SwitchDoc Labs

The Smart Garden System
Assembly and Operation Manual

November 2018

Version 1.3

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Cautions when building and using The Smart Garden System

1) **Keep all water away from the electronics and power supply at all times!**
2) **The Smart Garden System is designed for indoor use only and should be placed in a dry environment where no water or rain can reach to avoid short circuiting the electronics**
3) **Insert the moisture sensor into the CENTER of the flower pot, and keep it near the center of the plant and away from the water coming out of the holes cut in the watering pipe.**
4) **This is not a toy! Keep it out of reach of young children and pets.**
5) **SwitchDoc Labs assumes no liabilities in the use of this kit, beyond the refund of the purchase price.**

Errata

V1.3 November 26, 2018: Corrected 8 Pixel RGBW Stick Grove Connector to D21/D26

What is The Smart Garden System?

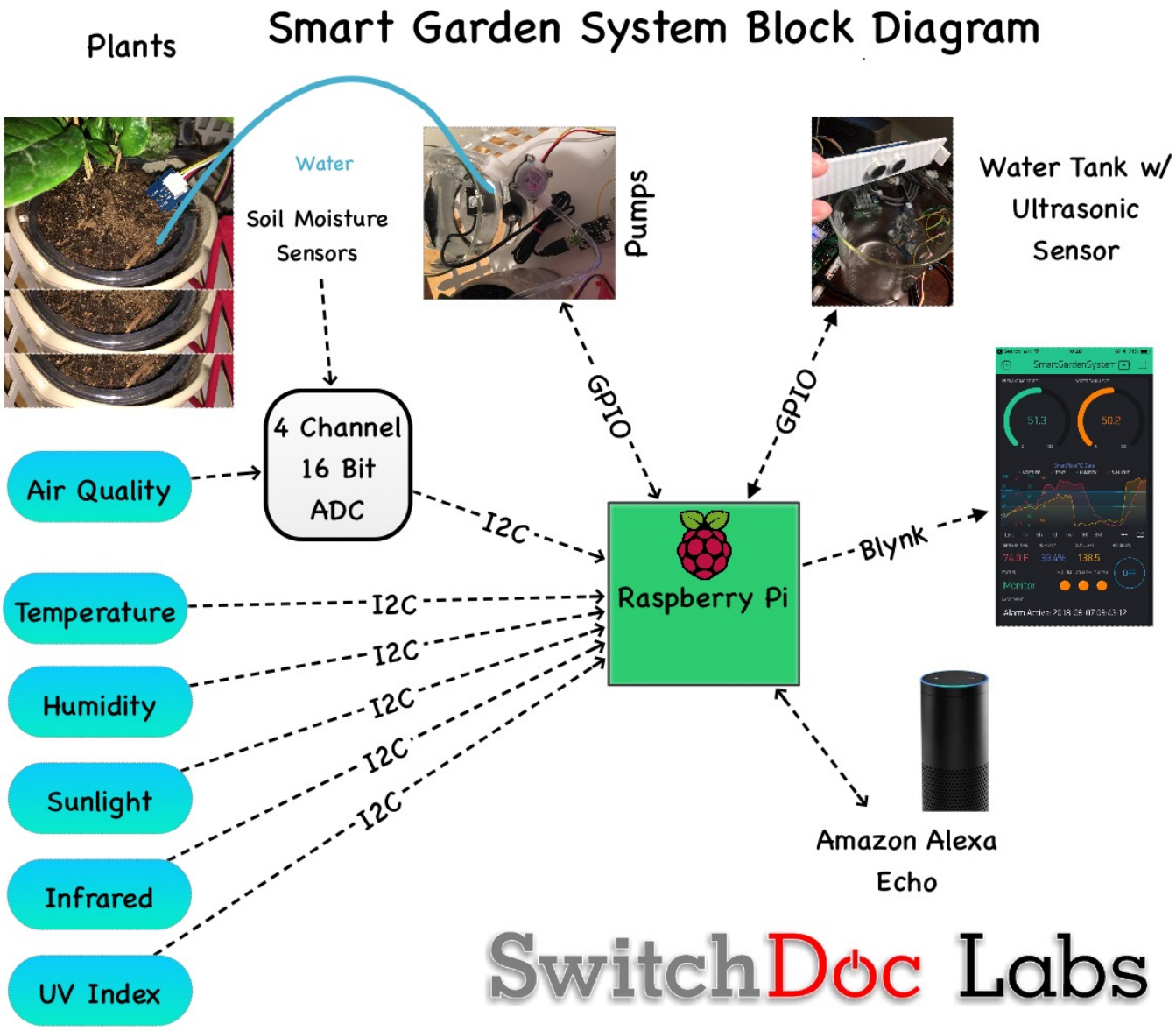
This is a perfect project kit for kids with some help from the adults and for adults trying to learn some new things. We have done this before with our successful OurWeather KickStarter so we know what we are talking about. People all over the world have built the OurWeather weather station with great success. This project has **no soldering** involved and uses Grove connectors to wire everything up! You can't reverse them and blow things up. Here is our tutorial on the Grove system.

The Smart Garden System Features

- Measure your Temperature
- Measure your Soil Moisture
- Measure your Sunlight
- Measure your Air Quality
- Show your results on the Internet and your Phone
- Even connect your plant to the Amazon Echo/Alexa

Easy to build. Easy to learn about the IOT (Internet Of Things) and the Raspberry Pi.

SwitchDoc Labs is building on the strength and reception of our last successful No Soldering Kickstarter Project - OurWeather.


Smart Garden System Block Diagram
Plants
Water
Soil Moisture Sensors
Pumps
Water Tank w/ Ultrasonic Sensor
GPIO
GPIO
4 Channel 16 Bit ADC
Air Quality
I2C
Raspberry Pi
Blynk
Temperature
I2C
Humidity
I2C
Sunlight
I2C
Infrared
I2C
UV Index
Amazon Alexa Echo
SwitchDoc Labs

Preparing and Learning your Raspberry Pi

The Smart Garden System requires a working Raspberry Pi. You can use virtually and Raspberry Pi (2, 3, Zero, etc.) but you do need to set it up before starting the process of building The Smart Garden System.

Initial setting up your Raspberry Pi and connecting to it on your network is well beyond the scope of this manual. There are just two many variables in how you might set up your Raspberry Pi.

SwitchDoc Labs provides an SD Card that has the Raspberry Pi operating system, version Stretch, and all the Smart Garden System software installed. https://shop.switchdoc.com/products/16gb-sd-card-with-stretch-smart-garden-system-groveweatherpi

Once you have your Raspberry Pi setup up, running and can access a command line window (terminal) than you are ready to go with this manual.

This is the reason that we consider The Smart Garden System and advanced beginners kit, rather than a beginners kit (like the OurWeather Weather Station).

Here are some resources to get you set up and running as quickly as possible.

Helpful Getting Started Videos:

https://www.raspberrypi.org/help/videos/

Helpful Getting Started Written Tutorial:

https://www.raspberrypi.org/wp-content/uploads/2012/12/quick-start-guide-v1.1.pdf

If you want to set up a headless (no monitor, keyboard, mouse) Raspberry Pi, it is more complicated. Here are some links to tutorials for that process.

http://www.circuitbasics.com/raspberry-pi-basics-setup-without-monitor-keyboard-headless-mode/

http://blog.self.li/post/63281257339/raspberry-pi-part-1-basic-setup-without-cables

Many, many more tutorials are available on the web.

Once you have it set up, take a brief tutorial about using the terminal window and the very powerful Raspberry Pi Command Line.

https://www.raspberrypi.org/blog/learning-the-command-line/

https://www.raspberrypi.org/blog/learn-to-love-the-command-line-with-the-magpi/

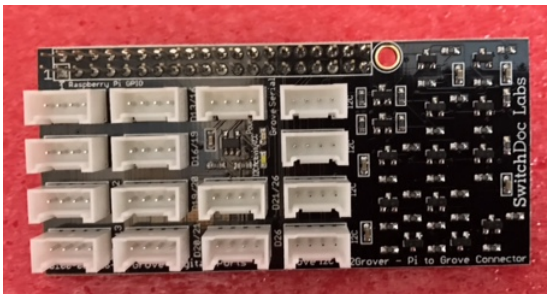
You don't need to know a lot about the command line to enjoy building and running The Smart Garden System, but you do need a bit of knowledge.

What is in the The Smart Garden System Box?

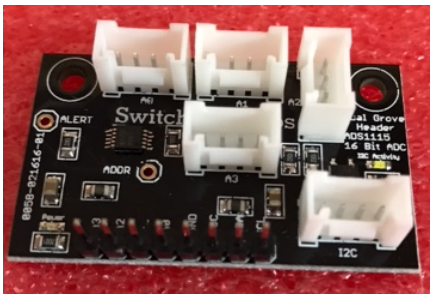
Note: You will need to add three additional things to finish your SmartPlant Project

- A Raspberry Pi is NOT included and must be purchased separately. Any Raspberry Pi with a 40 pin GPIO connector will work (such as the Raspberry Pi 2, 3 or Zero).
- A Water Reservoir – Any bottle will work providing the USB Submersible Pump (Part L) will fit inside.
- A Plant to water.

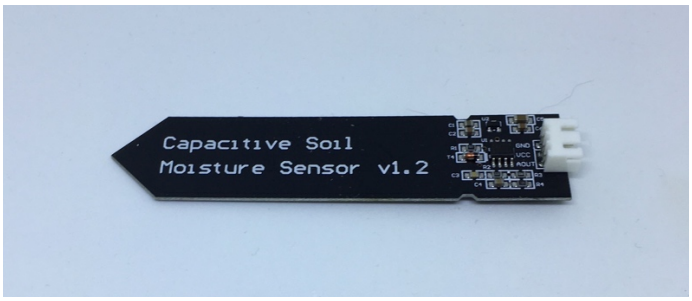
Part A – Pi2Grover



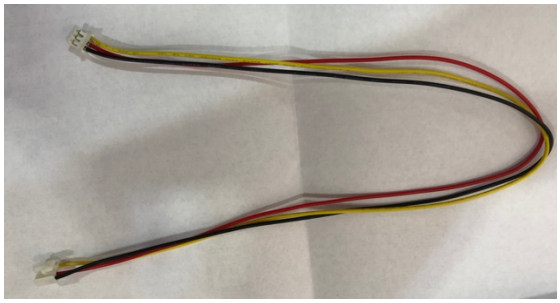
Part B – 4Channel ADC Board



Part C – Grove Capacitive Moisture Sensor

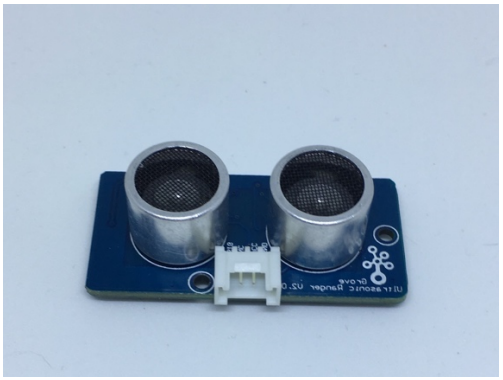


Part D Grove to Capacitive Moisture Sensor Cable

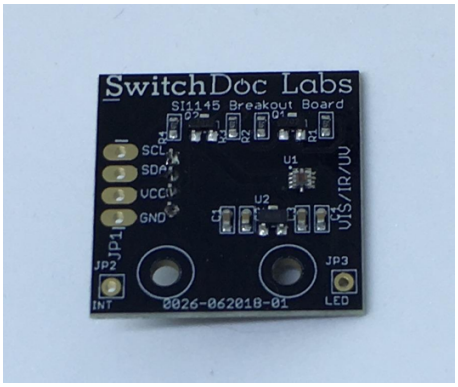


Part E – Temperature / Humidity HDC1080 Board

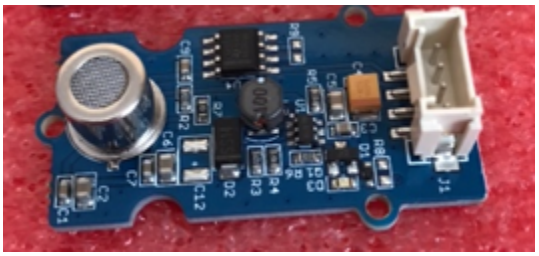
Part F – Ultrasonic Ranger



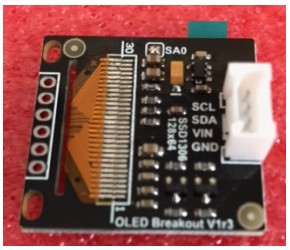
Part G – Sunlight Sensor



Part H – Air Quality Sensor



Part I – OLED Board

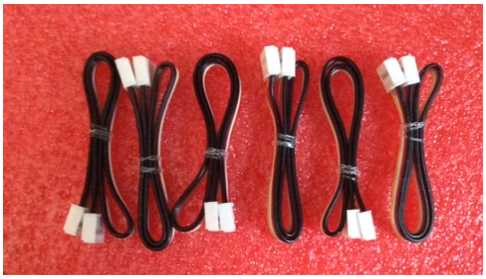


Part J– Grove Pixel RGBW Stick

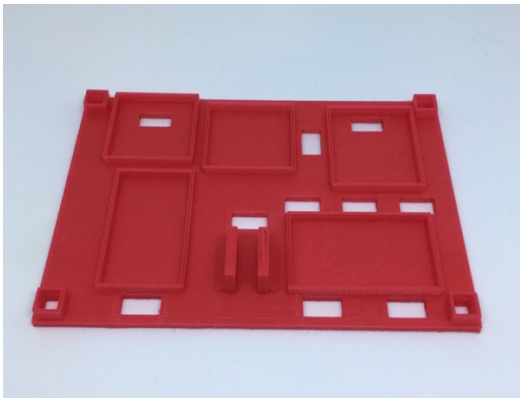
Part K – USB Submersible Pump

Part L – Stakes (2)

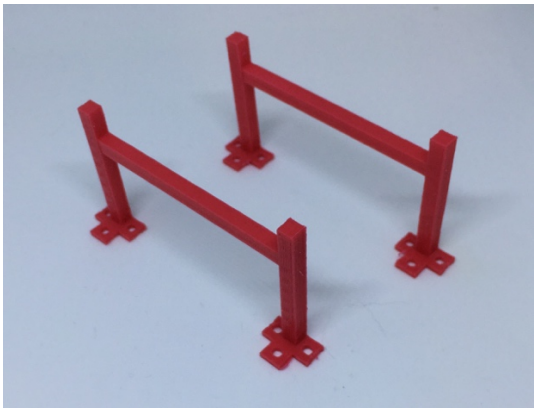
Part M –20cm Grove Cables (6)



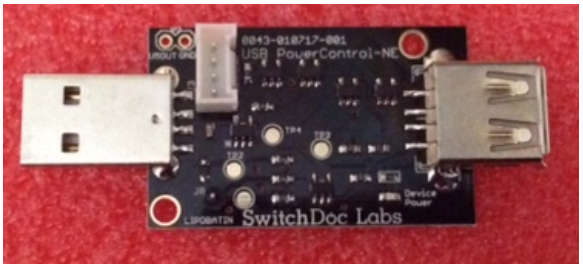
Part N – 3D Printed Top



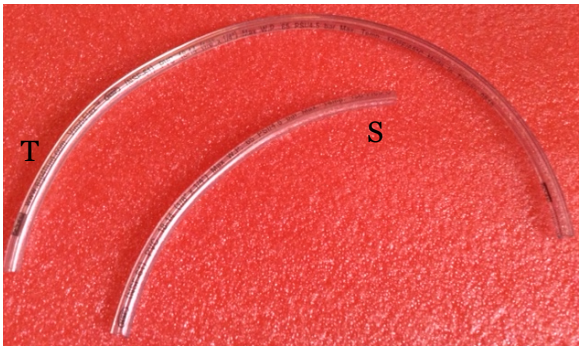
Part O – 3D Printed Stands (two)



Part P – USB PowerControlNE

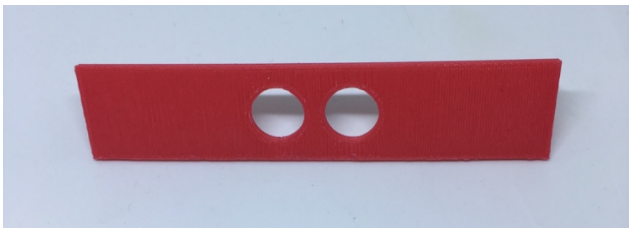


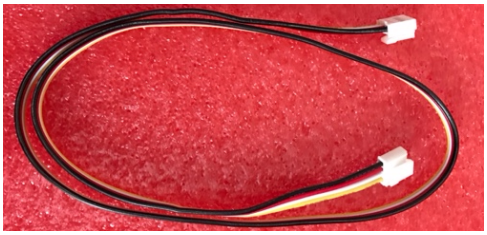
Part Q - Long (300mm) ¼” Plastic Pipe



Part R – Plastic Pipe Plug

Part S – 3D Printed Ultrasonic Stand





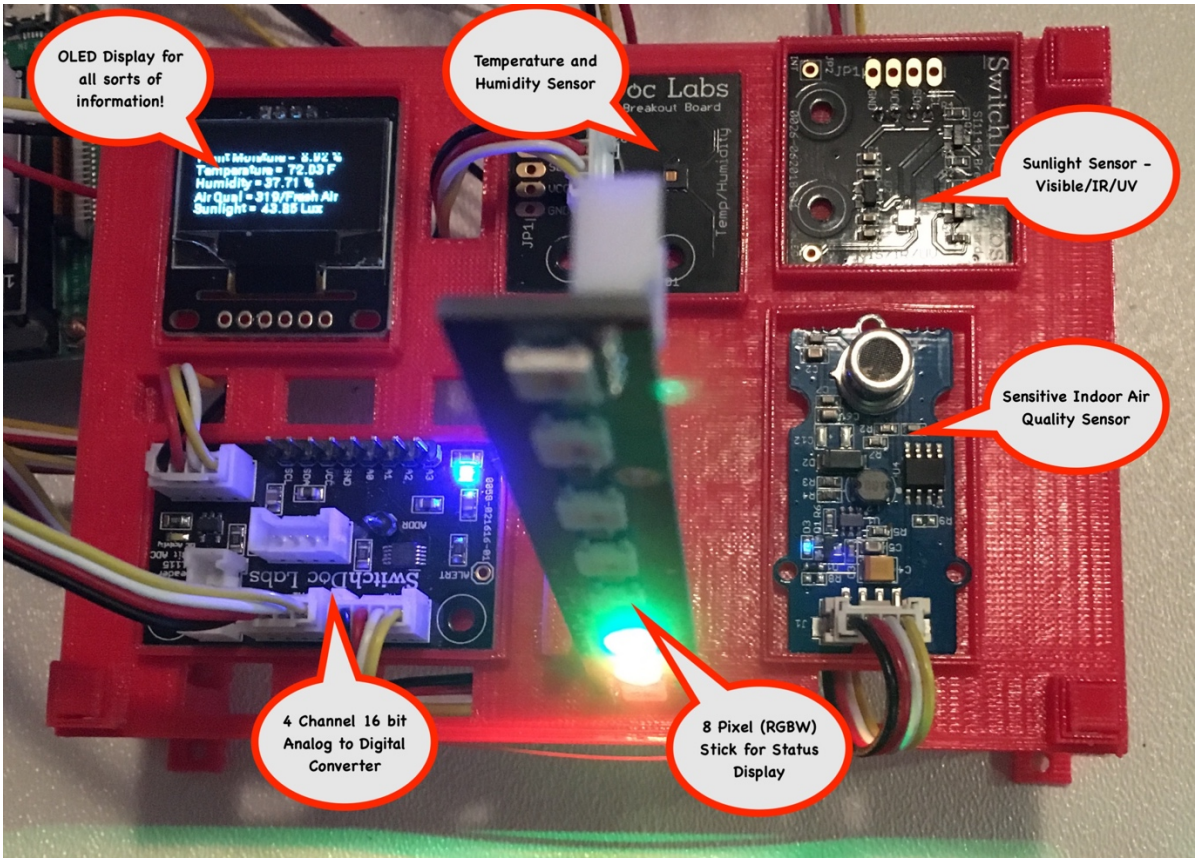
Part T – 50cm Grove to Grove Cable

Step by Step Assembly

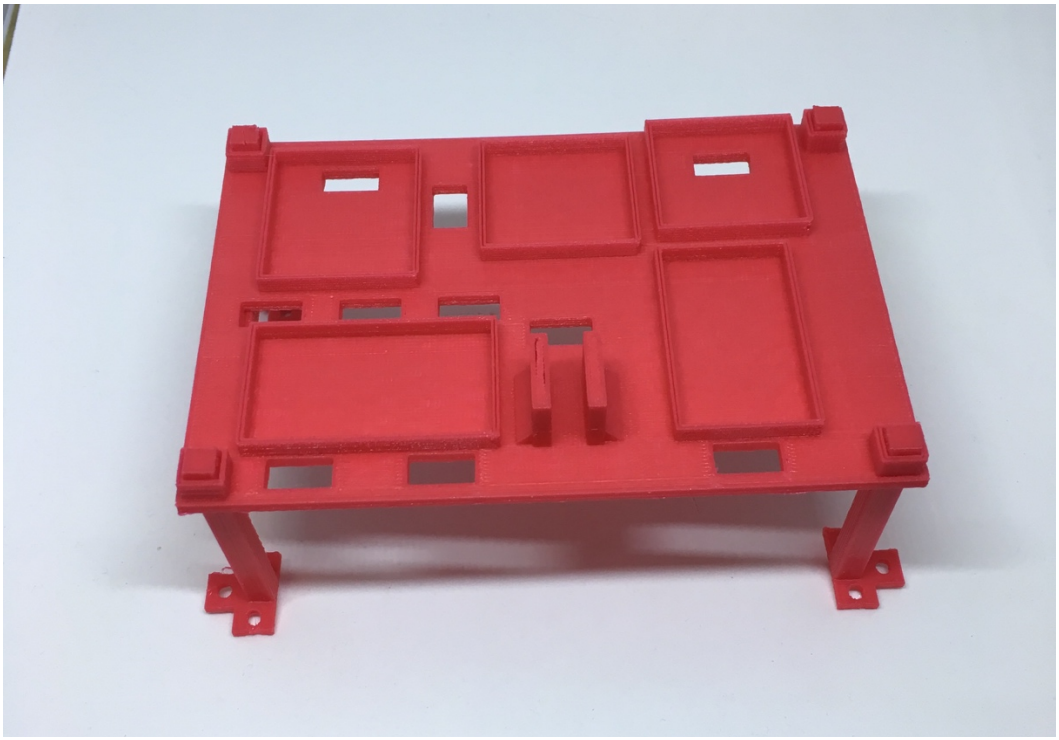
Cautions: Keep your static charge to a minimum during your assembly and operation. Touch metal before handling parts. Avoid shuffling your feet. Before starting assembly, layout all the parts above and familiarize yourself with the various parts.

Populating the The Smart Garden System 3D Printed Top

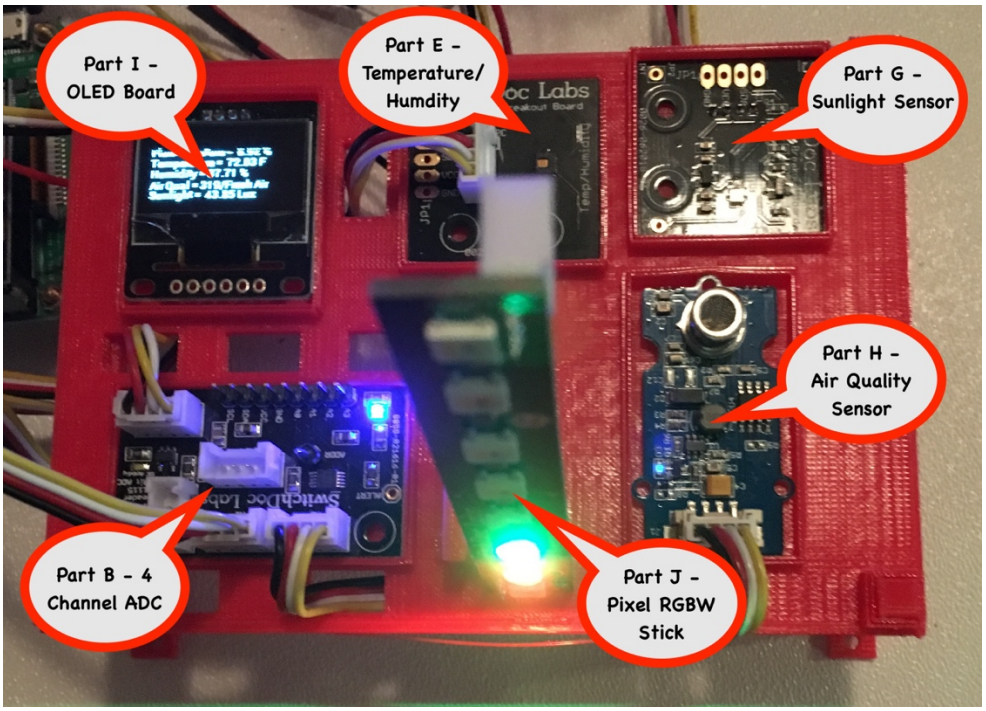
Step 1) Take the 3D Printed Top (Part N) and lay it on a flat surface.



Step 2) Take the two 3D Printed Stands (Part O) and insert them in the holes at each end of the 3D Printed Top (Part N). If the stands are tight, take a nail file and sand the ends down slightly so they fit through the holes in the 3D Printed top. Insert the stands so the flanges with the screw holes face out from the 3D Printed Top as shown.



Step 3) Take the following parts (Parts I, E, G,B,J and H) and gently snap them into the below indicated slots on the 3D Printed Top (Part N).

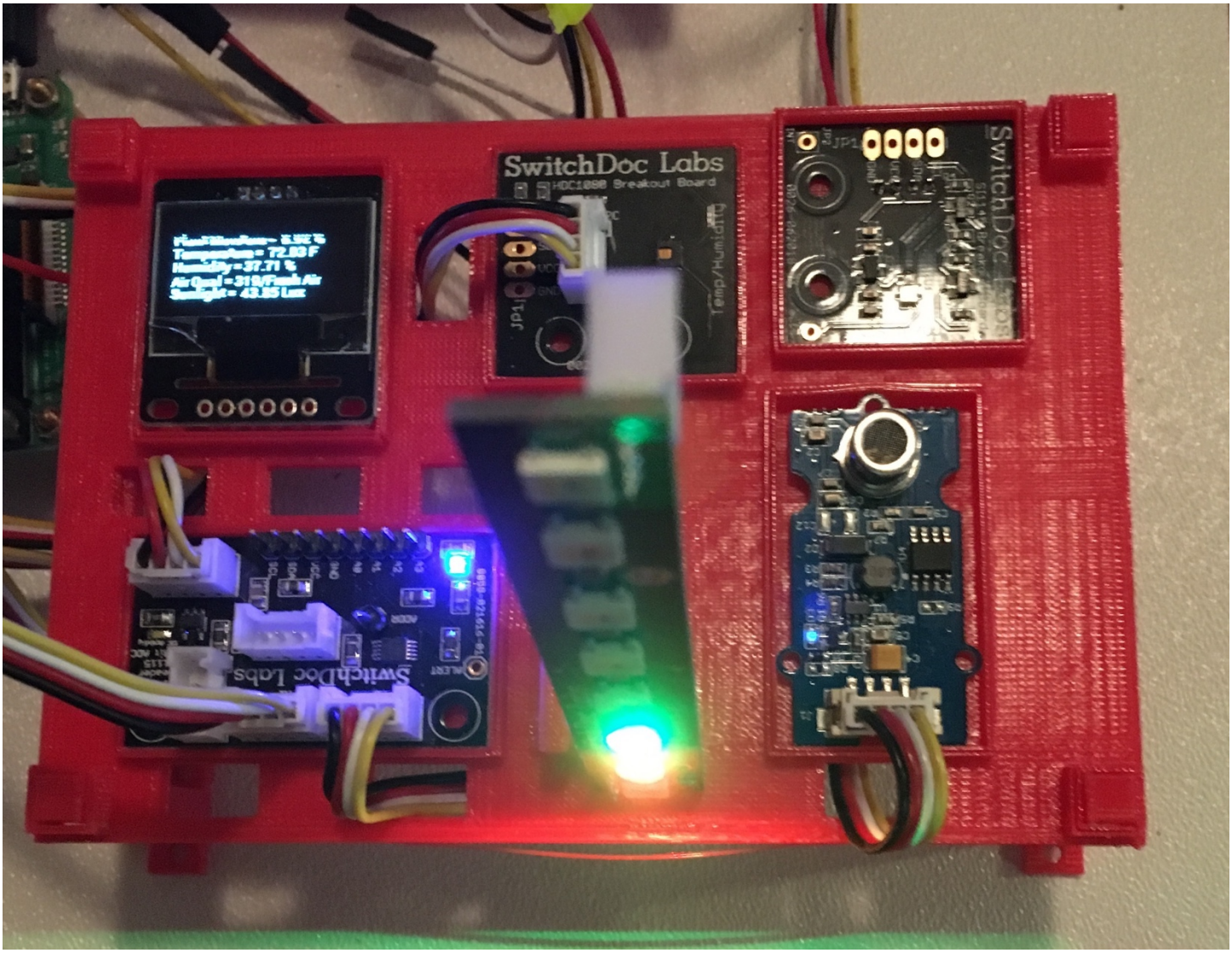


Note on Part J – The Pixel Stick will not stand up until you plug in the Grove Cable ☺

Step 4) Take the 50cm Grove to Capacitive Moisture Board Cable (Part D) and plug it into port labeled A1 on the 4 channel ADC (Part B) as indicated in the above photograph.

Step 5) Plug the 20cm Grove Cables (Part M) into all the other devices and route them through the provided holes in the 3D Printed Top (Part N). Some of the parts (I and G) have Grove connectors on the bottom of the boards. Note that all Grove Cables are keyed and can only be put in the Grove Connector in one direction. This keeps us from blowing up things!

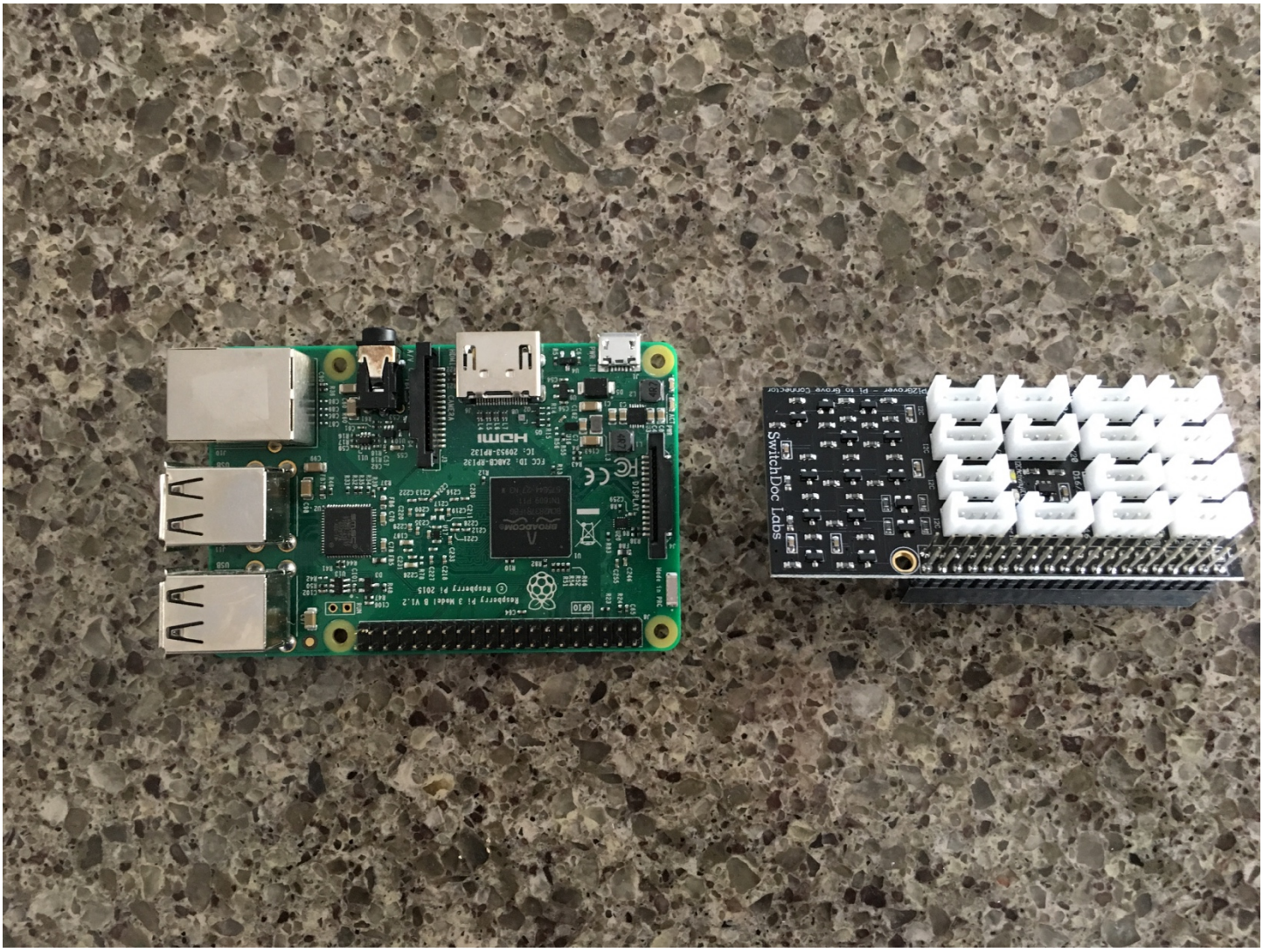
Now the 3D Printed Top is fully populated. The next section is to wire up the Raspberry Pi.



Setting up the Raspberry Pi

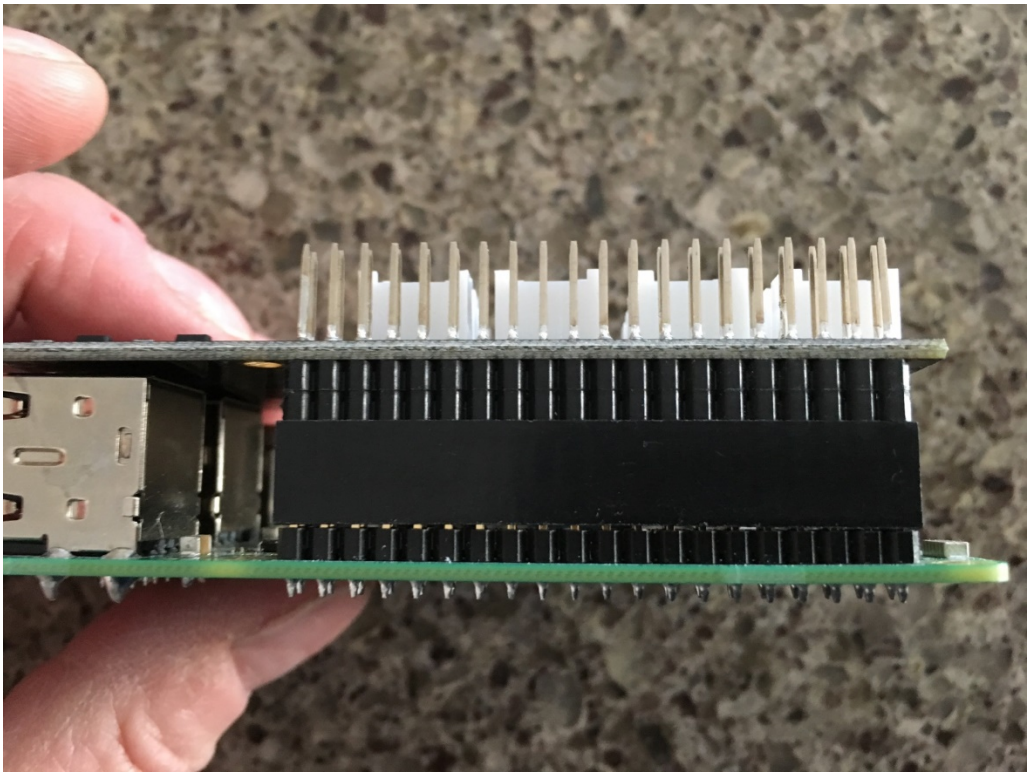
In this section, we show you how to install the Pi2Grover Raspberry Pi to Grove connector interface on your Raspberry Pi. While these pictures show a Raspberry Pi3, the process is the same on any Raspberry Pi.

Step 6) Identify the Pi2Grover board (Part A)

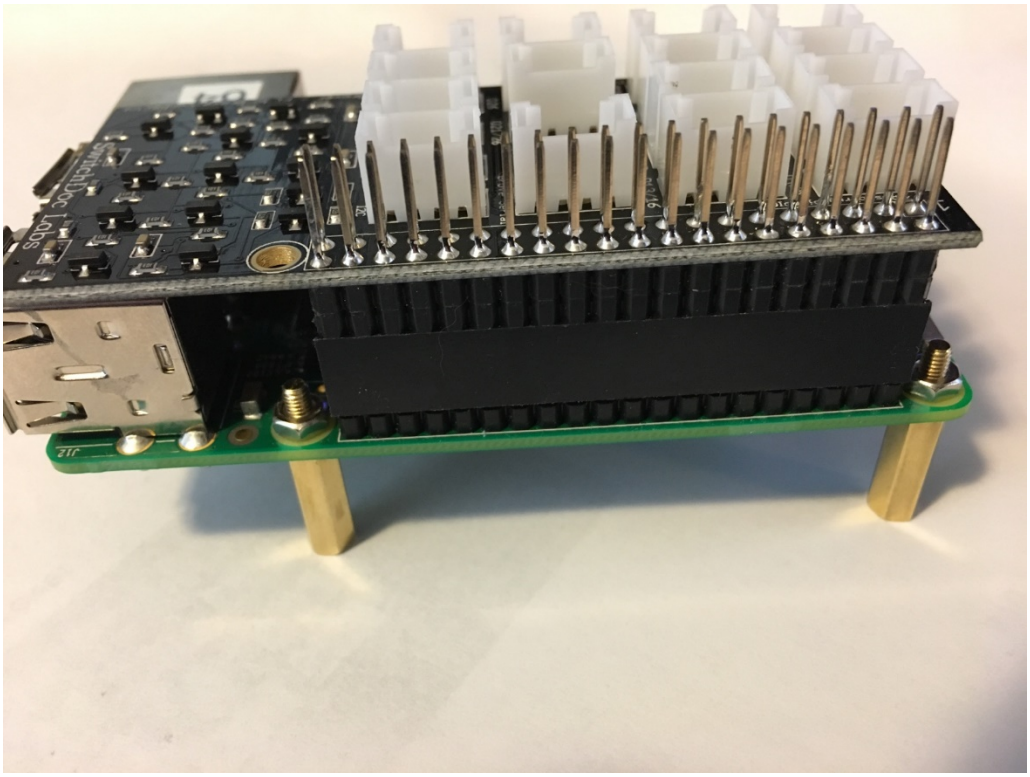


Step 7) Making sure you align the pins correctly gently press the Pi2Grover Board (Part A) onto the 40 pin GPIO connector on the Raspberry Pi

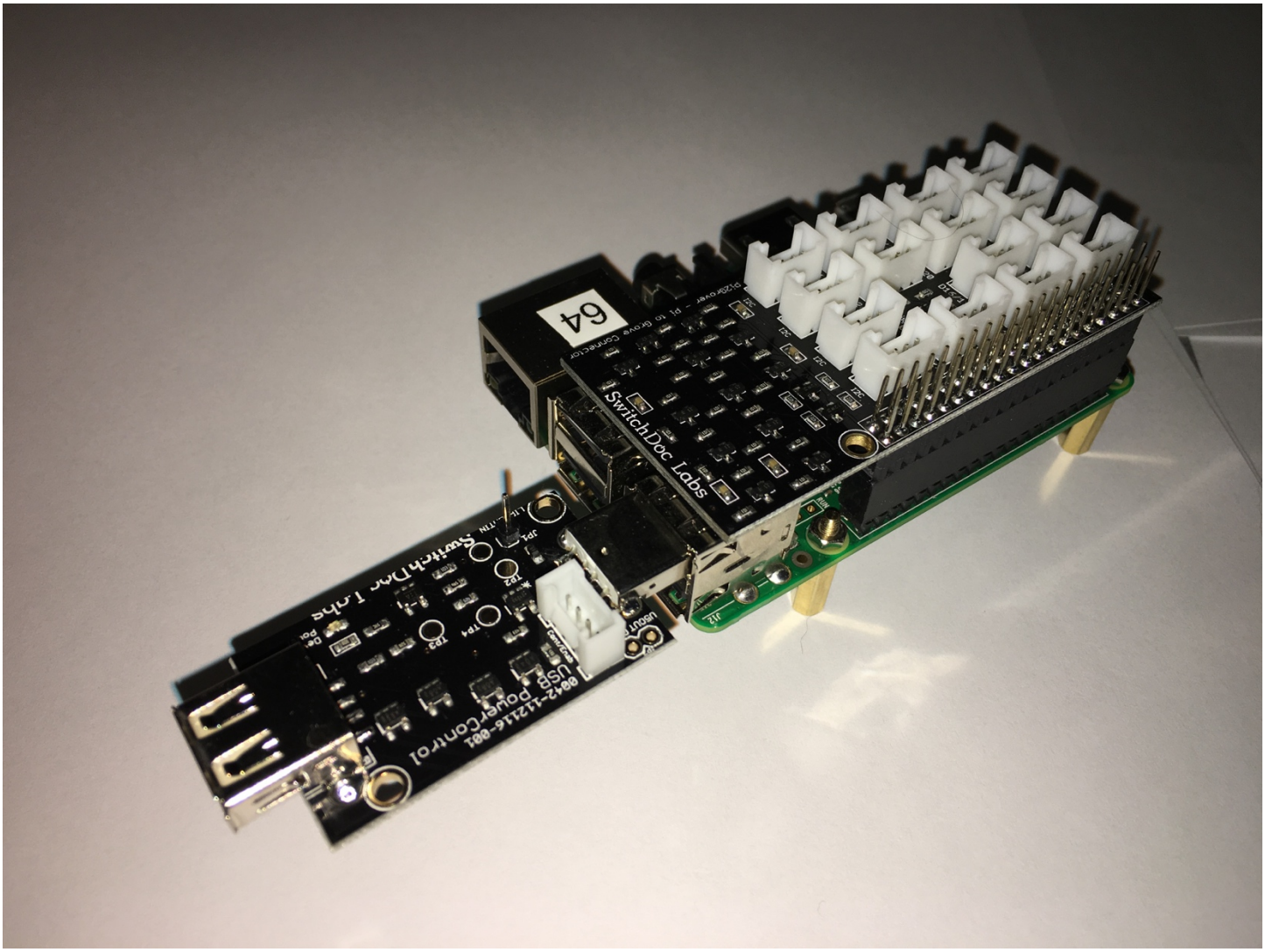
Step 8) Gently finish pushing the Pi2Grover (Part A) onto the Raspberry Pi GPIO pins, making sure the pins are aligned. There will be no pins showing on either end.



Step 9) Place your Raspberry Pi in a plastic case bottom (not included) or use pylons (not included) to keep it up above the ground you will be sitting it on (we are dealing with water here!). The picture below uses metal pylons but you may have nylon pylons.



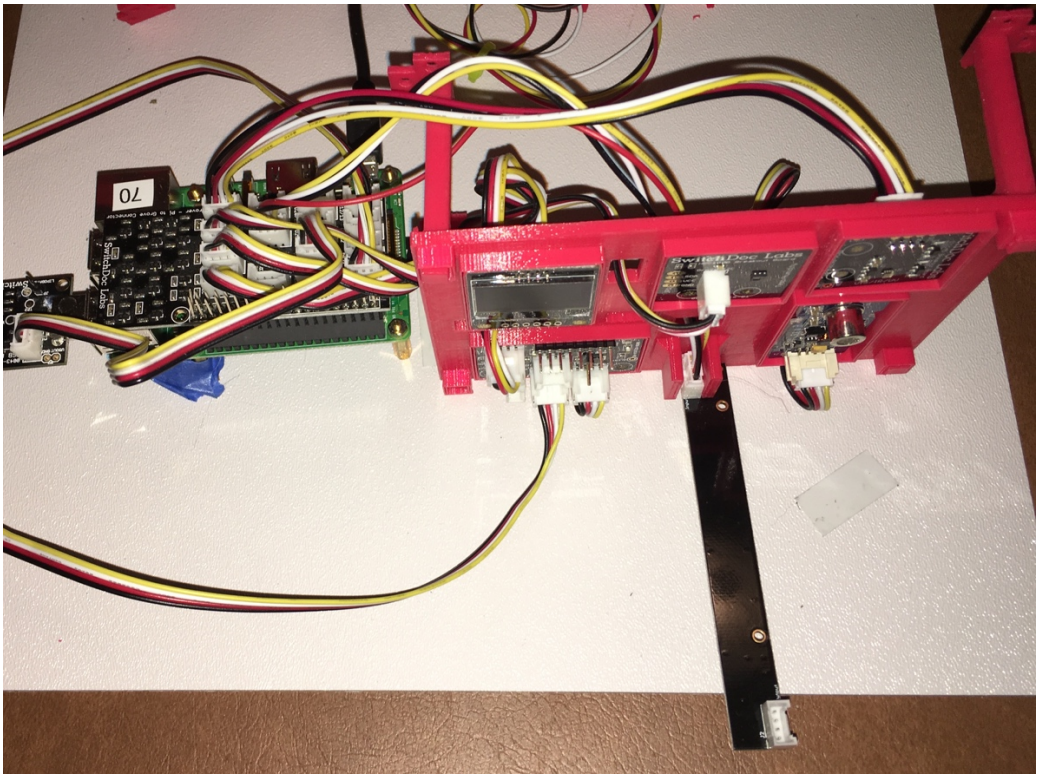
Step 10) Take the USB PowerControlNE (Part P) and plug it into any of your USB Ports on the Raspberry Pi

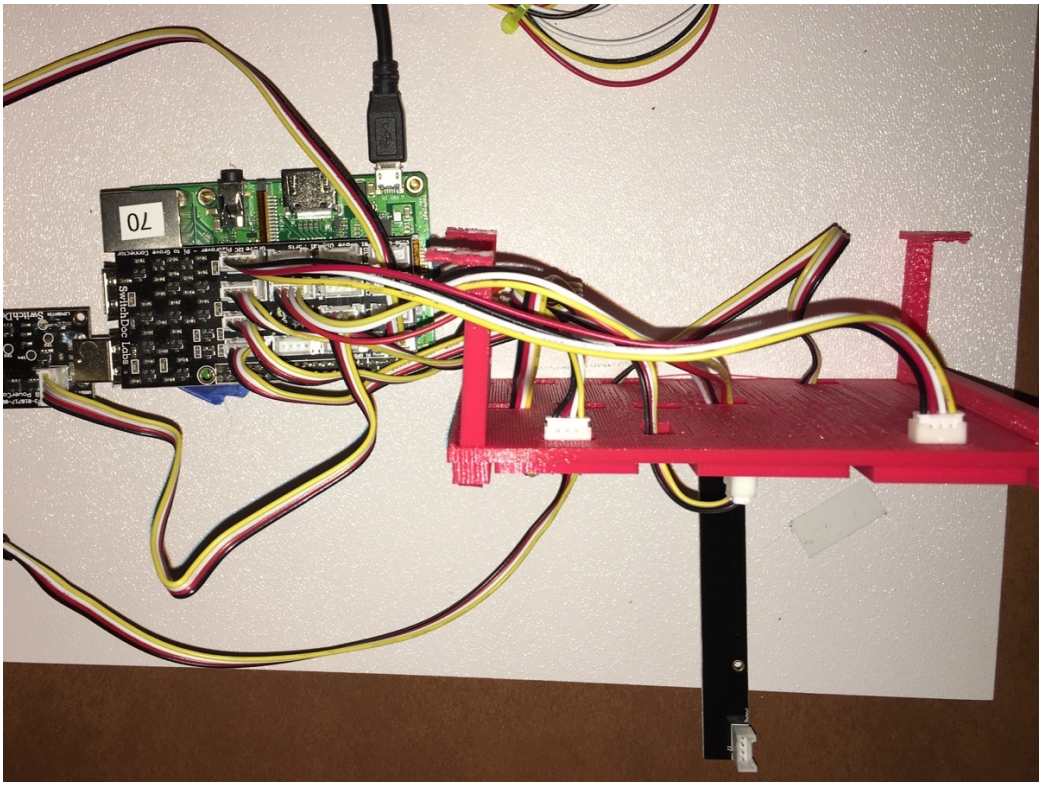


Step 11) Take the Ultrasonic Ranger (Part F) and plug it into the holes on the 3D Printed Ultrasonic Stand (Part S). Make sure you have the flanges on the stand oriented the way shown below.

Adding All the Grove Cables from the 3D Printed Top to the Pi2Grover

We know this looks complicated (see the pictures below), but we are going to connect up one Grove cable at a time, which makes things quite simple.

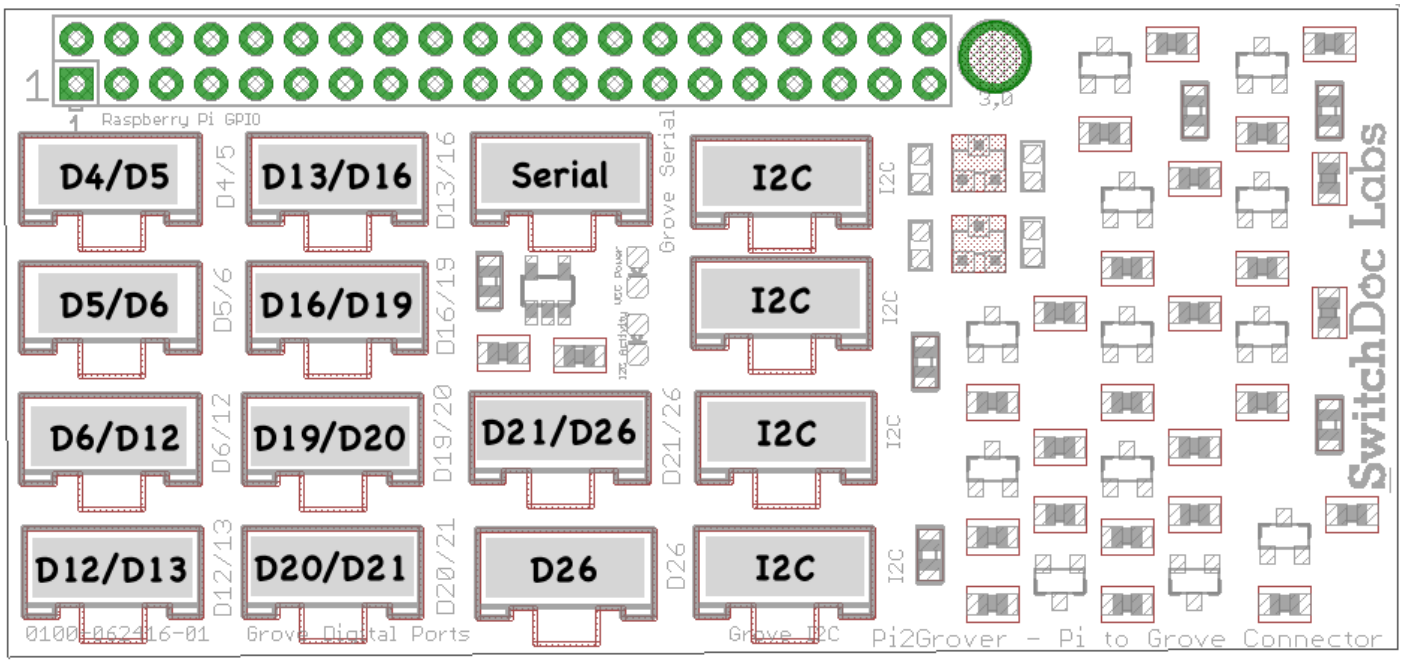




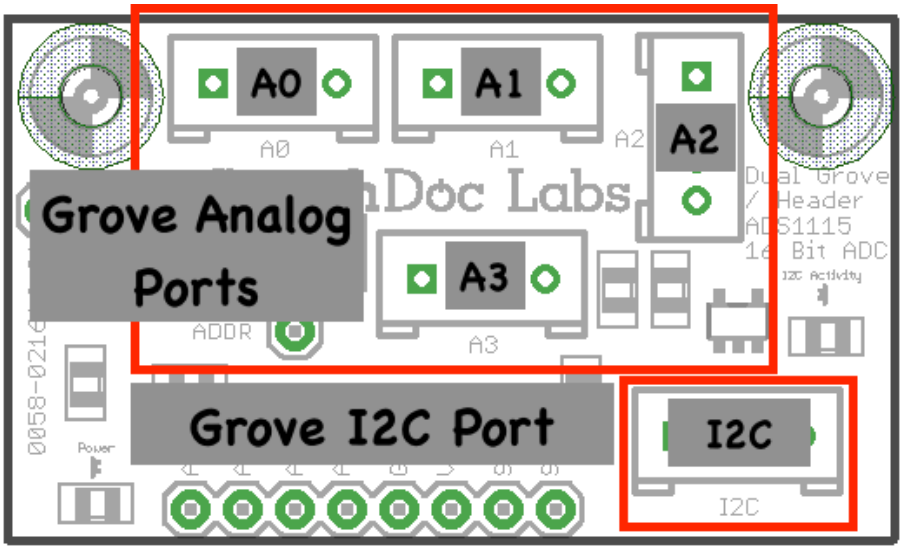
Here is a chart of all the connections and then we will hook them up one at a time. Make sure your Raspberry Pi is NOT PLUGGED IN!

Grove Connections from 3D Printed Top to Pi2Grover		
From	To	Description
OLED Display (Part I)	Pi2Grover (Part A) I2C Bus Connector (Any)	OLED Display I2C Sensor Bus
Temperature / Humidity Sensor (Part E)	Pi2Grover (Part A) I2C Bus Connector (Any)	I2C Sensor Bus for the Temperature / Humidity Sensor
Sunlight Sensor (Part G)	Pi2Grover (Part A) I2C Bus Connector (Any)	I2C Sensor Bus for Sunlight Sensor
8 RGBW Pixel Stick (Part J) marked INPUT	Pi2Grover (Part A) D21/D26	The Pixel stick will stand up once you have plugged the Grove cable into the stick
USB PowerControl-NE (Part P)	Pi2Grover (Part A) D16/D19	USB PowerControl-NE for Pump
Ultrasonic Ranger (Part F)	Pi2Grover (Part A) D4/D5	Water Sensor
4 Channel ADC / I2C Port (Part B)	Pi2Grover (Part A) I2C Bus Connector (Any)	Connection to the Raspberry Pi I2C sensor bus
4 Channel ADC / A0 Port (Part B)	Air Quality Sensor (Part H)	Analog output of Air Quality Sensor to Port A0 on the 4 Channel ADC
4 Channel ADC / A1 Port (Part B)	50cm Grove to Capacitive Moisture Sensor Cable (Part D)	Will be connected to the Moisture Sensor later

Pi2Grover (Part A)



4-Channel ADC (Part B)



Step 11) Connect the 20cm cable (Part M) plugged into the OLED Display (Part E) into the I2C Plug (any I2C Plug – it's a bus) on the Pi2Grover (Part A)

Step 12) Connect the 20cm cable (Part M) plugged into the Temperature Humidity Sensor (Part D) into the I2C Plug (any I2C Plug – it's a bus) on the Pi2Grover (Part A)

Step 13) Connect the 20cm cable(Part M) plugged into the Sunlight Sensor (Part G) into the I2C Plug (any I2C Plug – it's a bus) on the Pi2Grover (Part A)

Step 14) Connect the 20cm cable(Part M) plugged into the I2C Port of the 4 Channel ADC (Part D) into the I2C Plug (any I2C Plug – it's a bus) on the Pi2Grover (Part A)

Step 15) Connect the 20cm cable (Part M) plugged into the Air Quality Sensor (Part G) (routing it under and then up again through the hole next to A0 on the 4 Channel ADC (Part B)) into Port A0 on the 4 Channel ADC (Part B)

Step 16) Leave the 50cm Grove Capacitive Moisture Sensor Cable (Part D) plugged into Port A1 of the 4 Channel ADC (Part B) until we connect the Moisture Sensor in a later step

Step 17) Connect the 20cm cable (Part M) plugged into the end of the Grove Pixel RGBW Stick **marked INPUT** (Part J) (routing it through the provided hole) and then into Port D21/D26 on the Pi2Grover (Part A)

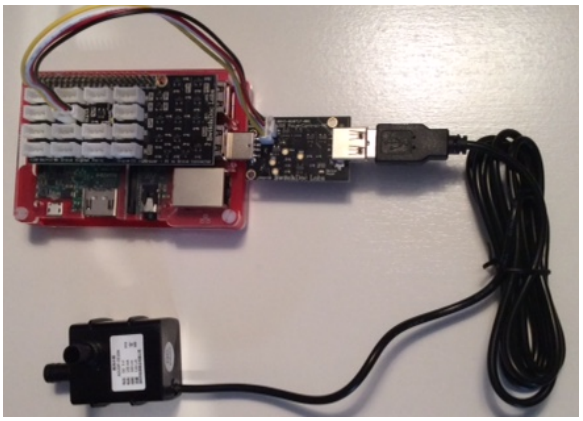
Step 18) Connect the 50cm Grove cable (Part T) into the Grove connector on the Ultrasonic Ranger (Part F) and then into Port D4/D5 on the Pi2Grover (Part A)

Adding the Soil Moisture Sensor

Step 19) Connect the 50cm Grove to Capacitance Moisture Sensor Cable (Part D) (plugged into Port A1 of the 4 Channel ADC (Part B)) into the three wire non-Grove Connector on the Capacitive Moisture Sensor (Part C). The plug is keyed!

Adding the USB Submersible Pump

Step 19) Take the USB Submersible Pump (Part K) and plug the USB cord into the USB Port on the USB PowerControlNE (Part P). Then take a 20cm Grove Cable (Part M) and plug it into the Grove Connector on the USB PowerControlNE (Part P) and the other end into the Pi2Grover (Part A) in the D16/D19 Connector.



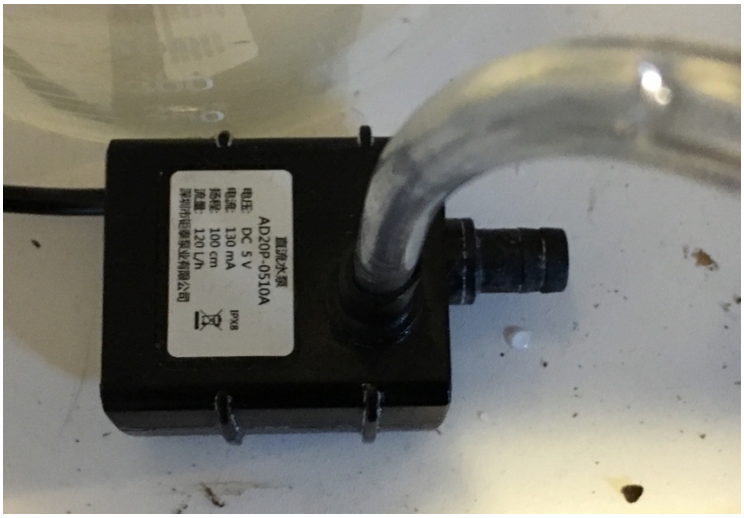
Preparing the Tubes

Note: If your length requirements are different than the tubes supply, any ¼" irrigation plastic pipe will work for this project. Available at any major hardware store.

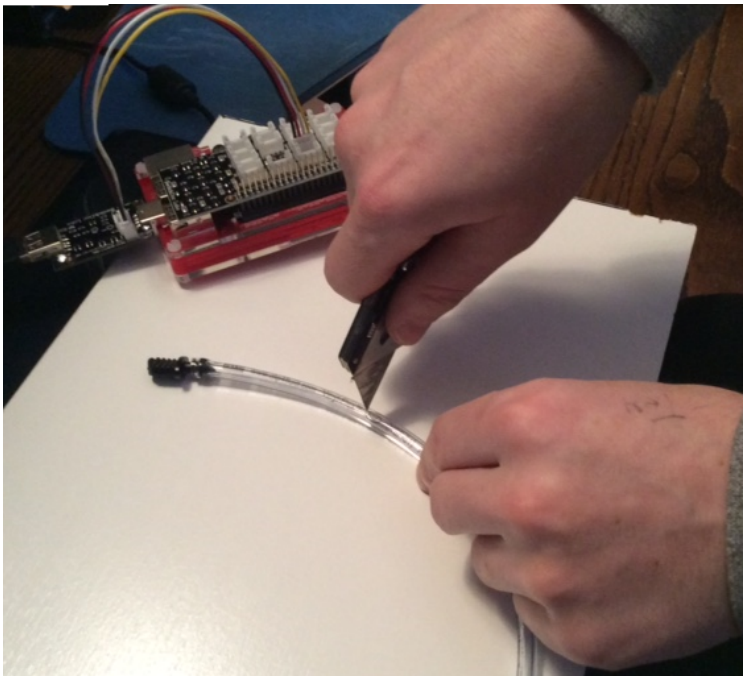
There is one length (300mm) of ¼" plastic pipe included with The Smart Garden System (Part Q)

Step 21) Take the long pipe (Part T) and push it onto the nipple of the USB Submersible Pump (Part K). If you are having a hard time pushing it in, soak the end of the pipe in hot water for a few minutes to soften it. Then try again. Plug the other end of the pipe with the Plastic Plug Pipe (Part R).

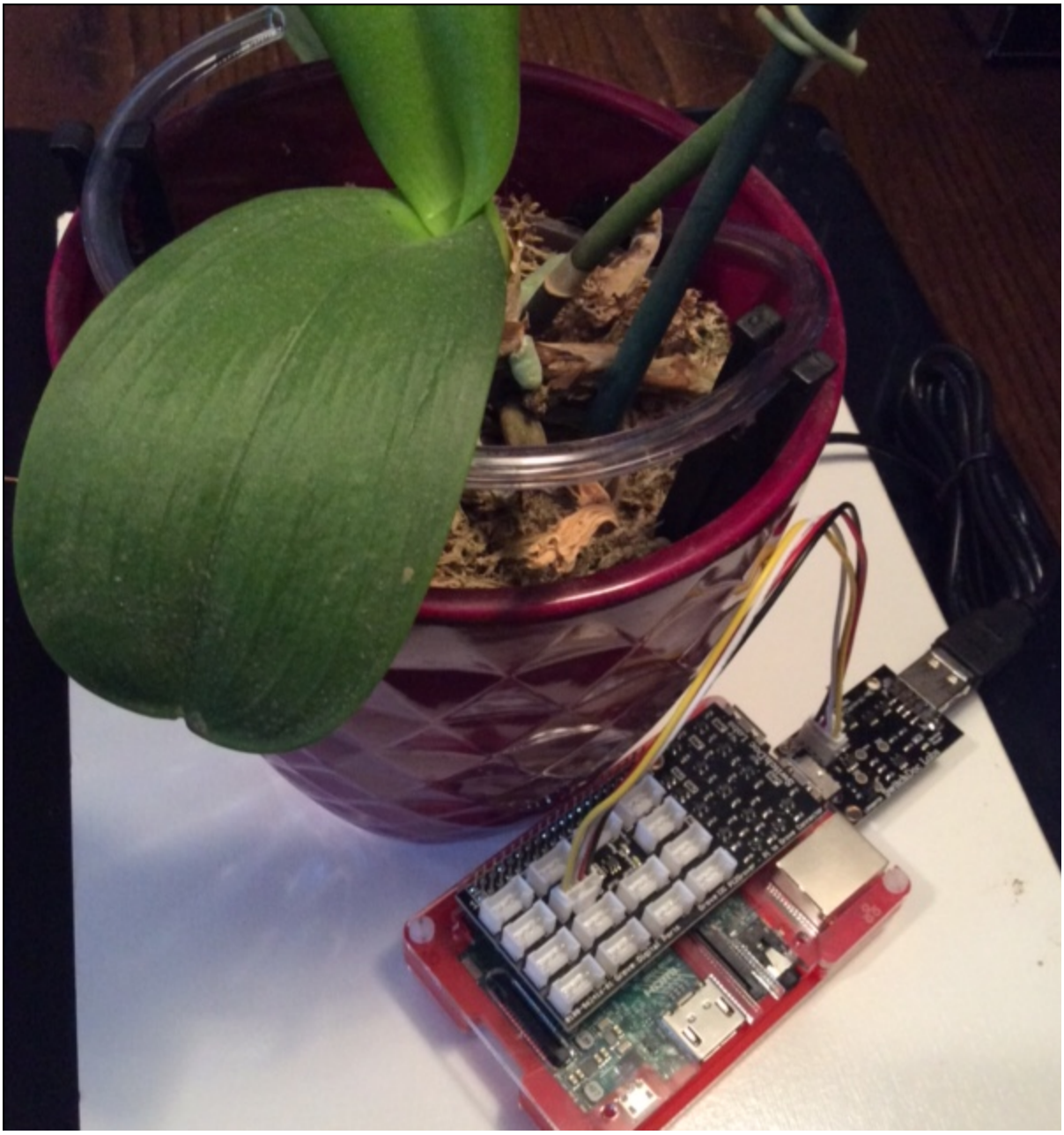
The pump output is on the side of the pump (Part K) next to the label as show below.



Step 22) With an Xacto knife or sharp blade (be careful!) make at least three evenly spaced holes around the pipe that will circle the plant.



Step 23) With the included plant Stakes (Part L) secure the pipe to the plant pot circling the plant. Cut the Stakes with a pair of scissors if the stakes are too tall for your plant.



You have now completed the initial assembly of The Smart Garden System.

NOTE THAT THERE IS NO WATER ANYWHERE IN THE PROJECT AT THIS TIME!

We will now proceed to initial testing.

Installing the The Smart Garden System Software and Initial Testing on the Raspberry Pi

In order to test The Smart Garden System before installing the water, you must be familiar with the Raspberry Pi and the terminal command line as suggested in the Learning Your Raspberry Pi Chapter. You cannot do this test without understanding how to use your Raspberry Pi.

To save yourself the trouble of installing the Operating System and all the drivers, SwitchDoc Labs provides an SD Card that has the Raspberry Pi operating system, version Stretch, and all the Smart Garden System software installed. ***https://shop.switchdoc.com/products/16gb-sd-card-with-stretch-smart-garden-system-groveweatherpi***

If you have this SD Card, you can skip steps 2 – 6 below.

Step 1) Plug in your Raspberry Pi. You should see two blue LEDs turn on, one on the Pi2Grover board, one on the 4 Channel ADC Board and a third dim blue LED on the Air Quality Sensor board. In addition, you will see a red LED on the Raspberry Pi board and an occasionally flashing yellow LED.

Step 2) Open a terminal window on your Raspberry Pi, either on the Pi Graphical Interface or using ssh from another computer.

Step 3) Run the following commands:

sudo apt-get update

Next, upgrade all your installed packages to their latest versions with the command:

sudo apt-get dist-upgrade

This may take quite a while.

Now we are ready to start installing the The Smart Garden System software.

Step 3) First install I2C on Raspberry Pi – Follow the directions in this link:

https://learn.adafruit.com/adafruits-raspberry-pi-lesson-4-gpio-setup/configuring-i2c

Step 4) Next, Install GPIO and apscheduler

sudo apt-get install build-essential python-pip python-dev python-smbus git

git clone ***https://github.com/adafruit/Adafruit_Python_GPIO.git***

cd Adafruit_Python_GPIO

sudo python setup.py install

sudo pip install --upgrade setuptools pip

sudo pip install setuptools --upgrade

sudo pip install apscheduler

Step 5) Install PubNub

sudo pip install 'pubnub>=4.0.5'

Step 6) Install the The Smart Garden System software

sudo git clone *https://github.com/switchdoclabs/SDL_Pi_SmartGardenSystem*

Check the README.md in this directory for any new installation instructions for the software.

Step 7) I2C Test - Now we can run the first major test.

Type this into a terminal window:

i2cdetect –y 1

Here is what you should see:

```
pi@RPi3-62:~/SDL_Pi_The Smart Garden System $ i2cdetect -y 1
     0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00:          -- -- -- -- -- -- -- -- -- -- -- -- --
10: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
20: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
30: -- -- -- -- -- -- -- -- -- -- -- -- 3c -- -- --
40: 40 -- -- -- -- -- -- -- 48 -- -- -- -- -- -- --
50: -- -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
60: 60 -- -- -- -- -- -- -- -- -- -- -- -- -- -- --
70: -- -- -- -- -- -- -- --
pi@RPi3-62:~/ SDL_Pi_SmartGardenSystem $
```

This is a list of all the devices present on your I2C Bus.

0x3c – OLED Display (Part H)

0x40 – HDC1010 Temperature / Humidity Device (Part D)

0x48 – 4 Channel ADC Board (Part B)

0x60 – Sunlight Sensor

If you are missing any of the above devices, carefully check your wiring. You probably have made a mistake above in wiring.

If this looks good, move to the next step.

Step 7) Run the testALL.py program – this tests a number of the other devices on The Smart Garden System

```
cd SDL_Pi_The Smart Garden System
sudo python testAll.py
pi@RPi3BP-70:~/SDL_Pi_SmartGardenSystem $ sudo python testAllSensors.py
[Errno 121] Remote I/O error
[Errno 121] Remote I/O error
Error accessing 0x49: Check your I2C address
Error accessing 0x49: Check your I2C address

Test All SGS Devices Version 1.0 - SwitchDoc Labs

Program Started at:2018-10-17 19:02:22

Temp             = 22.227 deg C
Humidity         = 39.11 %
-----------------
 Sunlight Vi/IR/UV Sensor
-----------------
Sunlight Visible:  392
Sunlight IR:       3635
Sunlight UV Index: 0.72
376.580357143
Moisture Humidity = 53.80
------------------------------
Sensor Value=250 --> Fresh Air  | 0
Ultrasonic Level
Grove Ultrasonic get level and print
4.633cm
4.612cm
4.612cm
4.596cm
4.612cm
4.629cm
4.510cm
4.612cm
4.596cm
4.510cm
----------------------
Main Sensors
----------------------
ADS1115:          Present
OLED:             Present
Sunlight Sensor:              Present
hdc1000 Sensor:               Present
Ultrasonic Level Sensor:            Present

----------------------
Plant / Sensor Counts
----------------------
Sensor Count:  1
Pump Count:  1

----------------------
Extender Devices
----------------------
```

```
ADS1115_Ext1:           Not Present
ADS1115_Ext2:           Not Present
GPIO Extender 1:              Not Present
GPIO Extender 1:              Not Present

----------------------
Future Smart Garden System Expansions
----------------------
SunAirPlus:             Not Present
Lightning Mode:               Not Present
Solar Power Mode:             Not Present
MySQL Logging Mode:           Not Present

done with testAll
pi@RPi3BP-70:~/SDL_Pi_SmartGardenSystem $
```

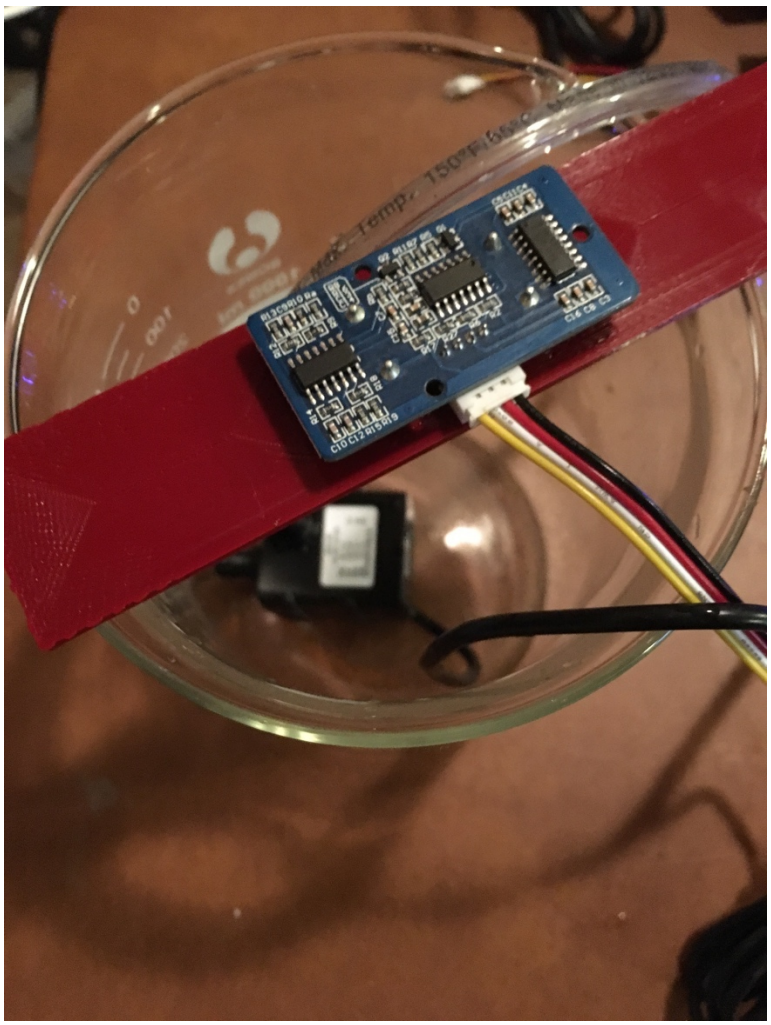
You can ignore the first four lines of errors. They are a result of the testing process.

Calibrating your Water Tank

Once you have done all the above steps and tests, it is time to add water and start The Smart Garden System (SGS) running for real. We have one more step before starting the software. We need to calibrate the ultrasonic sensor so the SGS will know how much water is in the tank. You already have the plant connected, so it is time to get a beaker, bucket or glass and add the USB Submersible Pump into the vessel.

Step 1) Take a glass (we used a beaker) and place the USB Submersible Pump inside the glass, making sure not to crimp the pipe coming out. Do NOT Add water at this time.

Step 2) Place the Ultrasonic sensor over the top of the tank with the sensor facing down. If your tank is larger than the 3D printed Ultrasonic Holder, take a piece of wood or plastic of the appropriate size and cut two holes to fit the sensor inside.



Step 3) In the SDL_Pi_SmartGardenSystem directory run the following CalibrateWaterTank program and following the on screen directions. Do NOT get the Ultrasonic Sensor wet and don't fill the tank so full that the sensors will be in the water! This program writes a calibration file containing these full and empty measurement numbers. If you change the tank size or depth, just re-run this calibration program.

```
pi@RPi3BP-70:~/SDL_Pi_SmartGardenSystem $ sudo python CalibrateWaterTank.py
############################
Ultrasonic Tank Calibration
SwitchDoc Labs
Software Version: 001
############################

Step 1) Empty Water Tank
Step 2) Put Ultrasonic Sensor in place on top of tank

hit return to continue:
Measuring Empty Level
11.265cm
11.355cm
11.265cm
11.318cm
11.269cm
11.285cm
11.249cm
11.285cm
11.285cm
11.285cm
calibrated EMPTY Level=   11.3

Step 3) Fill Water Tank
Step 4) Put Ultrasonic Sensor in place on top of tank

hit return to continue:
Measuring Full Level
2.314cm
2.314cm
2.314cm
2.179cm
2.331cm
2.351cm
2.196cm
2.196cm
2.196cm
2.196cm
calibrated FULL Level=    2.3

############################
Values written to TankCalibration File
############################
Calibration Complete
############################
pi@RPi3BP-70:~/SDL_Pi_SmartGardenSystem $
```

Starting the Smart Garden System

Step 1) Make sure that all your pipes are in the correct position and you have the output of the pipe in the plant. We don't want any water spillage.

Step 2) Type the following command into the terminal window while in the SDL_Pi_SmartGardenSystem system directory.

```
sudo python SGS.py
```

You will see something similar as below in the terminal and you will see the OLED display come alive on your 3D Printed Panel. You are running The Smart Garden System!

```
pi@RPi3BP-70:~/SDL_Pi_SmartGardenSystem $ sudo python SGS.py

SGS Version 007  - SwitchDoc Labs

Program Started at:2018-10-26 10:32:21

ADS1115:            Present
OLED:               Present
Sunlight Sensor:          Present
hdc1000 Sensor:           Present
Ultrasonic Level Sensor:                Present

----------------------
Plant / Sensor Counts
----------------------
Sensor Count:  1
Pump Count:  1

----------------------
Extender Devices
----------------------
ADS1115_Ext1:             Not Present
ADS1115_Ext2:             Not Present
GPIO Extender 1:          Not Present
GPIO Extender 2:          Not Present

----------------------
Future Smart Garden System Expansions
----------------------
SunAirPlus:               Not Present
Lightning Mode:           Not Present
Solar Power Mode:               Not Present
MySQL Logging Mode:             Not Present

----------------------
Moisture Sensor:          Present
----------------------
-----------------
Scheduled Jobs
-----------------
Jobstore default:
    blinkLED (trigger: interval[0:00:05], next run at: 2018-10-26 10:32:28 PDT)
    forceWaterPlantCheck (trigger: interval[0:00:08], next run at: 2018-10-26 10:32:31 PDT)
    updateState (trigger: interval[0:00:10], next run at: 2018-10-26 10:32:33 PDT)
    statusLEDs (trigger: interval[0:00:15], next run at: 2018-10-26 10:32:38 PDT)
    checkForAlarms (trigger: interval[0:00:15], next run at: 2018-10-26 10:32:38 PDT)
    tick (trigger: interval[0:01:00], next run at: 2018-10-26 10:33:23 PDT)
    checkAndWater (trigger: interval[0:15:00], next run at: 2018-10-26 10:47:23 PDT)
-----------------
Pump #1 turned On
```

```
Pump #1 turned Off
Tick! The time is: 2018-10-26 10:33:23.420758
```

If your plant is dry, then you will see the pump turn on. Look at your OLED screen to see the current moisture and plant information!

Congratulations. You now have a Smart Garden!

The Smart Garden System Operations

Before we discuss the various controls and their usage, let's talk about a few important things about The Smart Garden System.

1) **Keep all water away from the electronics and power supply at all times!**
2) **The Smart Garden System is designed for indoor use only and should be placed in a dry environment where no water or rain can reach to avoid short circuiting the electronics**
3) **Insert the moisture sensor into the CENTER of the flower pot, and keep it near the center of the plant and way from the water coming out of the holes cut in the watering pipe.**
4) **This is not a toy! Keep it out of reach of young children and pets.**
5) **SwitchDoc Labs assumes no liabilities in the use of this kit, beyond the refund of the purchase price.**

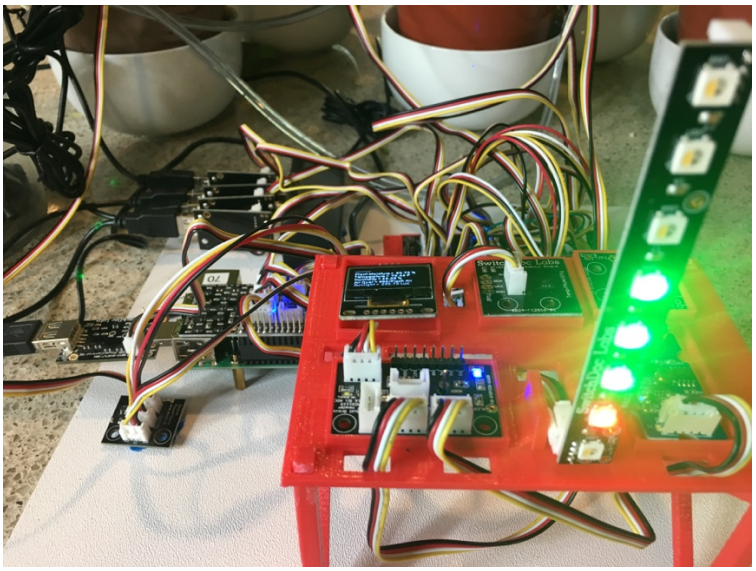
OK, now that we have that out of the way, let's talk about the software and how things work.

While the the Smart Garden System system is pretty simple, the architecture of the software is pretty sophisticated. The Smart Garden System is a real-time system. What we mean by "real time" is that the program has to monitor environmental variables and then do certain actions at certain times. In a nutshell, we used a scheduler to build and run a set of tasks to check the moisture content of the plant and then turn the pump on if applicable. We detect that we are out of water by monitoring level of the tank using an ultrasonic sensor. No water pumped? We are out of water.

So, we have a task to check the water, update all the environmental sensors and a variety of other tasks. All source included, all open source. Feel free to add sensors, more pumps or anything you want to do!

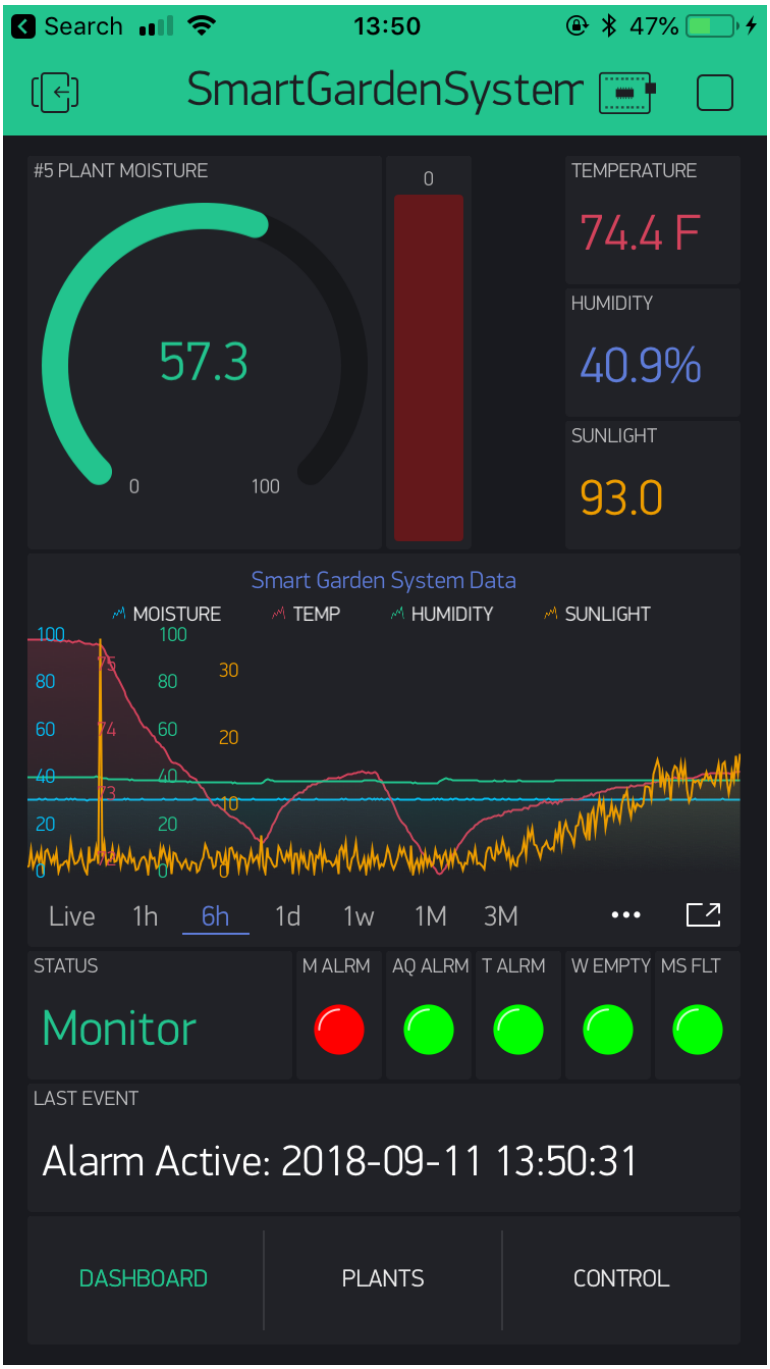
What does the LED Strip Display?

The 8 Pixel RGBW (NeoPixels) strip shows three things. The bottom-most LED blinks to show you that the system is still running and the program and Pi has not bombed. The other 7 LEDs alternate between displaying the water tank level and the moisture readings from plant #1.



What About Blynk?

Please see the manual “Installing Blynk for the Smart Garden System”.



The Science and Education Goals Behind The Smart Garden System

Everything we build for the Maker market is designed for education and learning. Making is education. Making is learning. Building your own projects allows you to innovate around a framework and do wonderful things that we have never thought of.

The educational goals for Smart Plant are:

- Learn about the Raspberry Pi and installing software on the Pi
- Connecting up sensors to the Raspberry Pi
- Learning about Feedback loops and regulating water to plants
- Understand your indoor environment and what affects it
- Learn about the new technology called the Internet of Things

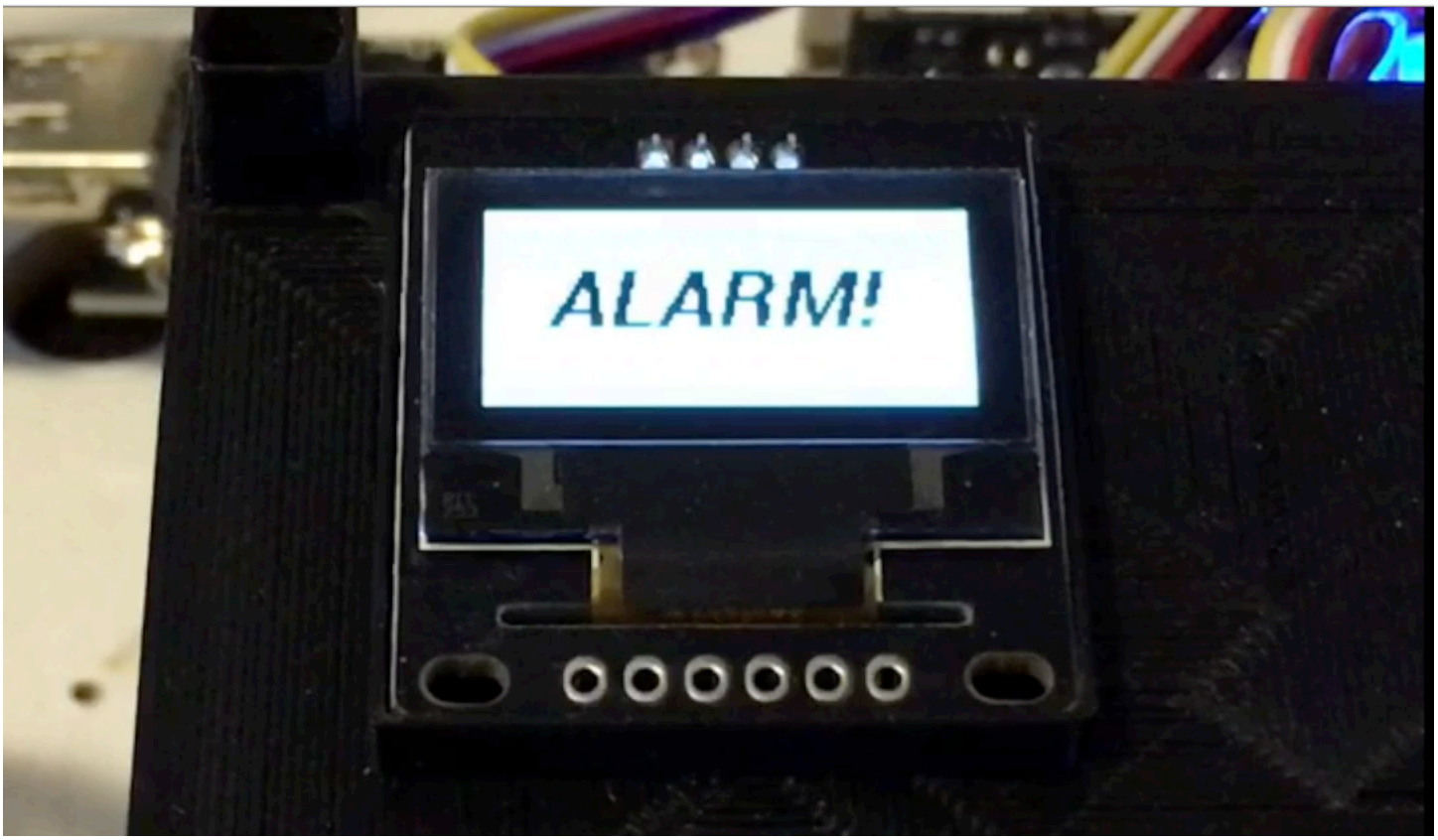
Just a few words about the theory behind The Smart Garden System. This was a great project to design and build. It was really an interesting process learning about the sensors, how to interconnect them and then learning about flow meters, USB Pumps and especially the software bringing them all together.

Where is the science and engineering in this project? All through it from the bottom to the top. The most interesting points? One, we are using feedback in the system. Negative feedback to be exact. We aren't just watering on a timer, we are looking at the soil moisture and if it is high enough, we don't water. We don't water unless we need to. Very cool.

Secondly, the sensors we have in this project are amazing. For example, the Air Quality sensor is very, very sensitive. We can detect hairspray from 50 feet away.

Thirdly, We got a lot out of learning how to display the data from Smart Plant on the Blynk App.

The Amazon Alexa was fascinating and although very complex (we are releasing a tutorial on how to do it) we learned a lot about designing voice interfaces. We can use Alexa [https://youtu.be/q141lM3S05s] but it is not released to the general public. That will take a bunch more work to do that so it will be easy to use by our customers.



Alarms

If you activate alarms and one (or more) of them are triggered, it will flash the screen “ALARM” and then display the specific alarms that have been triggered.

The alarms are:

- Dry Plant
- Low Temperature
- Water Reservoir Empty
- Air Quality Threshold Exceeded
- Moisture Sensor Error

What is in the The Smart Garden System Advanced Manual?

The Advanced manual covers these topics:

- Storing Data in a MySQL Database (Maria DB)
- Using SwitchDoc Labs DataLogger to record all the information generated by your The Smart Garden System system

Support

As with all SwitchDoc Labs products, technical support is given through the forums on Forum.switchdoc.com

If you have issues that can be solved by our fabulous customer service department, please go to www.switchdoc.com and send your issues through our Contact page on the top menu.

Disclaimer

SwitchDoc Labs, LLC takes no responsibility for any physical injuries and possession loss caused by those reasons which are not related to product quality, such as operating without following the operating manual and cautions, natural disasters or force majeure.

SwitchDoc Labs, LLC has compiled and published this manual which covers the latest product description and specification. The contents of this manual are subject to change without notice.