

Shield

- In the kicad folder are all the files needed for you to reproduce the shield.
- You can find the schematic [here](#).
- You can find the partslist [here](#).

When you make a circuit (with breadboard or with PCB board), in order to be able to use arduino sketch you must use the [ethernet shield](#).

You also need to have a router with free ethernet ports (or set up your own local network)

Arduino

- Copy the files in arduino/libraries to [path-to-sketchbook]/libraries.
- Open arduino/vocab_mqtt/vocab_mqtt.ino.
- On line 32 it says: `const boolean USE_DHCP = false;`, if you want to connect the device directly to your computer or for any other reason use a manual ip address set this to false. If you want to connect the device to a network (router, hub, etc) you can set this to true.
- On line 53 it says: `char server[] = "192.168.1.2"; // "mqtt.lan";`, change that ip-address to where you have your [MQTT](#) broker.
- On line 56 it says: `#define MQTTPREFIX "/plant/10"`, this is where you set the MQTT address of this device.
- Now load the sketch to your arduino, stack the ethernet shield on the arduino and the *PlanEt* shield on the ethernet shield.
- install [mosquitto](#) on your computer. (how?) *You can find instructions on here (link).*
<http://mosquitto.org/download/>

NOTE - you can transmit data straight to your computer (Apple, Ubuntu), but remember that there might be some differences in installing mosquito based on the OS. You also can use Raspberry Pi as a broker and data collector.

Broker

Two ways of getting data - one through raspberry pi and one directly on your computer.

RASPBERRY PI SET UP

We will be using the raspbian wheezy OS for the raspberry pi. To install this to your sd card please follow these instructions:

<https://www.raspberrypi.org/documentation/installation/installing-images/README.md>, please look at the last paragraph titled writing an image to the sd card.

Next step is to install mosquitto. For this you first need to open the terminal, then run these commands:

- 'sudo apt-get update'
- 'sudo apt-get install mosquitto mosquitto-clients git'

Now when you start the RPi you would need to start the terminal and type mosquitto to start the broker.

To be able to log data, you need to copy a script for that to the raspberry pi. To do this you will start with making a folder (or creating a directory) through the terminal. You will do so by typing commands in there. Remember to press Enter after each command. Open a terminal and type:

```
mkdir git
```

Next we need to enter this folder, type:

```
cd git
```

Now we will put in here the PlanEt repository, type:

```
git clone https://github.com/WorldWilderLab/Planet.git
```

Before we start with logging, we need to make another folder. Assuming you are still in the git folder we just made, type:

```
mkdir ../plantdata
```

Now you are ready to run our script for the first time. You need to go to the folder where the script located, you do so by typing:

```
cd Planet/scripts
```

First you need to make sure that the script has the right permissions, type:

```
sudo chmod +x start_log
```

Now type:

```
./start_log plant/1 127.0.0.1 /home/pi/plantdata
```

To read more about the log script please look here:

<https://github.com/WorldWilderLab/Planet/tree/master/scripts>. You can now find your logged data files in the 'plantdata' folder we created.

If you want to stop the script from running (please be aware that this will stop all instance of the script!) type:

```
sudo pkill start_log && sudo pkill mosquitto_sub
```

You also can always SSH (you can find out what it means here https://en.wikipedia.org/wiki/Secure_Shell) to your raspberry pi and run those commands from the terminal in your laptop or to transfer the data file to your computer/laptop

List of commands.

install mosquitto: `sudo apt-get install mosquitto mosquitto-clients`

find ip address of raspberry pi: `hostname -I`

start broker: `mosquitto`

For information on how to use the script in the scripts folder please see the readme in the scripts folder.

command to run from your computer

connect to rasp via ssh: `ssh pi@[raspberry pi ip address]`

send files from rasp to your laptop: `scp pi@[rasp ip]:[file location] [location on your computer]`

Scripts

- In the scripts folder you will find scripts we use for logging data.
- Please read the readme in the scripts folder for more info on usage *and proceed according to the OS that you decided to use*

Protocol

Electrodes and Ground Probe

You can use subdermal electrodes such as that:

http://www.ambu.co.uk/ukca/products/area_of_interests/diagnostics/product/neuroline_subdermal-prod3614.aspx or electrode pads with the electrode gel, such as that:

http://www.amazon.co.uk/Healthcare-World-Electrode-Tenscare-NeuroTrac/dp/B00C6NI23Q/ref=sr_1_10?ie=UTF8&qid=1444662727&sr=8-10&keywords=electrode+pads

Make sure that your ground probe is made of stainless but conductive steel. It has to be placed in the pot in the soil. Also make sure that the pot itself is standing on isolated surface - such as plastic plate.

Plants

Use plants with juicy and thick stems and quite big leaves. Please note that if you decide to use electrode pads, leaves of the plant have to be big enough to accommodate pads.

Connecting to plants

Insert or place one electrode on the leaf and one on the stem leading to this leaf. If pads are too big for the stem, you can cut it to the size. Insert probe in the ground.

Collecting data

The good practice is to collect data over at least few hours period. You can leave a plant in one place, but if you touch it, water it or do anything else it is good to make a note on the time when that has happened and description what has happened.

DATA GRAPHS PLOTTING:

In order to do that you need to make sure that you save your data file as CSV (https://en.wikipedia.org/wiki/Comma-separated_values).

We are using MagicPlot software to create plots. You can download free (student) version from here <http://magicplot.com/downloads.php>

Once you have your csv file, in order to use it in Magic Plot you might need to prepare it in a following way:

1. open the csv file in a text editor. open XL Doc. Copy all from the text editor and paste it into XL. Then go to the "data" in your XL doc and select: "text to columns" option. Choose "Delimited", press "next" and select all the available options. Click on "Finish"
2. Now you have the data nicely separated by columns. You can get rid of some columns which are not necessary for making plots (i.e. date, or day of the week or human time). But if you also can leave it for your own references.
3. The most important thing in this new XL sheet is to filter out probes readings which are not necessary and make sure you leave those probe number from which you want to make a plot. To do so: click on the column with probes (that is where is written: /plant/10/status *remember that "10" here shall be replaced by the number which you have used in the arduino code. Make sure that the whole column is selected. Go to "data" and select filter. You should see a small arrow on the column heading. Click on that and select this PROBE from which you want to make a plot. Once you do that, what remains on your xl sheet is everything which you do not need. Select All and delete. Now what shall be left is that probe which you want. You might end up with the clear rows. Before you save your file, go to the corner of the XL sheet where rows number meets the columns. You will see an arrow there. Right click that and from the menu select option "sort" ⇒ "Ascending". That way you will get a nice spread with no clear spaces arrange by the Epoch Time (first column).
4. The last thing is to make sure that the Epoch Time (https://en.wikipedia.org/wiki/Unix_time) (column A) is in a right format. To do so - click on the column A - select it all. Then navigate on your XL sheet to the option just above the spread which is called "increase the number of decimal spaces" - that usually looks like a little blue arrow with three zeros. Click on it as many times as needed to the point when you see 12 number after decimal point (1.xxxxxxxxxxxxxxx).
5. Now make sure you save or export this file as CSV.
6. Open Magic Plot. From "Project" select "Import text table" and navigate to your CSV file. from available option panel which opens up, make sure that: in column

deliminator you select “comma”, and then choose for X axis a column with the Epoch time (usually A) and then for Y Axis a column with values (usually the last column). Click on “import” and the plot will be created.