PMT Setup Manual

Version 1.0

Spring 2020

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Manufacturing

Overview

To provide instructions for programming and assembling PMT hardware and components.

What do I need?

1. Full parts list as per the BOM
2. Phillips screwdriver
3. Soldering equipment
4. One Micro USB Cable

Procedure

a. Programming the Esp32PicoD4
   i. Take the Esp32PicoD4, an internet capable computer, and the Micro USB cable. Using the cable, plug the Esp32PicoD4 into the computer.
   ii. Assess which communication port the Esp32PicoD4 has been assigned to.
      1. On a Windows Machine this can be done through the Device Manager tool. Open Device Manager, find and expand the "Ports (COM and LPT)" tab.
      2. Search for the option named "Silicon Labs CP210x USB to UART Bridge (COMx) as shown below. Take note of which COM port this device is listed as. In the image provided it is shown as "COM4".


   iii. Download the tool used for flashing the Esp32PicoD4. This tool is called uPyCraft. A link to a download page is provided. Clicking the link will download the executable immediately: https://randomnerdtutorials.com/uPyCraftWindows
   iv. Run the uPyCraft tool by double clicking its icon.

v. A box should appear prompting you to install a font as shown below. This can be ignored. Simply click cancel.

vi. A new window should open. This is uPyCraft. With your Esp32PicoD4 plugged into your computer, select Tools > BurnFirmware. A new window should appear as shown in the figure below. From here forward we will refer to this as the "uPyCraft Figure".
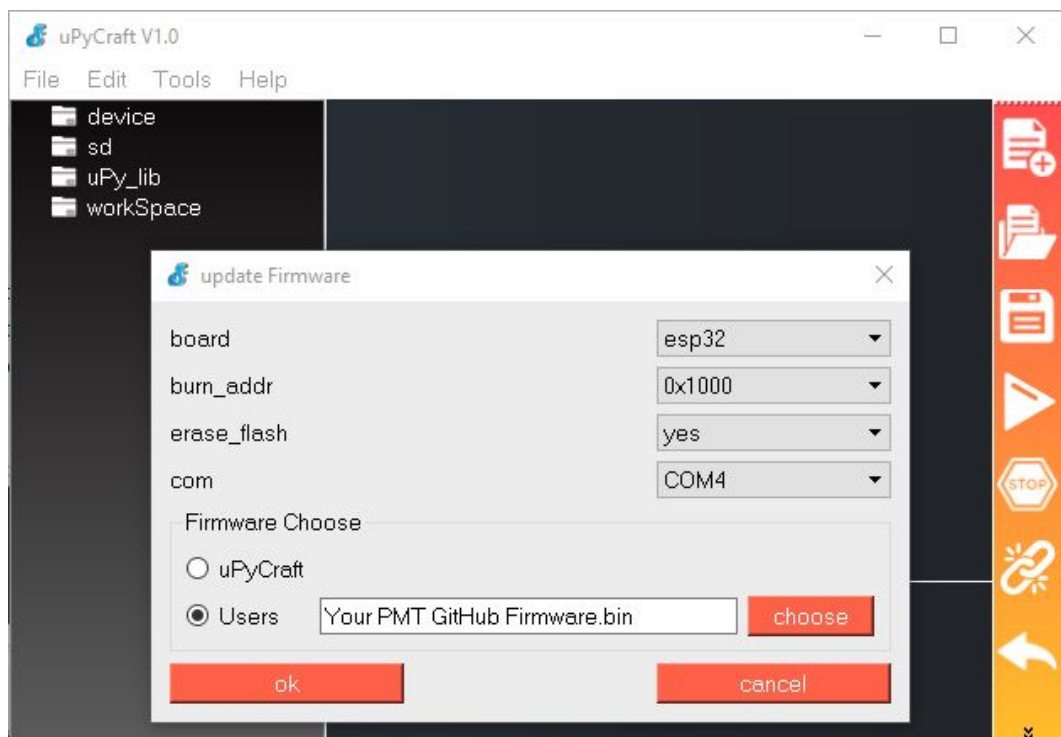
vii. Copy the same options as presented in the uPyCraft Figure. Set the board to esp32, the burn_addr to 0x1000, erase_flash to yes, and the com to the same COM port you identified earlier from your Device Manager. Remember in the writer's case this was COM4, yours will likely be different.

viii. To download the firmware to flash to the board, go to https://github.com/skinnyrad/PMT and select the "firmware.bin" item. This will take

you to another page. From this page, select the "Download" button to download the firmware.

ix. Going back to uPyCraft, at the bottom, select "Users" and click "choose". Browse to the location of the firmware.bin download and select it.

x. Click "ok" to begin flashing your Esp32PicoD4 with the PMT firmware.

xi. Now that the base firmware has been flashed it is time to move over the final file, our main.py. To do this we will need to install a tool called "ampy", and to install the tool we will use a python tool called "pip". If you do not have Python installed on your system, please do so now. The installation of python is very simple and many guides are already available online so one will not be provided in this text. Here is the official python downloads page: https://www.python.org/downloads/

xii. With Python installed, open up a command prompt and type the following command: "pip install adafruit-ampy". This will install the ampy tool.

xiii. Now to place the main.py file on the board, if you have not already downloaded the PMT github repository or downloaded the single main.py file, do so now from your web browser. Link: https://github.com/skinnyrad/PMT/tree/master/uPy from this page, select the file "main.py" and clink the Download button.

xiv. Find here the file was downloaded on your system and using your command prompt's "dir" and "cd" commands navigate to where this file was downloaded. A quick rundown for a new user: cd stands for **C**hange **D**irectory. dir stands for list **DIR**ectory.

Example usage:

```
Command Prompt

E:                          \Documents>cd Github

E:                          \Documents\Github>dir
 Volume in drive E is MAIN 1
 Volume Serial Number is

 Directory of E:                          \Documents\Github

04/05/2020  03:49 PM    <DIR>          .
04/05/2020  03:49 PM    <DIR>          ..
04/05/2020  04:14 PM               547 Notes.txt
04/05/2020  04:14 PM    <DIR>          PMT
               1 File(s)            547 bytes
               3 Dir(s)   442,098,601,984 bytes free

E:                          \Documents\Github>cd PMT

E:                          \Documents\Github\PMT>cd uPy

E:                          \Documents\Github\PMT\uPy>dir
 Volume in drive E is MAIN 1
 Volume Serial Number is

 Directory of E:                          Documents\Github\PMT\uPy

04/05/2020  04:14 PM    <DIR>          .
04/05/2020  04:14 PM    <DIR>          ..
04/05/2020  03:57 PM             3,304 accel.py
04/05/2020  03:57 PM             1,615 encry.py
04/05/2020  04:14 PM             1,914 gdt.py
04/05/2020  03:57 PM             3,712 gps.py
04/05/2020  04:14 PM             2,386 logging.py
04/05/2020  04:14 PM             8,292 main.py
04/05/2020  03:57 PM             2,061 post.py
04/05/2020  08:40 PM            10,410 reqst.py
04/05/2020  03:57 PM             4,142 wifi_connect.py
04/05/2020  03:57 PM                 0 __init__.py
              10 File(s)         37,836 bytes
               2 Dir(s)   442,098,601,984 bytes free

E:                          \Documents\Github\PMT\uPy>
```
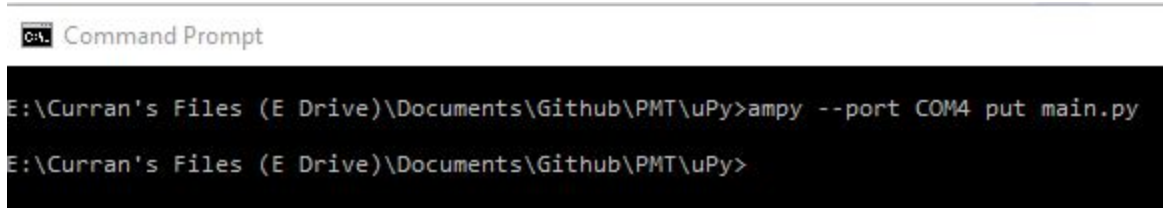
xv.   Once you have navigated your command prompt to the location of the file download, with the Esp32PicoD4 plugged into your system type the following command:

ampy --port COMX put main.py

Where COMX is the COM port you took note of earlier from Device Manager. The command should not return anything if successful. Simply wait until completion. This should take a short amount of time (a few seconds) if it takes longer than 15

seconds or if the command returns with what looks like gibberish then the board has not responded. It is highly recommended before executing this command to push the EN button (the one closest to the silver antenna) then immediately after, execute the ampy command. This button reboots the board and increases the chances the board will respond dramatically.

xvi. (optional) The user can now observe the board in operation with a serial connection. The code will report errors until almost all steps in the Manufacturing section of this guide are completed. There are several options to establish this serial connection. We recommend MobaXTerm. Guides for establishing a UART (aka serial) connection over MobaXTerm are available online and will not be provided in this text.

b. Printed Circuit Board (PCB) Soldering
   i. Solder male header pins into all the following breakout boards: EspPicoD4, MicroSD module, NEO-M8N GPS module, Triple Axis Accelerometer. **DO NOT** solder male header pins into the Accelerometer holes listed as "A1, A2, A3" as these will be unused and would make the Accelerometer module unable to be placed on the PCB. Make sure to solder the male header pins into the GPS module **UPSIDE DOWN** since this is how the GPS module will be placed on the PCB.
   ii. Most components have designated locations as etched in the PCB for easy reference. Notes are the board listing all 3.3V solder pads listed on the PCB for reference when placing components to solder.
   iii. Place the programmed Esp32PicoD4 with the micro USB port facing off the board.
   iv. Place the MicroSD Card module with the SD card facing off the board.
   v. Place the GPS module upside down. The pinout is listed on the PCB for reference (3.3V, RX, TX, GND).
      1. Solder the GPS antenna onto the top of the GPS module. There are 4 large square solder footprints where the antenna is meant to be placed and soldered.

      vi.   Place the 3.3V Voltage Regulator with the heat sink laying against the PCB. The correct orientation of the Voltage Regulator is listed on the PCB as well as the pinout (Vin, GND, 3.3V Out).

      vii.   Solder the 2.2uF and 0.47uF ceramic disk capacitors into the holes behind the Voltage Regulator. The polarity does not matter when placing these capacitors.

      viii.   Solder the RGB LEDs with the longest leg (GND) in the 2nd hole for each RGB LED.

      ix.   Solder the 100 ohm resistors into the appropriate holes next to the RGB LEDS. The polarity does not matter when placing these resistors.

      x.   Solder the Screw Terminal with the front (input side) facing off the board.

      xi.   Solder the LIPO Battery connector with the locking mechanism facing towards the inside of the board.

c. Mount the PCB with M3x10mm Female standoffs with M3x6mm Screws into each corner of the board. Use a small screwdriver for tightening.

d. Connect the LIPO battery to the PCB connector titled "LIPO_BAT". The LIPO battery can then be stored underneath the PCB.

e. An external 3.7-12V power supply can be attached to the PCB by inserting the positive and negative wires of the power supply into the screw terminals on the PCB. Polarity for the screw terminals is written on the PCB as "+" for Positive Power and "-" for Ground.

f. Once the desired power supplies have been attached to the board, use the slider switch on the PCB to select which power source you would like to use to power the system. Sliding the switch towards the LIPO battery connector will use the LIPO battery. Likewise, sliding the switch towards the screw terminals will use the screw terminal power.

g. Insert an SD card into the SD card module on the board. The SD card must be no greater than 32 GB.

The PCB can then be mounted in the enclosure box and screwed shut.

PMT Web Hosting-side

Overview

To allow PMT to send the collected gps data through possible **Free Open Hotspots**, we need to set up a Free Hosting Account and then add the provided files (**PMT_Web_Files.zip**). The procedures contained in this document are needed to successfully set up the PMT.

What do I need?

1. **PMT_Web_Files.zip**
2. Free Hosting Account (Step-by-step below)
3. PMT Device setup

Procedure

a. **Download PMT_Web_Files.zip**
b. **Free Hosting Account**

   Any hosting provider that supports PHP can be used.

   The following Free Hosting Providers are recommended:

1. 000webhost.com (Free SSL Certificate)
   a. Sign up and verify email address
   b. Create a new website (top-right corner)

   c. Select and set a **Website Name** or **ALIAS** (needed later for PMT Device setup). In this example **<name>.000webhostapp.com [HOST]**

d. **Login** and go to **My Websites**. Select **Manage Website** under your previously named website.
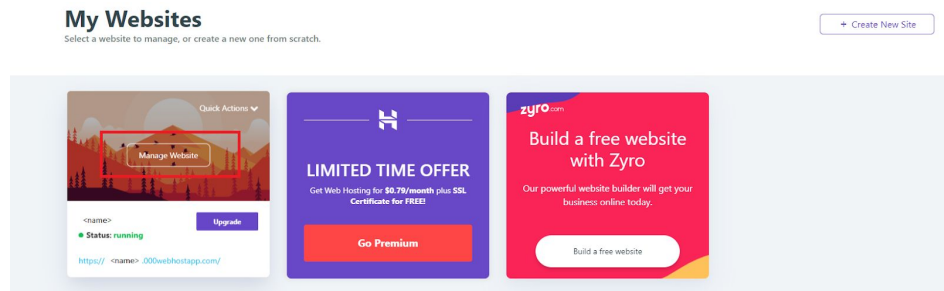
e. Select **Tools**, under the Left-side Navigation Bar.
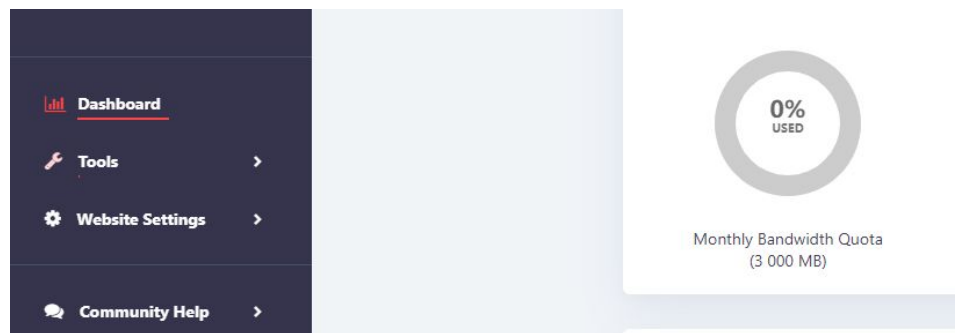
f. Select **File Manager** and click **Upload Files**
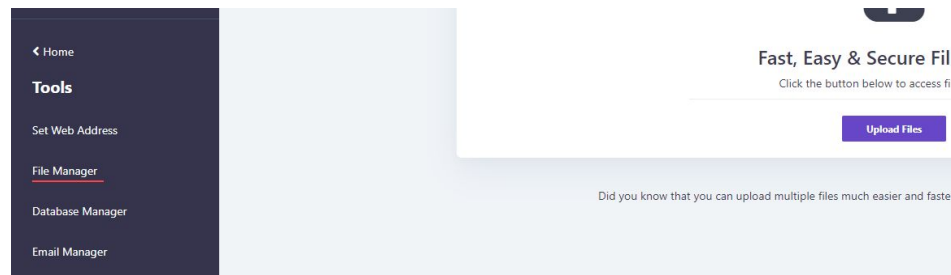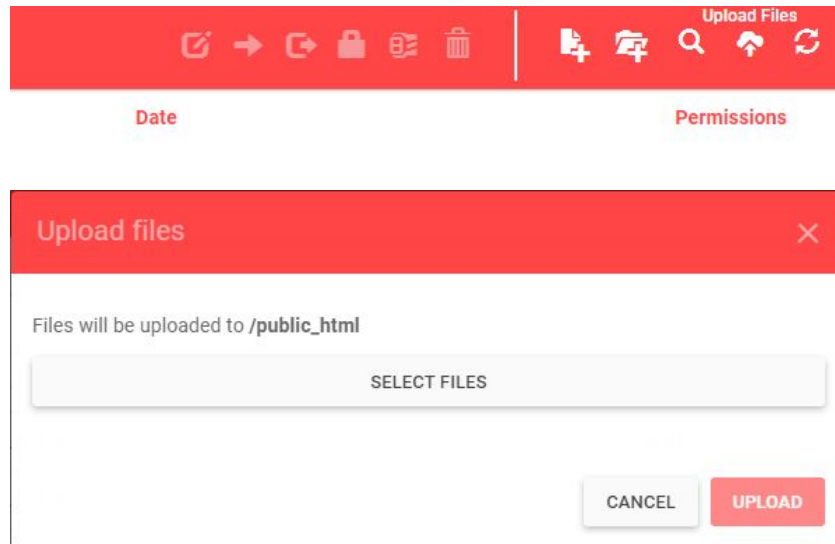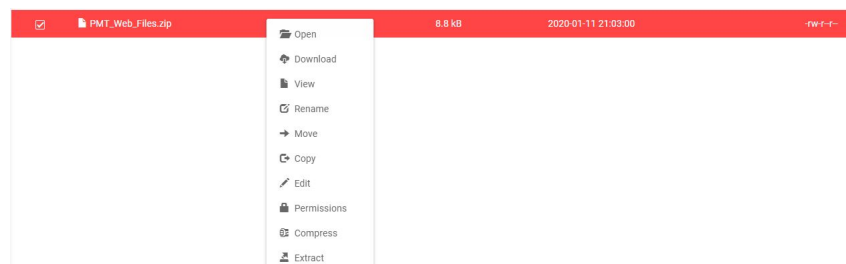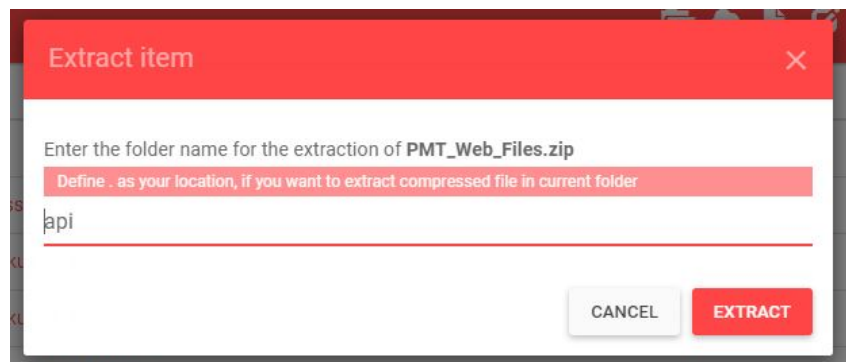

g. Open or Double-click **public_html** folder
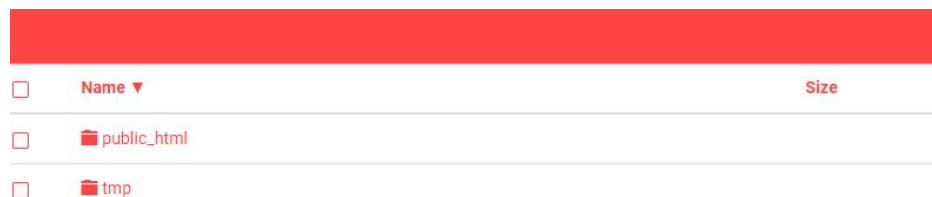
h. Click **Upload Files** and **Upload** PMT_Web_Files.zip

i. **Right-click** the .zip file and **extract**

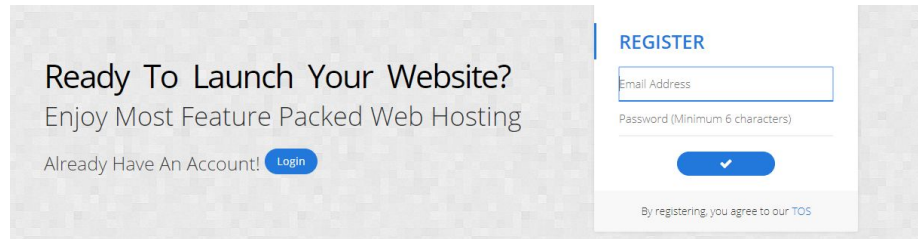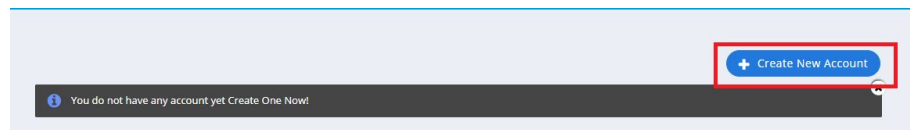j. **Rename** to **api** and confirm **Extraction**
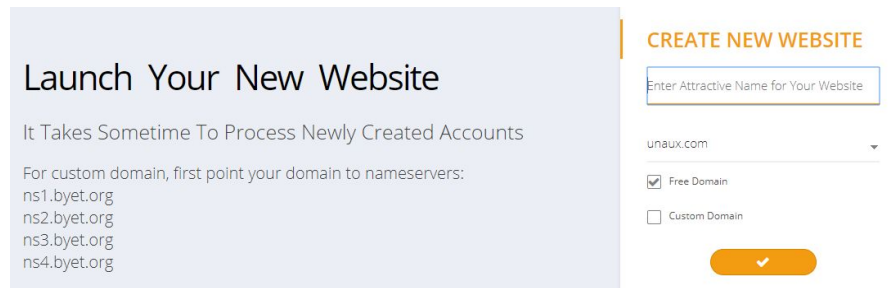

IMPORTANT: extracted folder has to be named **api**

k. **Sign out**
2. infinityfree.net (No Free SSL Certificate) [Same procedure as profreehost.com]
3. profreehost.com (No Free SSL Certificate)
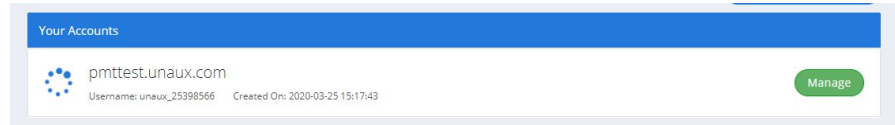   a. Sign up and verify email address to activate account

   b. Create a new website (top-right corner)

   c. Select and set a **Website Name** or **ALIAS** (needed later for PMT Device setup). In this example our **Name**=pmttest. Therefore, **pmttest.unaux.com** is the [**HOST**].
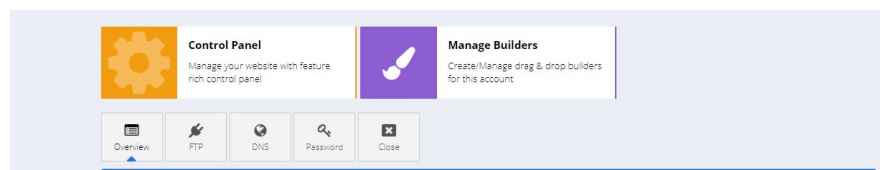
d. **Login** and go to your **Account**. Select **Manage** under your previously named website.

IMPORTANT: Might take a few minutes for its creation

e. Select **Control Panel**, under the Manage Page.

IMPORTANT: Might take a few minutes for its creation

f. OPTIONAL: If a temporary page shows up, "Approve" and continue.
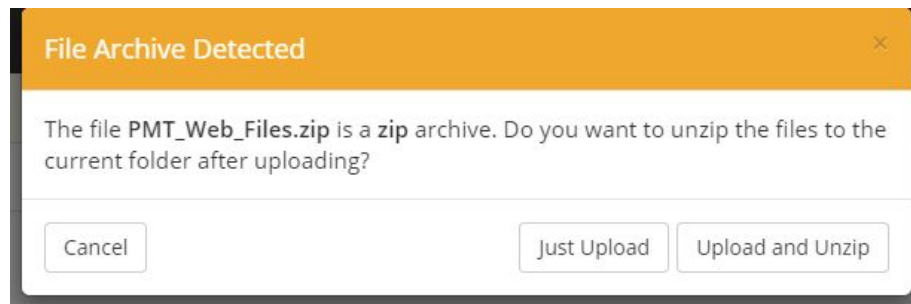g. In the Control Panel, under the FILES container, select **Online File Manager.**
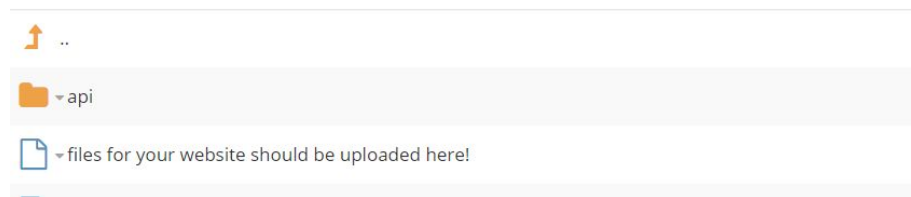

h. Open or Double-click **htdocs** folder

i. Click the **Upload Files icon** on the **bottom-left** and **Upload Zip...**

j. And Browse to the location where PMT_Web_Files.zip is contained and select it.
Click **Upload and Unzip**

k. Verify that the unzip file is called **api**
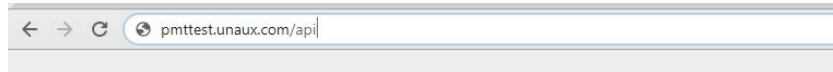

IMPORTANT: extracted folder has to be named **api**

l. **Sign out**

Important Information: The new hosting website might take up to 72 hours to be available for use.

4. Test Website Status

Through any browser of your choice, go to the created website using the URL input field. Using the previous Free Hosting Name created above (**pmttest.unaux.com**) as an example.

   a. Type the **HOST** name followed by **/api**

   b. You should see a white page with the text "**OK**". If so, PMT Web Files are set up correctly.
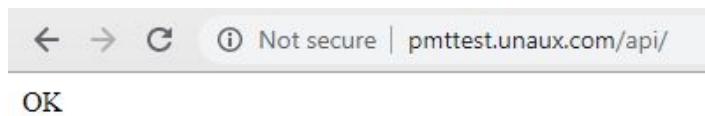
Error Hints: extracted folder has to be named **api** or the new hosting website might not be available yet (it can take up to 72 hours to be available for use).

PMT Device Setup

Overview

To set up the PMT we need a **configuration file**. There are two ways to get to the configuration file. A **Generation Mode** through the Portal or **Manual Mode** through a Text Editor like NotePad.
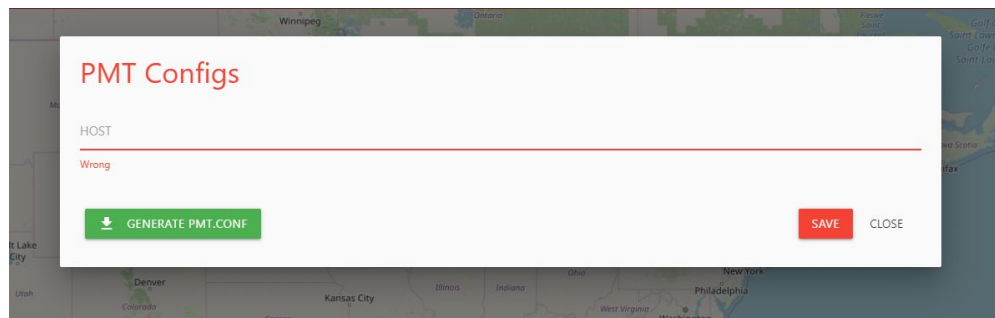
Generation Mode

1. After downloading and extracting PMT_Portal_Files.zip to the location of your choice, open **index.html** with the browser of your choice (Recommended: Google Chrome). Index.html can be opened by right-clicking on it , Open With and select a browser.
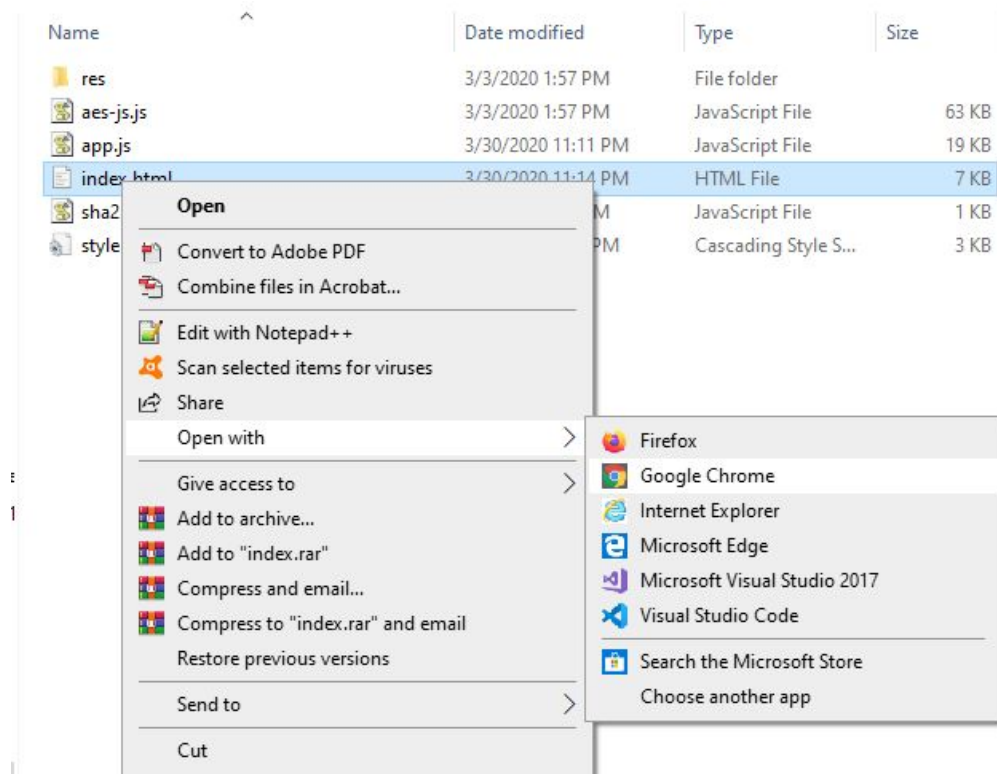
2. After the portal loads, you will be prompted to enter the web **HOST** name previously created. **Remember to save** once you have inserted the required information.

   Additional Information: **HTTP** if No Free SSL Certificate. **HTTPS** if Free SSL Certificate.

3. **Click "Generate PMT.conf"** and the PMT Configuration file (pmt.conf) will be saved to your downloads location.

   Additional Information: If you have downloaded multiple pmt.conf files make sure you rename it to **pmt.conf** before you put it in the SD Card.

4. Plug in the SD card you plan to use for PMT in your computer and browse to it.
5. In the SD Card location, copy & paste the previously generated **pmt.conf.**
6. Insert the SD card back into PMT and you are ready to go!!!

Manual Mode

1. Plug in the SD card you plan to use for PMT in your computer and browse to it.
2. Open the file **pmt.conf** in the Text Editor (example NotePad). If pmt.conf is not there, see the PMT Configuration File section.

   Add the previously created Website name [HOST] to the **'host'** parameter.

   You should see the following parameters (from example above):

   ```
   {
       'host': 'http://pmttest.unaux.com',
       'gps_interval': 5,
   }
   ```

   Additional Information: **HTTP** if No Free SSL Certificate. **HTTPS** if Free SSL Certificate.

3. Insert the SD card back into PMT and you are ready to go!!!

PMT Configuration File

Overview

To allow PMT to operate and send the collected gps data to the Web Hosting site (Setup), a configuration file is needed in the SD card.

What do I need?

1. SD Card
2. File editor

Procedure

a. **Format** the SD Card to Fat32 filesystem.

   IMPORTANT: SD card cannot be bigger than 16GB

b. Browse to the SD Card and move the **pmt.conf** file into it or create a new one.
c. Open it up with a File Editor of your choice and set it up according to operation behavior. The configuration file will look like the following:

```
{
    'host': 'http://pmttest.unaux.com',
    'gps_interval': 10,
}
```

PARAMETERS	Description
host	Corresponds to the URL to the Web Hosting from PMT Web Hosting-side
gps_interval	Corresponds to GPS data rate. Period in seconds. DEFAULT: 10