



# mangOH™ Green

## Tutorial—Arduino-compatible Shield to AirVantage

4119370

Rev 1

Contents subject to change

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## Document details

Title: mangOH Green User Guide

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Source: <http://mangoh.io/>

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## Revision History

Revision number	Release date	Changes
1	June 2016	Document created

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# 1: Getting Started

This tutorial will take you through the process of setting up your mangOH Green to allow Arduino sketches to transmit data to the cloud, and configuring AirVantage to receive that data.

The tutorial builds on basics covered in the mangOH Green Fundamentals tutorial and the mangOH Green User Guide. To work through this tutorial:

- You must have already set up your mangOH Green hardware and registered your device on your AirVantage account. See the mangOH Green Fundamentals tutorial for details.
- You must have an IDE loaded on your computer for Arduino sketch development. The examples in this tutorial reflect the use of the Arduino IDE, v.1.6.9 (available from <http://arduino.cc>).
- You should have a working understanding of sketch development. (This is not a coding tutorial.)

When you finish this tutorial, you will have git-cloned the mangOH platform, used the Arduino IDE to build and install a sketch on the mangOH Green, and configured your AirVantage account to receive data sent by sensors installed on an Arduino shield.

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**Tip:** *If you have only one monitor, you may want to print this document and use it when you don't want to switch back and forth between the PDF and the various windows/applications you'll be opening during the tutorial.*

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This tutorial includes:

- [Set up your mangOH Green on page 6](#)
- [Prepare your mangOH Green for Arduino development on page 10](#)
- [Prepare for Arduino development on page 12](#)

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**Important:** *To get maximum benefit from this tutorial, you are strongly recommended to carefully follow the procedures as described, since the tutorial continually builds on earlier procedures and results. If you skip steps or use alternate methods, you may encounter difficulty completing the tutorial.*

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## 2: Set up your mangOH Green

## 2

This chapter details how to prepare your mangOH Green to receive and run sketches on its ATmega32U4 chipset.

For this tutorial, you need the following materials:

- mangOH Green with (at least):
  - main antenna connected
  - activated SIM inserted
  - power supplied via USB or the DC jack
- AirVantage account with your mangOH Green registered on it

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*Note: The mangOH Green Fundamentals tutorial (available at <http://mangoh.io>) describes the basic device setup, Arduino account creation, and device registration.*

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- Mini-USB cable
- Grove Base Shield V2
- Grove sensors (one or more):
  - Temperature and Humidity Sensor
  - Dust Sensor
  - Gas Sensor(O2)
  - Light Sensor
  - Sound Sensor
  - Water Sensor

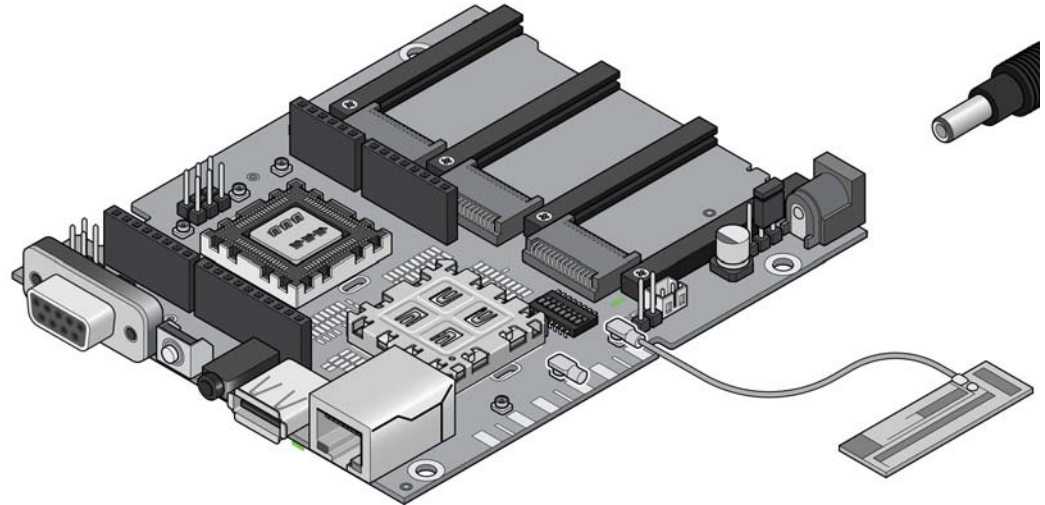
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*Note: Grove shield and sensors are available from [www.seeedstudio.com](http://www.seeedstudio.com).*

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To set up the mangOH Green for use with Arduino sketches:

1. Make sure your mangOH Green is set up with (at least) an activated SIM, the main antenna, and USB or DC power selected (but not connected). In this example, DC power is selected.



2. Hold the Grove shield by its edges, position it above the headers, and press it straight down. (Note that the two rows of headers have different numbers of pins—make sure to position the shield correctly.)

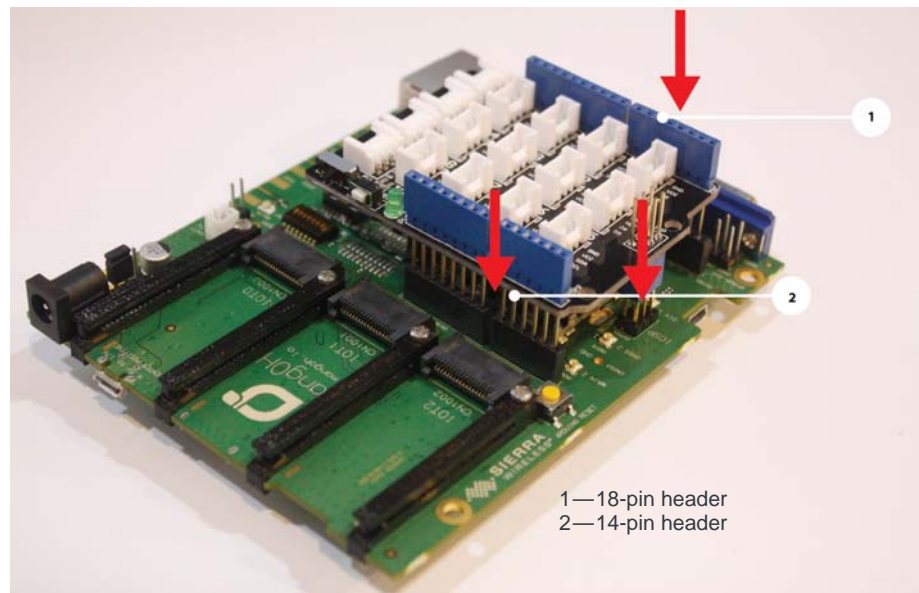


Figure 2-1: Installing an Arduino-compatible Shield

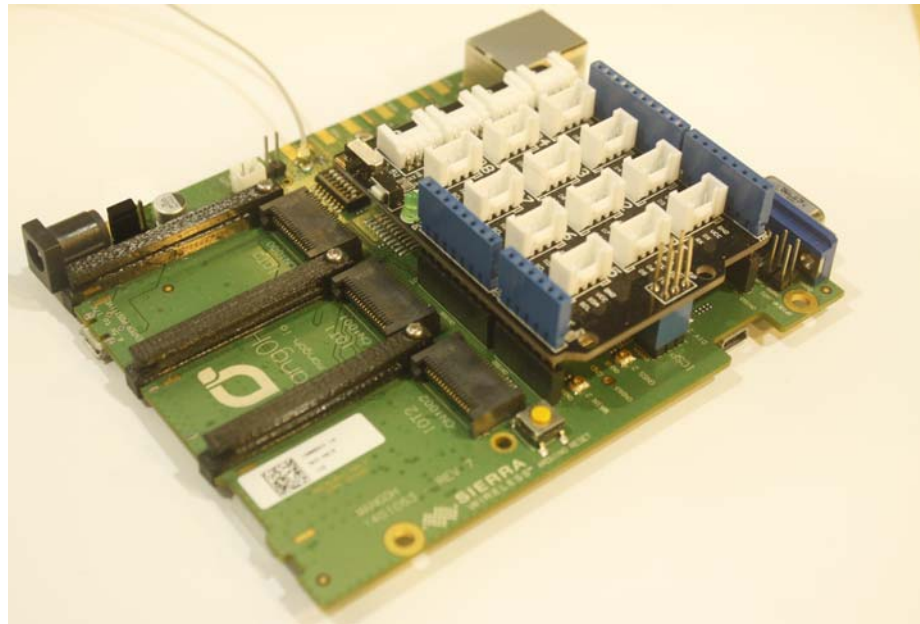


Figure 2-2: Grove Shield Installed on mangOH Green

3. Attach the DHT sensor(s) to the Grove shield connector pins as follows:
  - Temperature and Humidity sensor—Pin A0
  - Dust sensor—Pin D8
  - Oxygen sensor—Pin A3
  - Light sensor—Pin A1
  - Sound sensor—Pin A2
  - Water sensor—Pin D6

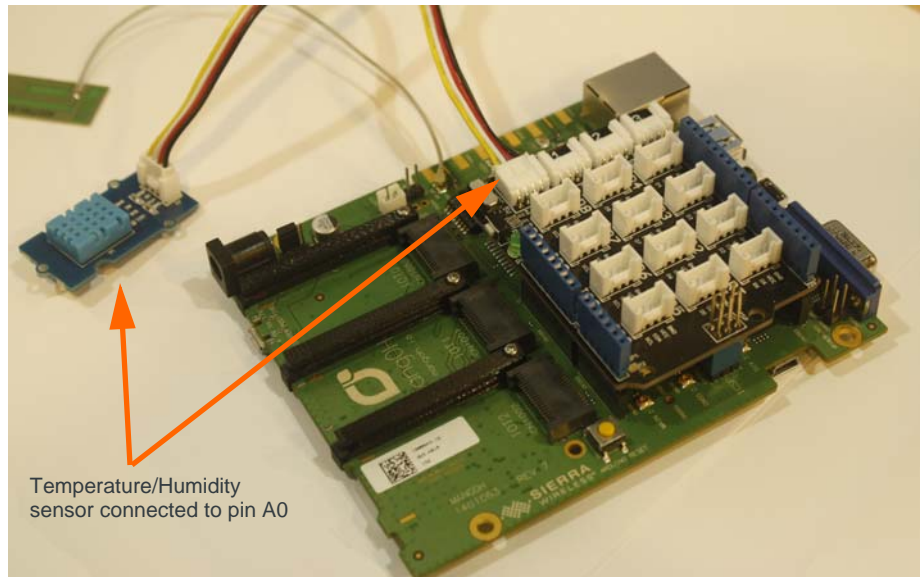


Figure 2-3: Grove Shield With Temperature and Humidity Sensor on Pin A0

4. Plug in your power source (micro-USB cable or DC power cable).





5. Connect the mini-USB cable between your computer and the mangOH Green (use connector CN330).

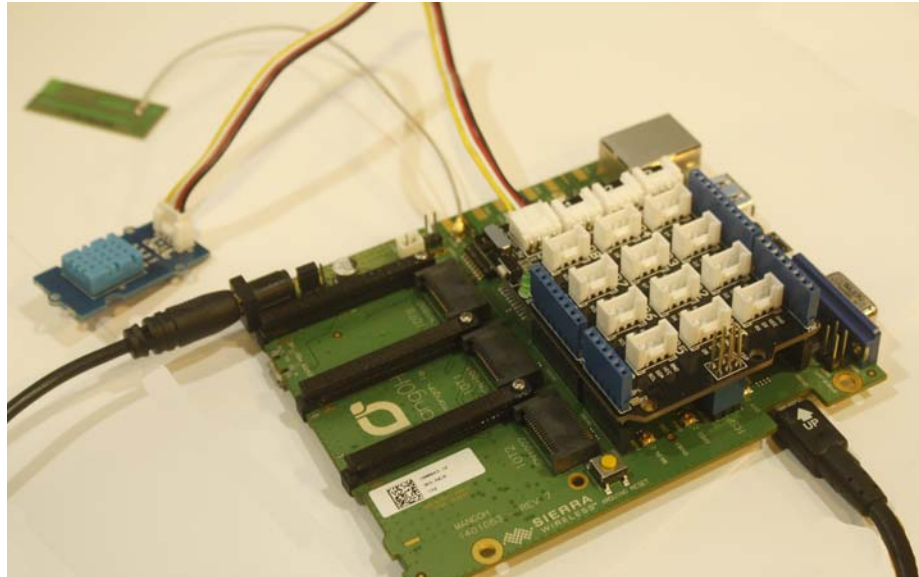


Figure 2-4: mangOH Green connected via mini-USB

Now you are ready to [Prepare your mangOH Green for Arduino development on page 10](#).



# 3: Prepare your mangOH Green for Arduino development

In this chapter, you will update the CF3 module on your mangOH Green with (among others) applications that allow the mangOH Green's ATmega32U4 chipset to communicate with AirVantage.

## 3.1 Install mangOH Green Platform Applications

The CF3 module used in your mangOH Green (e.g. AirPrime WP8548) must be loaded with the mangOH Green platform.

To load the mangOH Green platform onto your CF3 module:

1. Download the Project mangOH manifest from <http://github.com/mangoh> as follows:

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*Note: These steps are summarized in the "manifests" link on the project page, but are shown here with extra details for clarity.*

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- a. In your Linux environment (Linux system, or Linux Virtual Machine), open a terminal window.
- b. If you have not used git or git-repo to clone a project before, you must identify yourself:

```
$ git config --global user.email "youremail@example.com"  
$ git config --global user.name "your.name"
```

- c. In your home directory, get the repo tool, which you will use to clone the Project mangOH repository. In the terminal window, enter:

```
$ cd ~  
$ git clone https://gerrit.googlesource.com/git-repo  
The repo tool is copied into a subdirectory named git-  
repo.
```

---

*Note: You can clone the repo tool to any directory you prefer. This tutorial assumes it is cloned to your home directory (~, or \$HOME).*

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- d. Add the git-repo directory to your PATH environment variable.
- e. Create a directory that you will use to build the mangOH Green platform applications, and go to that directory:

```
$ echo "export PATH=$PATH:~/git-repo" >> .bashrc  
$ . ~/.bashrc  
  
$ mkdir ~/mangOH  
$ cd ~/mangOH
```



**f.** Download (clone) the Project mangOH files:

```
$ repo init -u "https://github.com/mangOH/manifests" -m mangOH.xml && repo sync
```

(Note: The 'repo init' command gets the list of files to copy, and 'repo sync' duplicates them onto your system.)

**2.** Build (compile) the mangOH Green platform:

```
$ cd ~/mangOH/legato  
$ make wp85
```

(Note: This creates a 'build' directory for the wp85's platform installation file.)  
When the project finishes building, the command prompt reappears.

**3.** Go to the build directory:

```
$ cd build/wp85
```

**4.** Install the Project mangOH applications on your mangOH Green:

```
instsys system.wp85.update 192.168.2.2
```

All of the applications for the mangOH Green platform (defined in the git manifest) are installed and begin running, including three that the ATmega32U4 chipset uses to communicate with AirVantage:

- mqttClient
- dataRouter
- arduinoBridge

Now you are ready to [Prepare for Arduino development on page 12.](#)

## 4: Prepare for Arduino development

When you install a sketch on the mangOH Green's ATmega32U4 chipset, its output is pushed over the arduinoBridge to the dataRouter, where it is then sent to applications (including AirVantage) that are configured to receive the data.

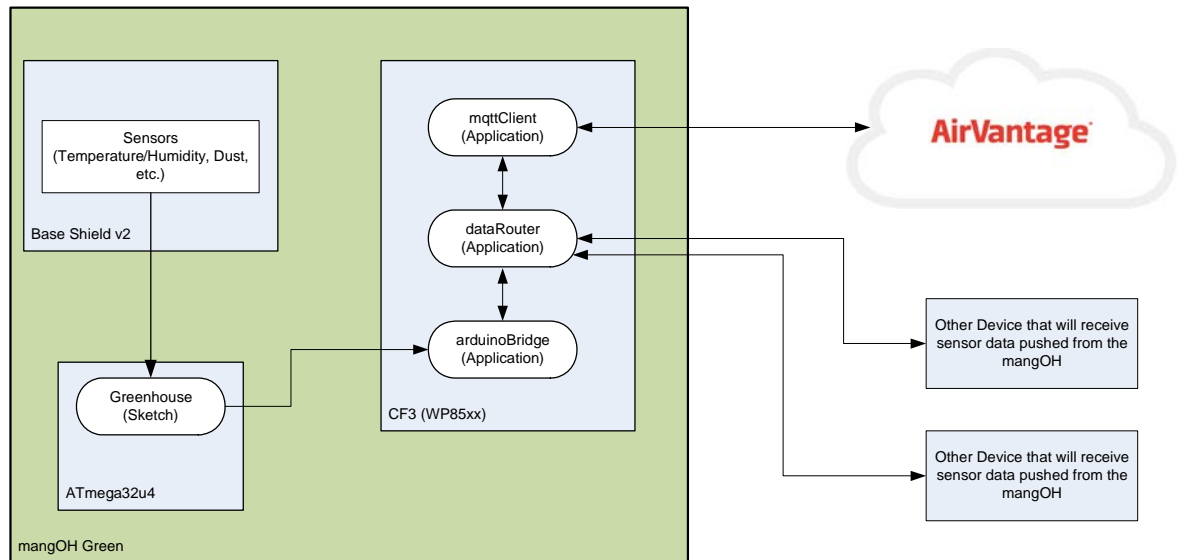


Figure 4-1: mangOH Green Arduino to AirVantage Communication

In this chapter, you will download, install, and run a sample multi-sensor sketch that accesses Grove sensor(s) that are attached to the Grove Base Shield (see [Set up your mangOH Green on page 6](#)).

*Note: The sketch can be run with any combination of the sensors. You can modify the sketch to ignore any sensors that are not used (or leave the sketch as-is, and ignore the readings reported from missing sensors).*

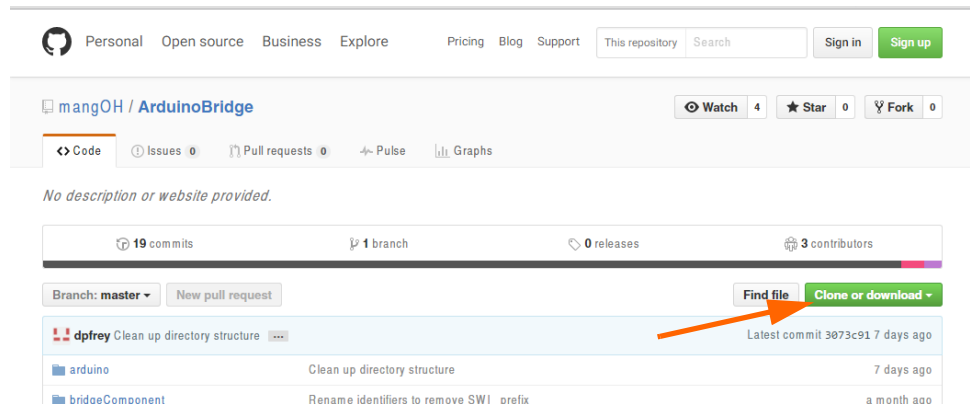
*Note: The tutorial covers the compilation and installation of a working sketch to the mangOH Green's ATmega32U4 chipset, and the collection of output by an AirVantage account; it does not cover Arduino coding.*

### 4.1 Download Sample Project

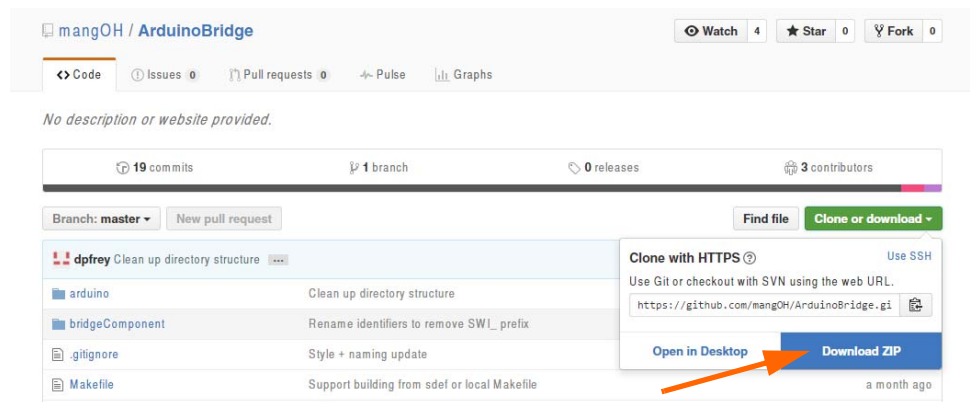
Download the sample project ("ArduinoBridge", which includes the sample multi-sensor sketch, a required library, and other files):

1. Go to <http://github.com/mangOH/ArduinoBridge>.

## 2. Click Clone or Download.



## 3. Click Download ZIP



- When the download finishes, extract the zip file (ArduinoBridge-master.zip) to a working folder (referred to as \$WORK\_DIR for the remainder of this tutorial).

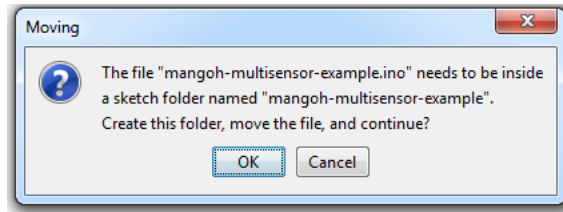
## 4.2 Prepare the Sketch

*Note: These instruction describe steps for the Arduino IDE. Adjust them accordingly if you use a different development environment.*

- In the Arduino IDE, open the sample sketch  
\$WORK\_DIR\ArduinoBridge-master\arduino\examples\multisensor\mangoh-multisensor-example.ino



If you are prompted to automatically create a folder to work on the sketch, click OK.)



2. In the sketch, set the AV\_URL variable to the server that hosts your AirVantage account. For example, "na.airvantage.net" or "eu.airvantage.net".

```

#include <BridgeSSLClient.h>
#include <BridgeUdp.h>
#include <Console.h>
#include <FileIO.h>
#include <HttpClient.h>
#include <Mailbox.h>
#include <Process.h>
#include <YunClient.h>
#include <YunServer.h>

#define AV_URL "eu.airvantage.net" // replace with url of your airvantage account
#define AV_PASSWORD "SwiBridge" // you can change this here and make it the same as the one
#define APP_NAME "Greenhouse"
#define APP TEMPERATURE "temperature"

```

3. (Optional step) If desired, modify the sketch to report only the sensors that you have installed on the shield. (When the sketch is run, any sensors that are not installed will be reported as 'noise' (random) values. You can modify the sketch, or just ignore them when you view the results.)

## 4.3 Add Required Libraries to Arduino Environment

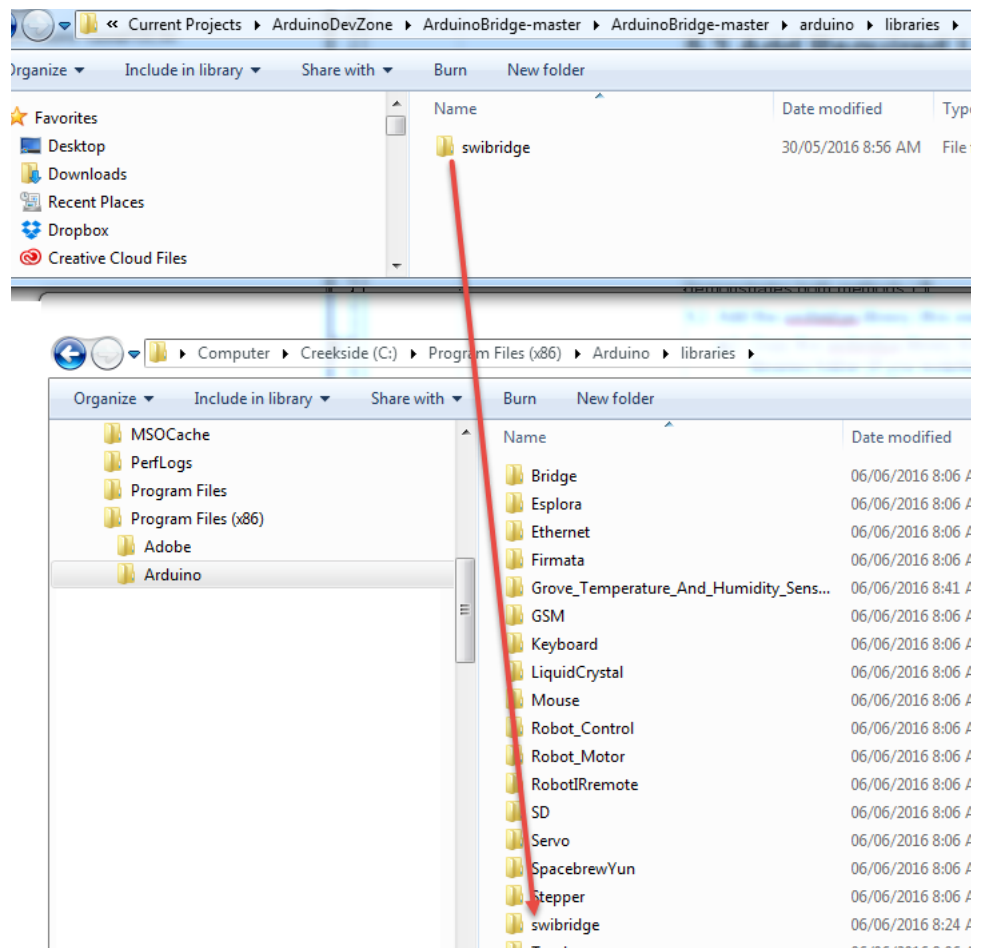
The sample sketch uses the following libraries that must be loaded in your Arduino environment.

- swibridge
- DHT (library for the Grove Temperature and Humidity Sensor)

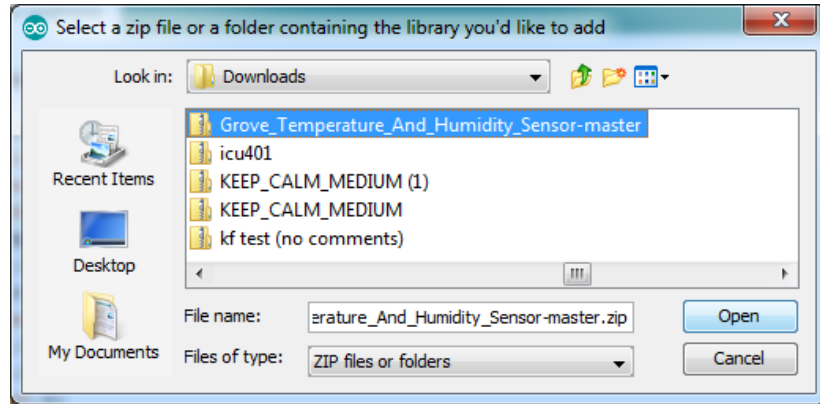
If you do not have previously added the libraries to your environment, add them now (Note: libraries can be installed manually or through the IDE. The following procedure demonstrates both methods.):

1. Add the swibrige library (this example shows how to manually add the library):
  - a. Copy the swibrige library folder from the sample project to your Arduino libraries folder (If you installed the Arduino IDE to a different location, use the appropriate path.)

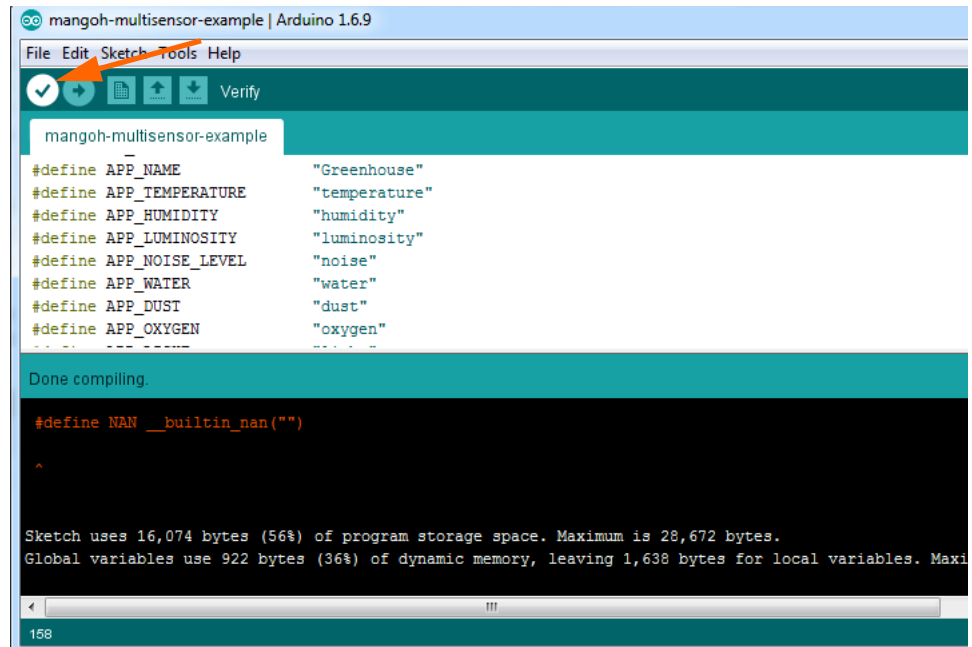
*Note: In this example, the swibrige library folder is in \$WORK\_DIR\ArduinoBridge-master\arduino\libraries) and the Arduino libraries folder is in C:\Program Files (x86)\Arduino)*



2. Get the DHT library (this example shows how to use the Arduino IDE to install the library):
  - a. Go to [http://github.com/Seeed-Studio/Grove\\_Temperature\\_And\\_Humidity\\_Sensor](http://github.com/Seeed-Studio/Grove_Temperature_And_Humidity_Sensor).
  - b. Click Clone or Download.
  - c. Click Download ZIP.
  - d. In the Arduino IDE, select Sketch > Include Library > Add .ZIP library.
  - e. Navigate to your downloads directory and select file you just downloaded.



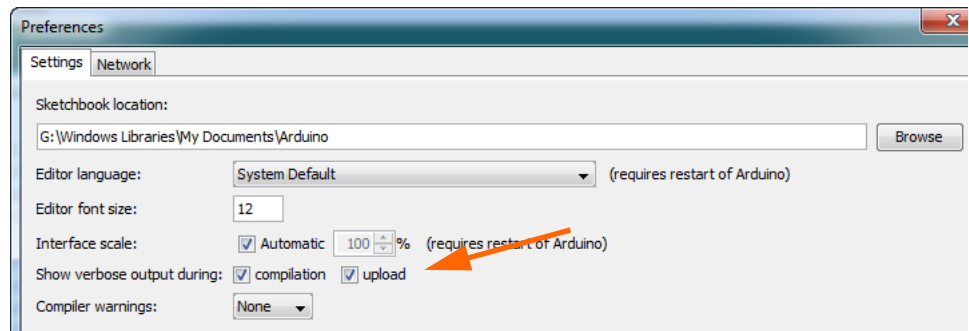
- f. Click Open and it installs to your 'contributed' arduino libraries folder.
3. (Optional step) Depending on the IDE you are using, you might have to restart the IDE to use the contributed library.
4. Verify/compile the sketch—Click the Compile icon or press Ctrl+R.



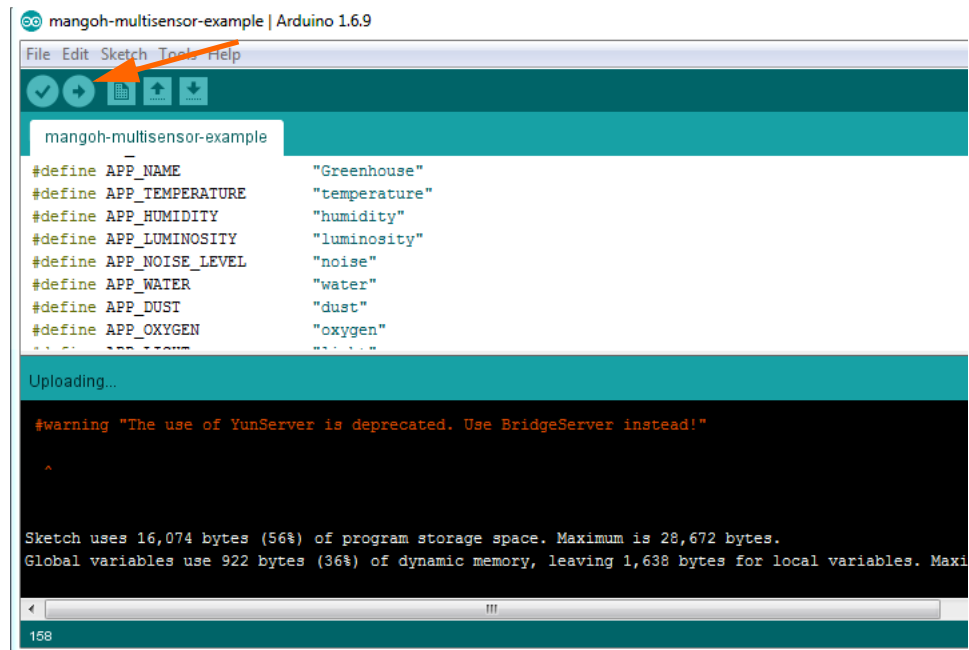




- (Optional step) It may take a long time to upload your first sketch. If you want to be sure there are no issues during the upload, you can turn on 'verbose' output which shows detailed status messages (File > Preferences):



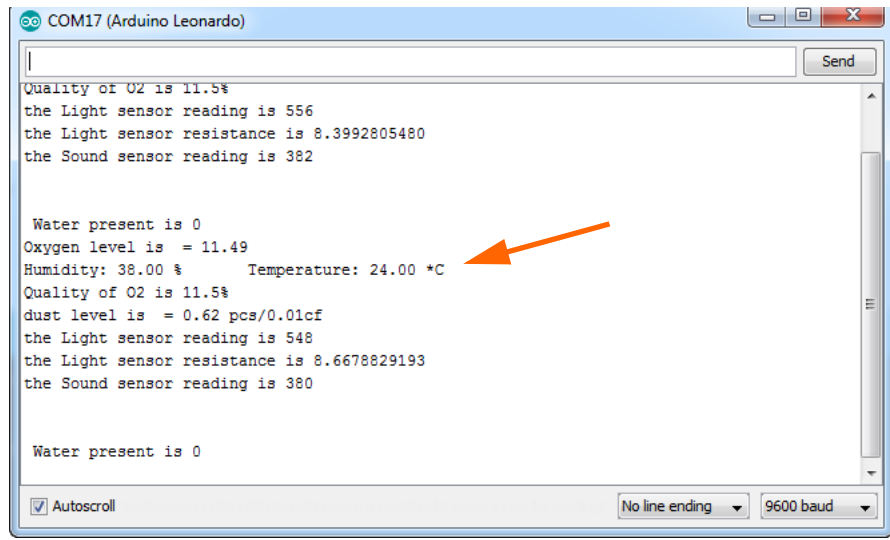
- When the sketch has successfully compiled, upload it to the ATmega32U4 chipset on the mangOH Green—Click the Upload icon or press Ctrl+U. The sketch will begin running automatically.



*Note: The ATmega32U4 chipset stores and runs only one sketch at a time. Each time you upload a sketch, it replaces the currently running sketch.*



7. Check that the sketch is running and whichever sensors you are using are working properly (showing reasonable values)—Open a serial monitor in the IDE (Tools > Serial Monitor)



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*Note: In the example above, only the Temperature and Humidity sensor is connected. Other values are random.*

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Now you are ready to [Connect to the IoT Cloud on page 19](#).



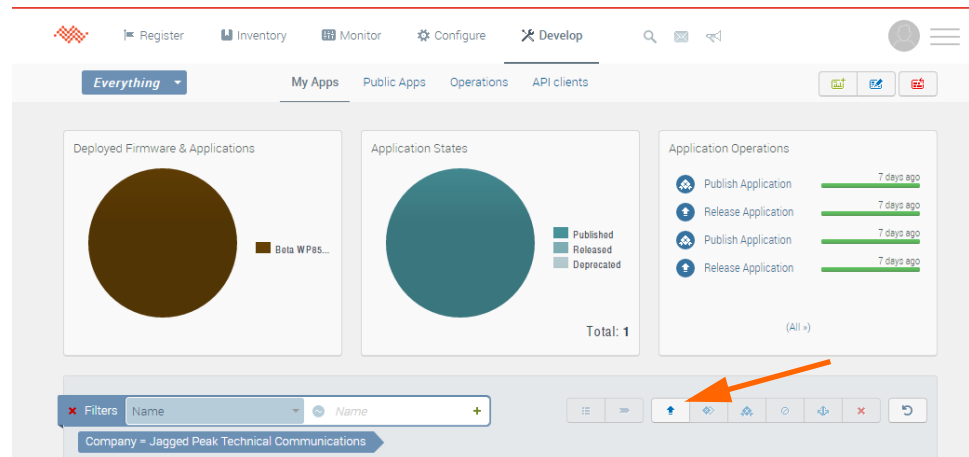
# 5: Connect to the IoT Cloud

Now that your mangOH Green is transmitting sensor data, you must configure your AirVantage account to receive it.

## 5.1 Configure AirVantage To Receive Sensor Data

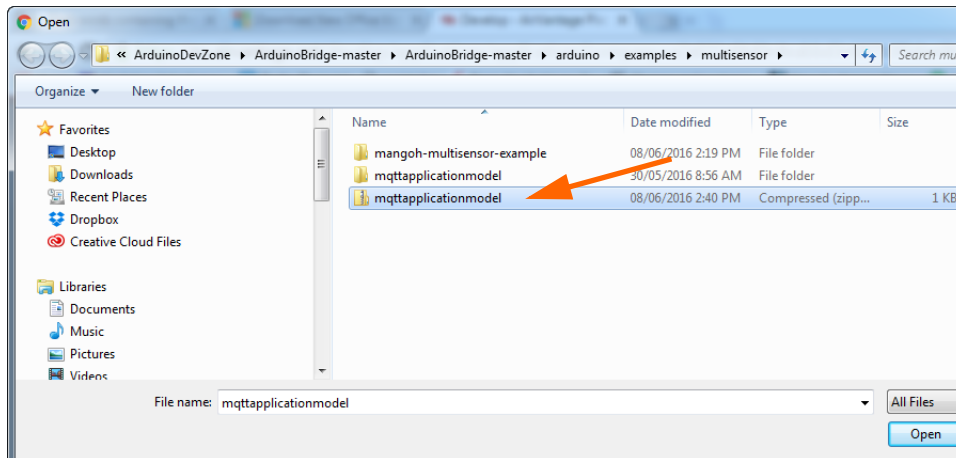
Before AirVantage can receive the sensor data, it needs to be configured to understand which messaging protocol is used for the data, and what the data represents. To do this, you must load a 'model' file containing this information.

1. In a web browser, log in to your AirVantage account.
2. Select Develop > My Apps.
3. Click the Release button.

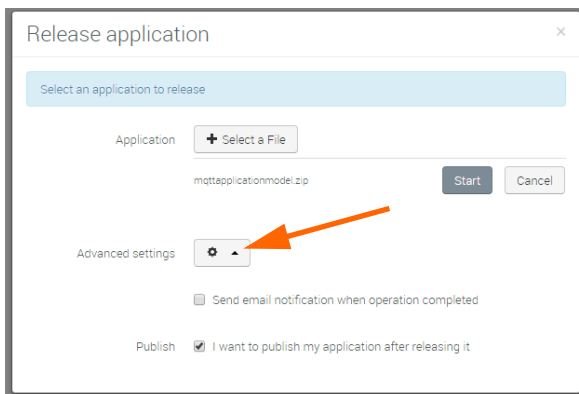


4. Click Select a file.
5. Navigate to the multisensor directory (`$WORK_DIR\ArduinoBridge-master\arduino\examples\multisensor`).

6. Make a zip file of the mqttapplicationmodel folder.



- 7. Select the zip file and click Open.
- 8. Select Advanced settings.



9. Select I want to publish my application after releasing it.

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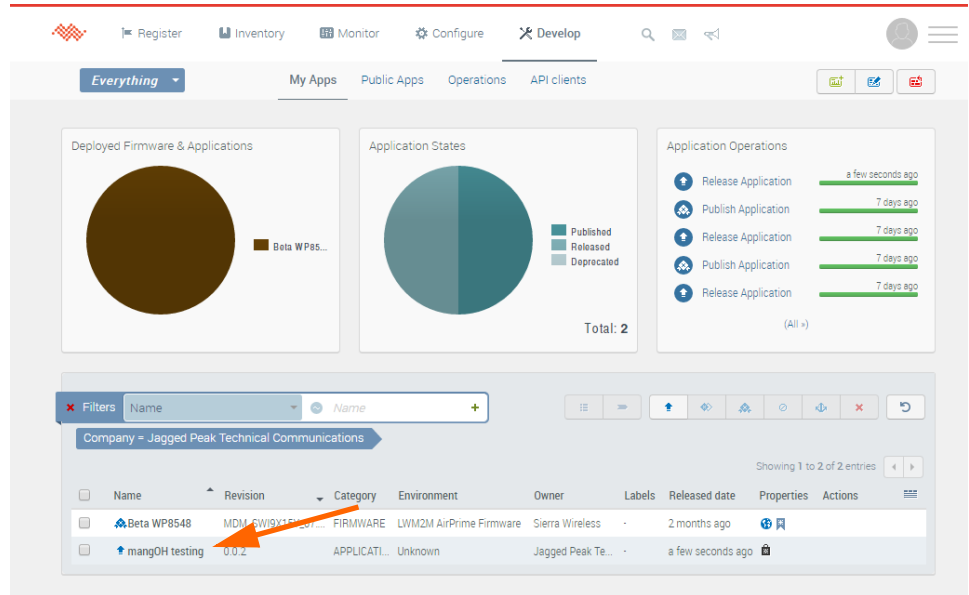
*Note: If you do not want to publish immediately, do not set this option. You can release now, then publish later by clicking the Publish button (in the same row of buttons as the Release button).*

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**10. Click Start to install the model.**

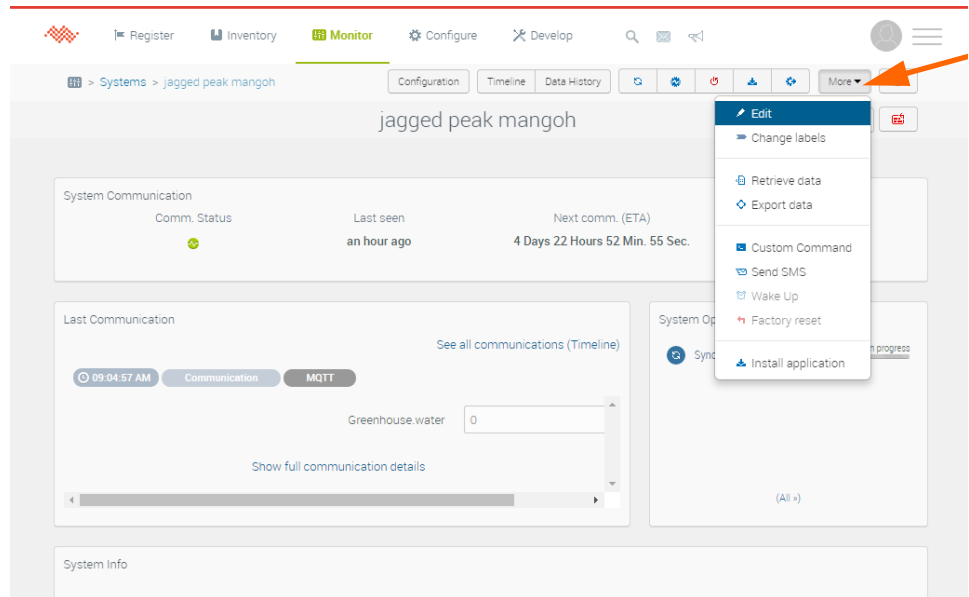
The model installs. When you return to the MyApps screen, you will see the application appear in the list of published applications for your mangOH Green.



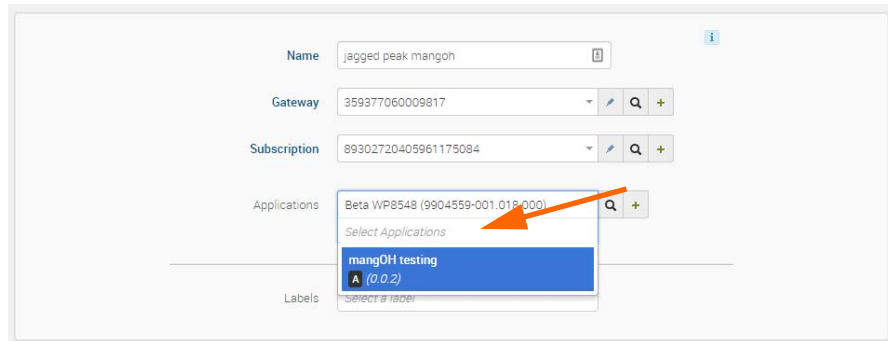
**11. Select Monitor > Systems.**

**12. Click your mangOH device in the listing.**

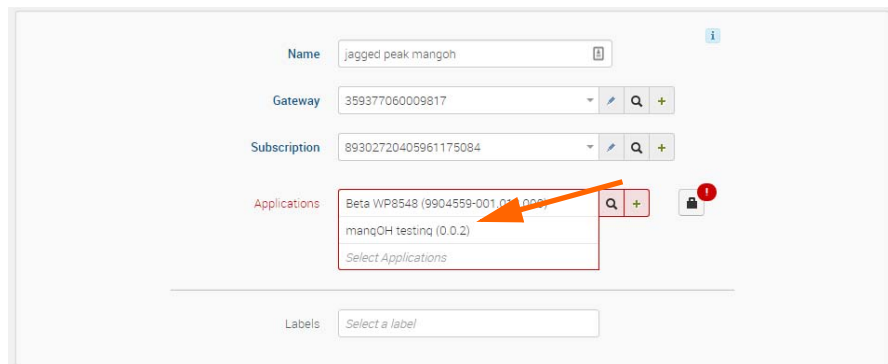
**13. Click More > Edit.**




14. In the Applications box, click the last line ('Select Applications') - the new application will appear.



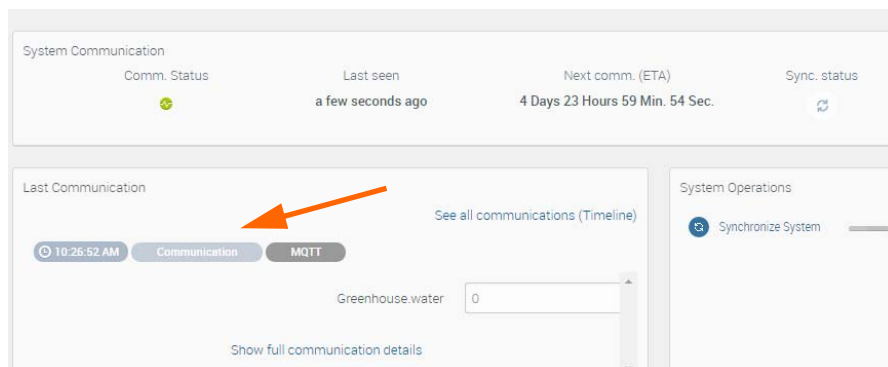
15. Click the new application. It gets added to the applications list.



16. Click the Credentials button .

17. Enter the MQTT password for the application (the password "SwiBridge" is defined in the model file) and click Continue.

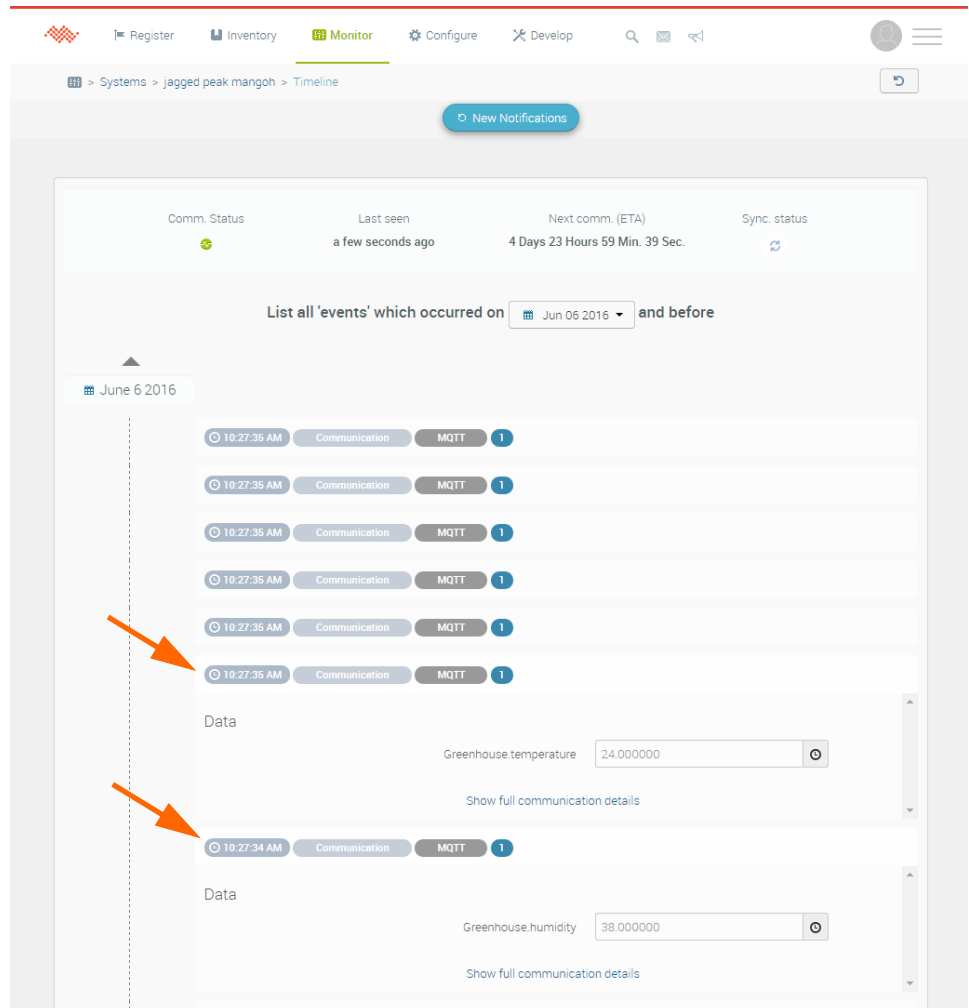
18. Click Save. The Monitor Systems screen reappears, and you can see the application is now included in the System Applications section. Assuming your mangOH has a network connection, you will start seeing a link to the most recent communication appearing in the Last Communication section.



19. To see all communications, click See all communications (Timeline).



20. To see details of a communication, click somewhere on the row. (In this example, the communications for temperature and humidity are shown.)



You have now set up your mangOH Green to support Arduino sketches, built and installed a working sketch that transmits data to the cloud, and configured AirVantage to receive that data.

For more information on the mangOH platform, visit <http://mangoh.io>.