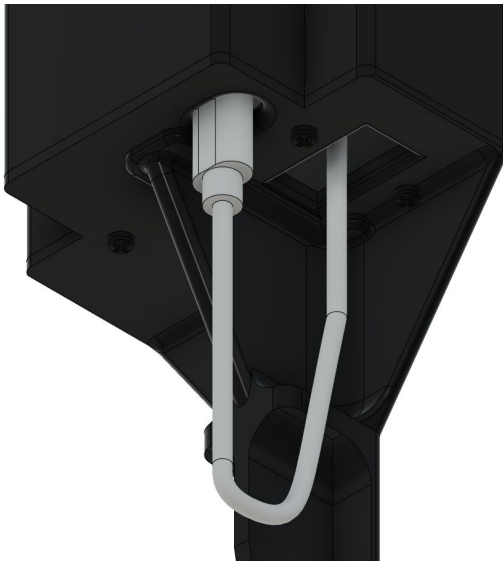


Photo 53: Plugged in the micro USB connector and passed through the USB connector.

3. Plug the USB connector into the power bank

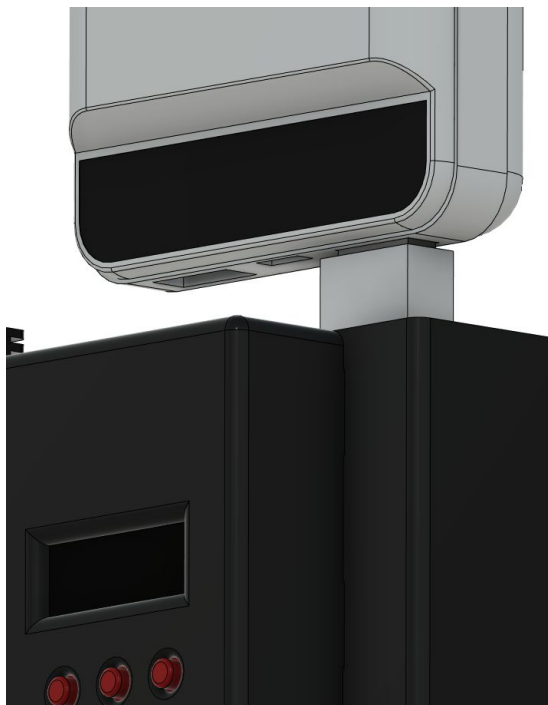


Photo 54: USB connector plugged into the power bank.

4. Enable power output on the power bank.
Note: Some power banks automatically enable power output when a device is connected.
5. Slide the power bank into the battery enclosure

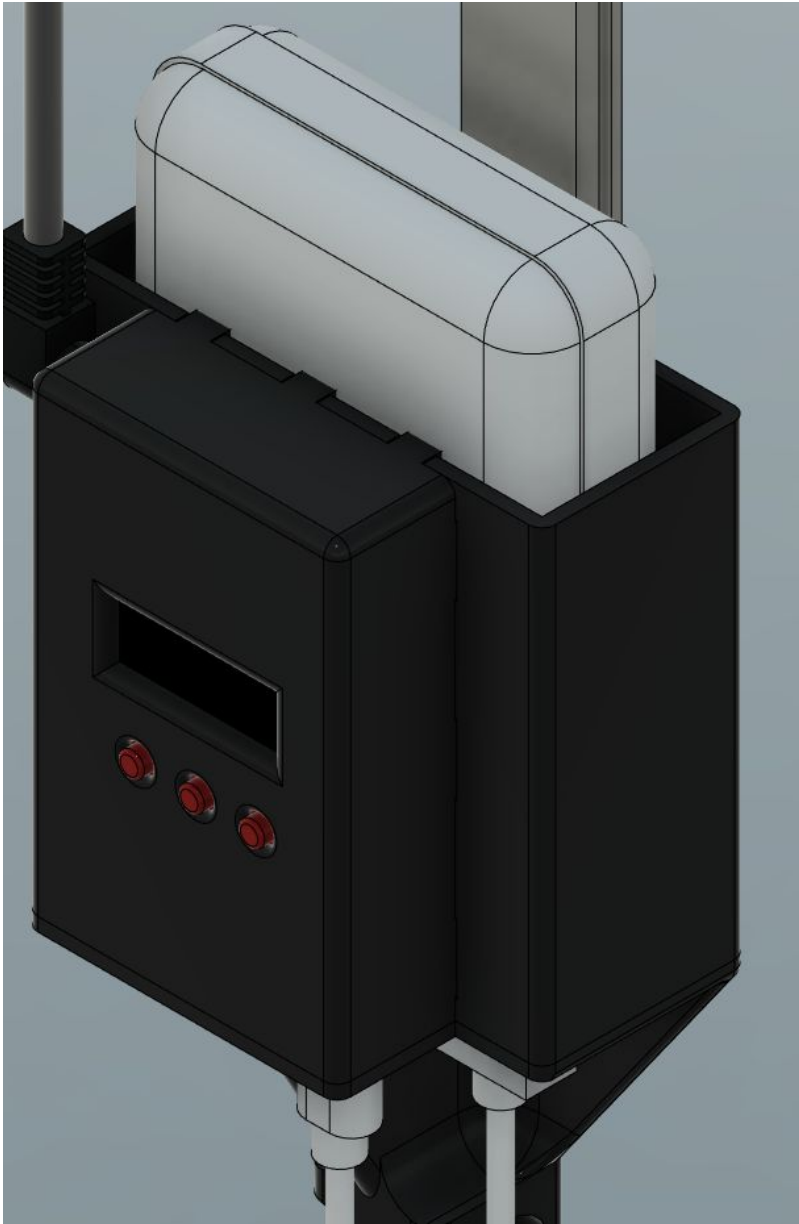


Photo 55: Powered VU Stick.

Adding preset FM stations

The following paragraphs will show you add an FM station to the preset FM stations

To remove or add preset FM stations, you will need to reprogram the Arduino Pro Mini.

For this you will require the following:

- PC or laptop with the Arduino IDE
- USB to TTL converter
- USB cable (to connect the converter to the PC/laptop)
- The Arduino sketch from the Naked Ninja GitHub.

After acquiring all items follow the following steps to add or remove FM stations:

1. Download and open the Arduino sketch for the VU Stick from the Naked Ninja product page or Github.
2. Scroll down to the “radioStations” matrix shown in photo 56.

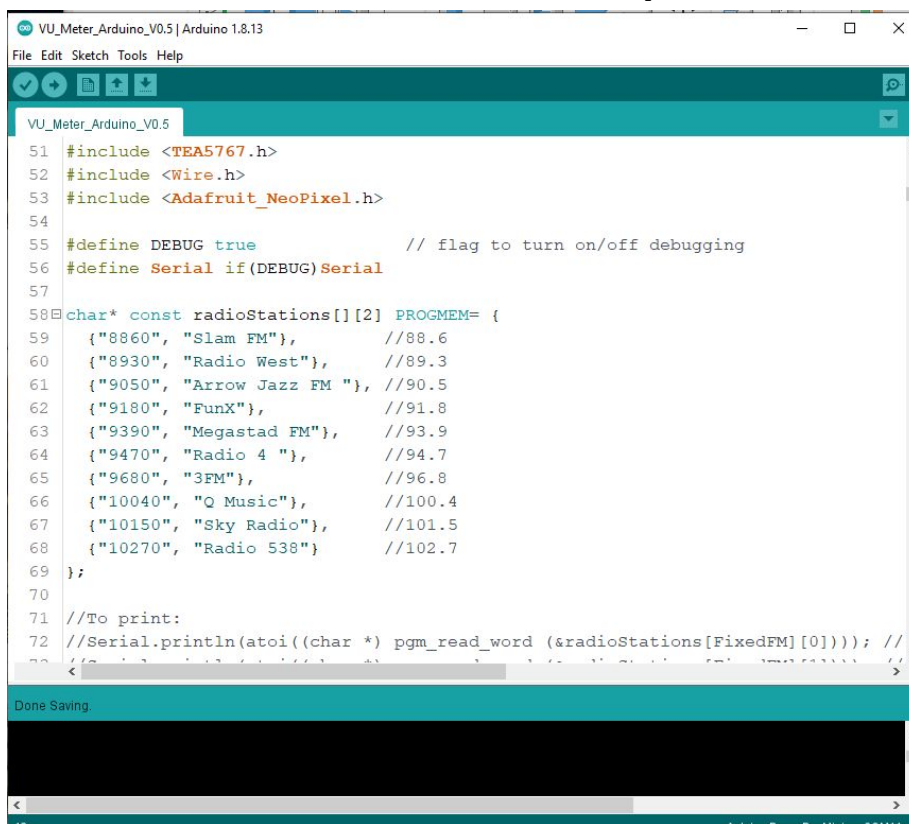
A screenshot of the Arduino IDE interface. The window title is 'VU_Meter_Arduino_V0.5 | Arduino 1.8.13'. The menu bar includes 'File', 'Edit', 'Sketch', 'Tools', and 'Help'. Below the menu bar is a toolbar with icons for saving, compiling, and uploading. The main text area shows the sketch code for 'VU_Meter_Arduino_V0.5'. The code includes headers for TEA5767, Wire, and Adafruit_NeoPixel. It defines a DEBUG flag and a Serial object. The 'radioStations' array is defined as a 2D array of character pointers, with 10 stations listed: 'Slam FM' (88.6 MHz), 'Radio West' (89.3 MHz), 'Arrow Jazz FM' (90.5 MHz), 'FunX' (91.8 MHz), 'Megastad FM' (93.9 MHz), 'Radio 4' (94.7 MHz), '3FM' (96.8 MHz), 'Q Music' (100.4 MHz), 'Sky Radio' (101.5 MHz), and 'Radio 538' (102.7 MHz). A comment indicates the array is for PROGMEM. The code also includes a comment for printing the station names. At the bottom, a status bar shows 'Done Saving.' and 'Arduino Pro or Pro Mini on COM11'.

Photo 56: Arduino IDE programming screen

3. Replace the FM stations in the array radioStations with your preferred stations. The first value is the frequency of the station, for example, 10270 would mean a frequency of 102.7 MHz.

The second is the name that will show up on the display.

Warnings:

1. Max of 10 stations can be given. More than this will result in memory problems.
2. This name for the radio station must be kept short to avoid problems displaying the radio station name on the OLED display.

4. Connect the USB-TTL converter to the Arduino Pro Mini

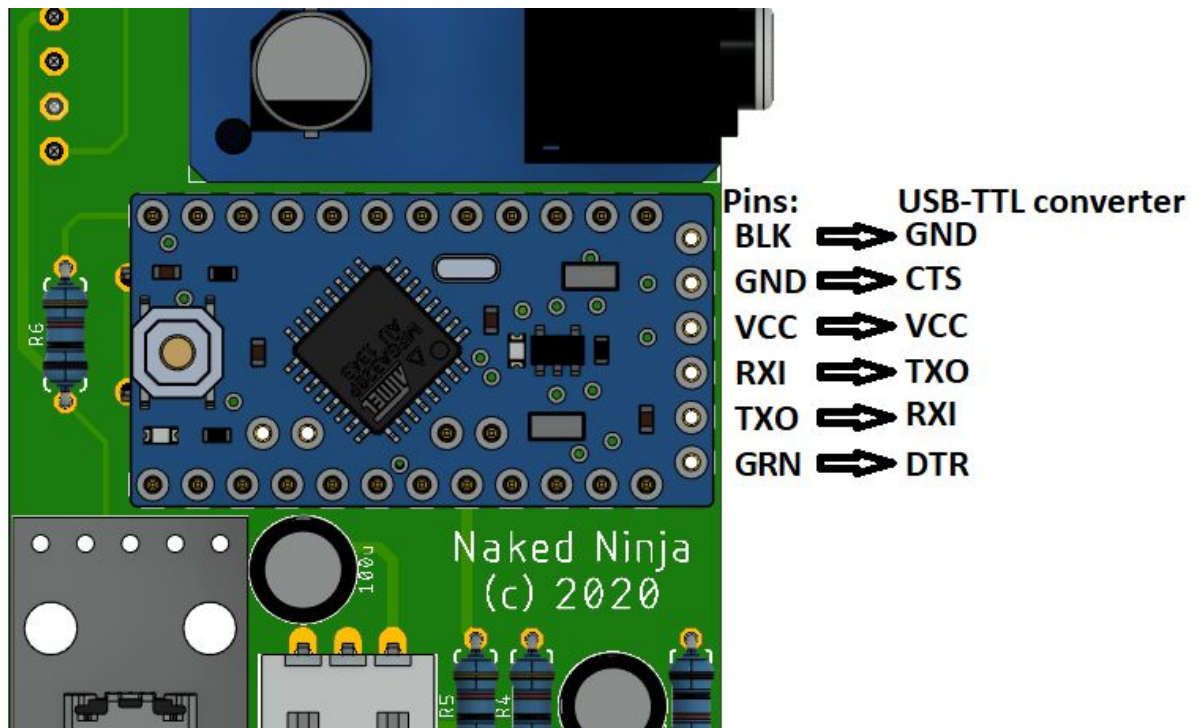


Photo 57: Arduino Pro Mini connection explanation

5. Connect the USB_TTL converter to the PC/Laptop.
6. Select the correct programming parameters.
Note: The programming parameters can be found in the top of the Arduino sketch
7. Program the Arduino Pro Mini
8. Disconnect the USB-TTL converter from the Arduino Pro Mini after the programming is completed

Switching between preset FM stations

The following paragraphs will explain how to switch between the preset FM radio stations.

After powering on the VU Stick, it will display the default screen as illustrated in photo 58.

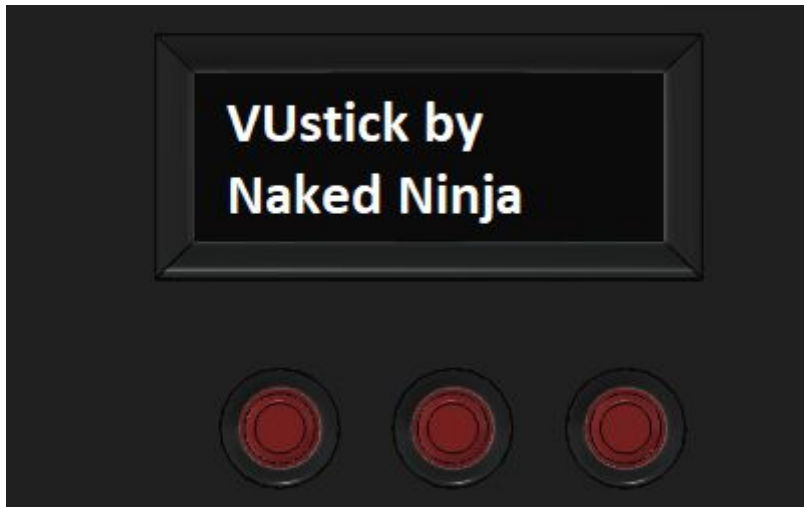


Photo 58: Default display screen.

To exit this default screen and enter the menu screen, press the “select” button.



Photo 59: Default display screen.

Select the “Fixed FM” option in the menu by navigating through the menu with the “previous” and “next” buttons and selecting the option with the “select” button.

Here you will be presented with the preset FM stations. You can navigate through the station with the “previous” and “next” buttons and exit the screen with the “select” button.

Note: The current station is instantly switched while going through the preset FM stations.

Setting manual FM frequency

The following paragraphs will explain how to manually set

After powering on the VU Stick, it will display the default screen as illustrated in photo 60.



Photo 60: Default display screen.

To exit this default screen and enter the menu screen, press the “select” button.



Photo 61: Default display screen.

Select the “Manual FM” option in the menu by navigating through the menu with the “previous” and “next” buttons and selecting the option with the “select” button.

Notes:

- The frequency can be set between 76 and 108MHz.
- The current frequency is instantly used while switching frequencies.

Calibrating RGB LED strip

The following paragraphs will explain how to calibrate the RGB LED strip.

After powering on the VU Stick, it will display the default screen as illustrated in photo 62.

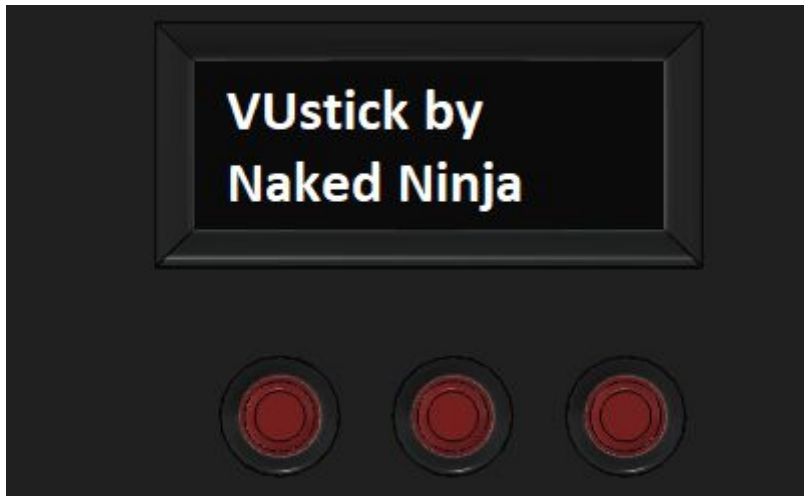


Photo 62: Default display screen.

To exit this default screen and enter the menu screen, press the “select” button.



Photo 63: Default display screen.

Select the “Calibrate” option in the menu by navigating through the menu with the “previous” and “next” buttons and selecting the option with the “select” button.

You will be presented a new menu with the following options:

- Automatic
- Manual
- Exit

Selecting the “Automatic” option will automatically calibrate the RGB calculation value for the currently set FM radiofrequency or station. After the calibration is done, the device will notify you with the message “Product Calibrated” and return to the main menu afterwards.

Selecting the “Manual” option will prompt you with the current set RGB calculation value. This value can then be changed by using the “previous” and “next” buttons. Increasing the value will decrease the location of the highest peak of the RGB LED’s, and decreasing the value will increase this peak.

Selecting the “Exit” option will return the user to the main menu,