SwitchDoc Labs

Tutorial: Managing a Backyard Hops Farm using the Smart Garden System 2 with Weather Station

August 2020

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Mature hops almost ready for harvesting

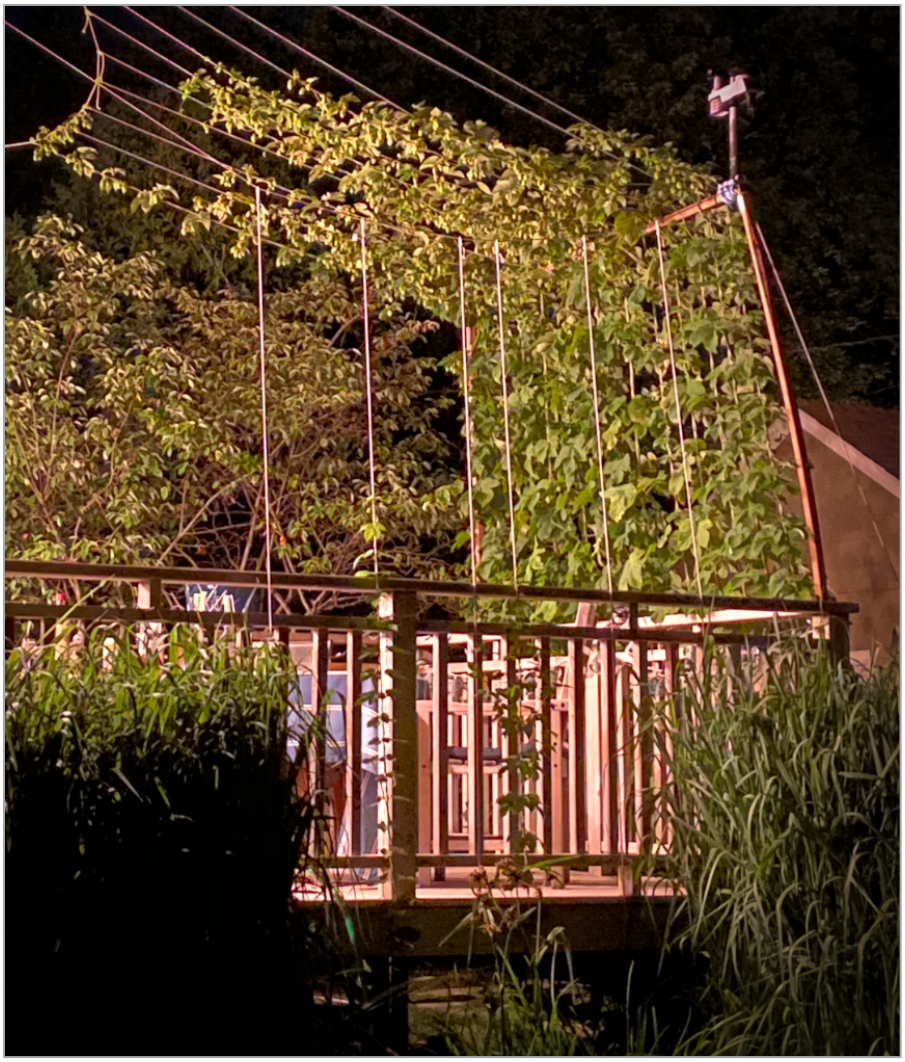
Why a hops farm?

The Backyard Hops Farm is little more than shading on my deck to cool us during hot summers in Chicago. Grapes were my original idea, but they do not grow well here. Hops are hardy and die back to their rhizomes in the ground every year, making them a perfect crop for this climate. If you ever visit northwest Michigan or Oregon, you can't help but see rows of 60' poles with cables strung across the top supporting lines of hops dangling to the ground. Hop bines grab on to these lines and begin their rapid ascent in May, reaching 30'- 50' in only a couple of months. Harvest is in the early fall. So much fun to watch!

Yes, they are bines, not vines. Vines send out tendrils or suckers to cling onto a supporting pole. Its stem grows vertically, all the twisting and gripping is done by the tendrils. A bine plant wraps its stem (not tendrils) in a helix around a supporting structure. The bine's stem is the flexible, twisting part of the plant unlike the vine. A bine has stiff hairs to provide structure and solidity as it grows.

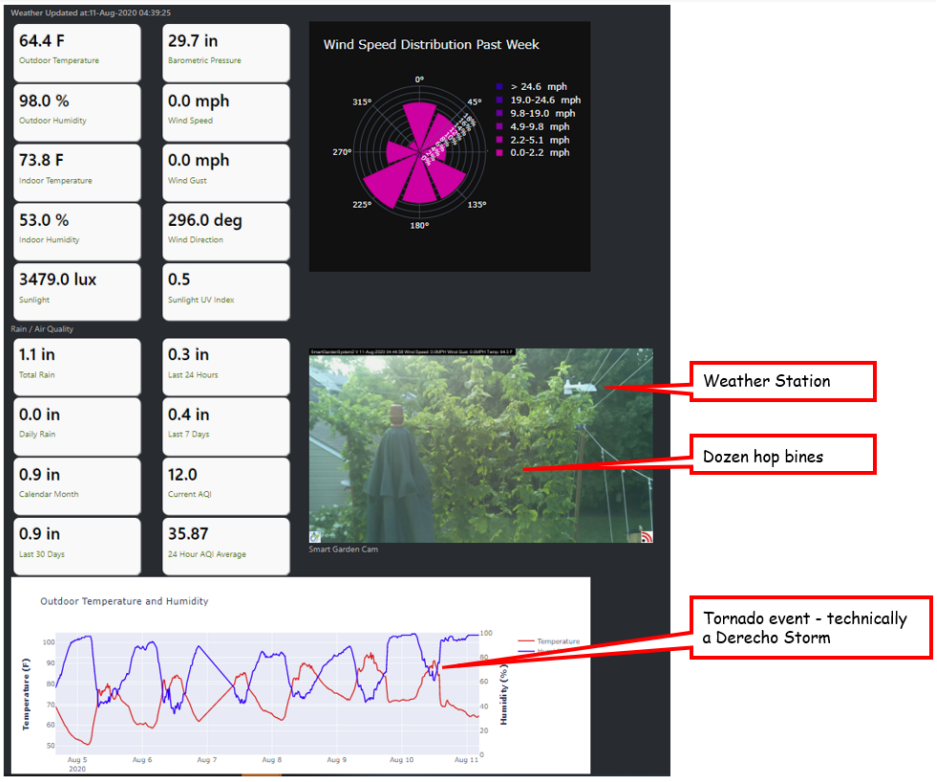
When harvested, "wet hops" are favored by brew masters for their fragrance. You do not need to be a home brewer – your local microbrewery would love to make a batch of Wet Hopped ale to reward your efforts.

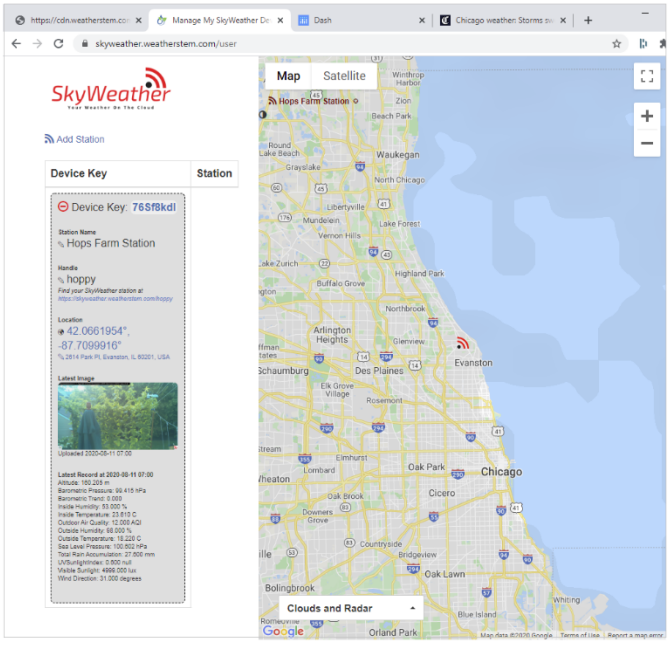
My Willamette hops supported by a simple wooden frame and 1/4-inch Manila rope

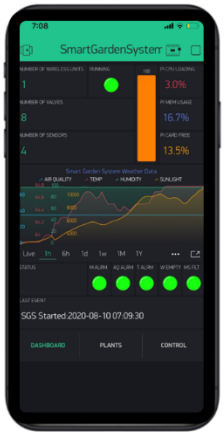


What we created

This project is an upgrade from the original Smart Garden System we built at the onset of the COVID-19 event in 2020 when we needed a system to water our hops from Maine, 1,500 miles away, where we sheltered in place for a month. We used the Blynk app to monitor soil moisture, temperature, and even water our plants. This upgrade brings all the features we liked from the first kit and added the weather station with live page on Weatherstem.com. The coolest feature is the 24 hour time-lapse images of the farm, viewable from anywhere in the world







What is The Smart Garden System with Weather Station?

Do you like to tinker? Imagine building your own remote monitoring and management system for your indoor or outdoor garden? How about sharing your garden and the weather worldwide? You can do all this and learn a little about electronic circuitry without touching a **soldering** iron. You can measure soil moisture and use that as water your plants or garden just the right about of water.

This project will cost you under $300 including a full Raspberry Pi computer which you can buy online for $35.00 This is a perfect for someone how knows nothing about electronics but curious to learn a little. Great for kids too.

The Smart Garden System with Weather System Features

- Control Valves, Pumps and Lights
- Measure your Soil Moisture
- Measure your Sunlight
- Measure your Air Quality
- Measure your Weather
- Show your results on the Internet and your Phone

Did I say no soldering?

I deviated from the original plan with respect to waterproofing the moisture sensors by soldering them to the wiring for extra strength. I wanted to practice my soldering skills. This is not necessary as show in this SwitchDoc Labs tutorial.

Parts not included

To add the moisture testing and irrigation system, I added a lot of parts not included in the kit. These are described below in detail.

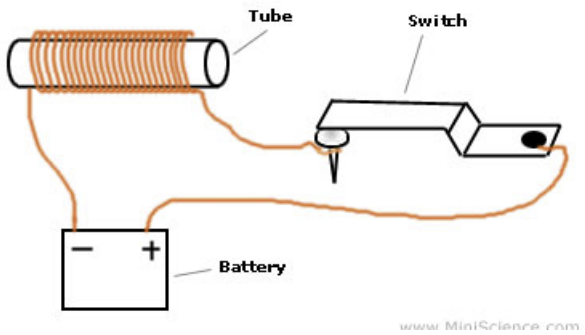
May the games begin!

We began with a trip to our neighborhood hardware store to purchase an inexpensive Tupperware box to house the extender. Individual holes were then drilled into the box for wiring to the four-moisture sensors, four solenoids and power. These were secured with rubber gromets. I was amazed what you could find at a small hardware store.

Finally, we secured a plexiglass window into the lid, making sure to secure it firmly with plenty of silicon calking. Water is your enemy! On a sunny day I left the lid off forgetting storms pass through the Midwest very quickly!

Pumps or Solenoids?

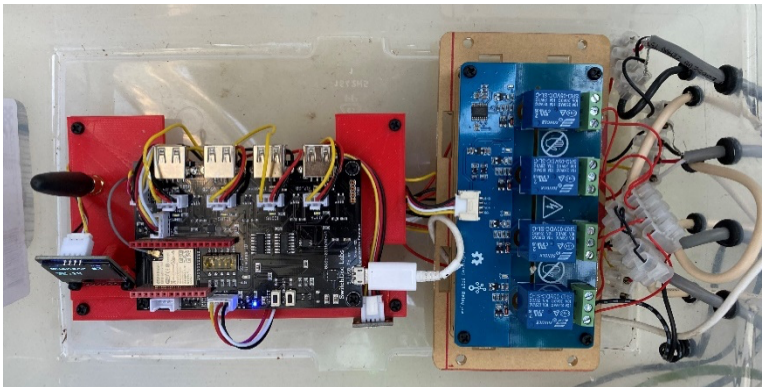
I had no idea what a solenoid was before starting this project. It is the device that opens car doors at the press of a button. That loud clanging noise you hear in prison movies when doors are opened is the sound of a solenoid pushing or retracting a piston lock. A solenoid is nothing more than an electrical charge flowing through a coil resulting in a metal rod being pushed or pulled through magnetism. You can create your solenoid own by following these instructions.



We did not need a pump for this project because water pressure from my hose faucet produces enough flow. But we did need solenoids to turn water on and off. Four were required.

There are eight valve ports in the standard configuration on the extender unit : The default setting for valves provide for Valves 1 – 4 to support pumps using the USB connectors on the extender board; such as the pump supplied in the Smart Garden System kit. Remember, the basic unit assumes you are watering house plants from a gallon jug; pumps are needed to move water from the jug to your plants. The extender also comes with a circuit board housing four blue relays, the four blue boxes in the image below. These are powered by Valves 5 – 8.

Relays are the four blue boxes on the right



The parts list included:

- Hose splitter
- Hose Extenders (two sets)
- 12 Volt Solenoids (four)
- Soak Hoses (two sets)
- Hose quick connectors (four sets – not required, Assembly can be tricky)
- Garden hose connectors to connect the two soak hoses to the lengths of hose (Shown below)
- Garden hose (Ace Hardware)
- Lawn Sprinkler (Ace Hardware – 2)
- Hose adapters as you will want to join short lengths of hose (Ace Hardware)
- Black and red wiring to connect the Solenoids to the relays (Ace Hardware)
- Gromets (Ace Hardware)

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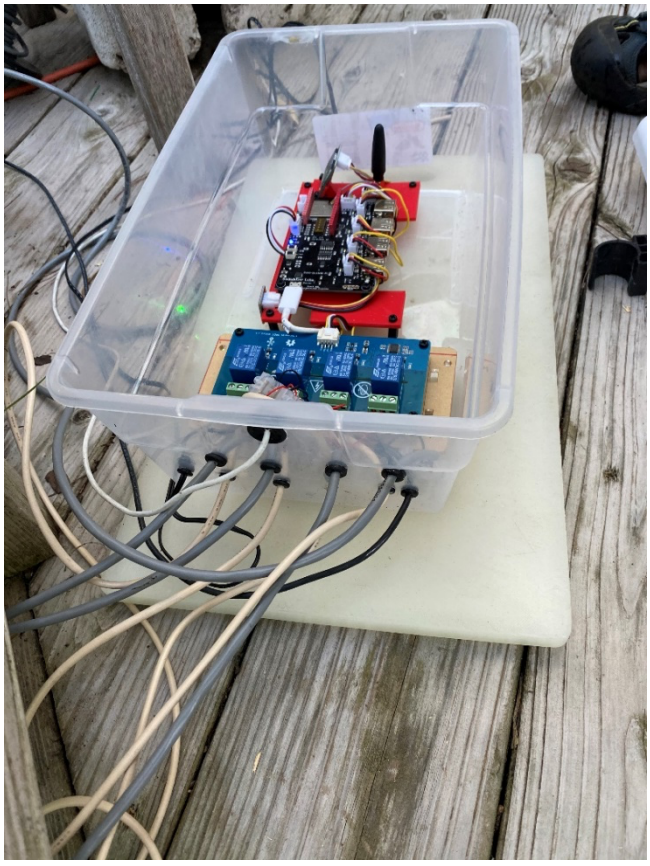
Hose from faucet splitting to four solenoids – two soak hoses and two lawn sprinklers. I never have all four on at the same time, so water pressure was never compromised.

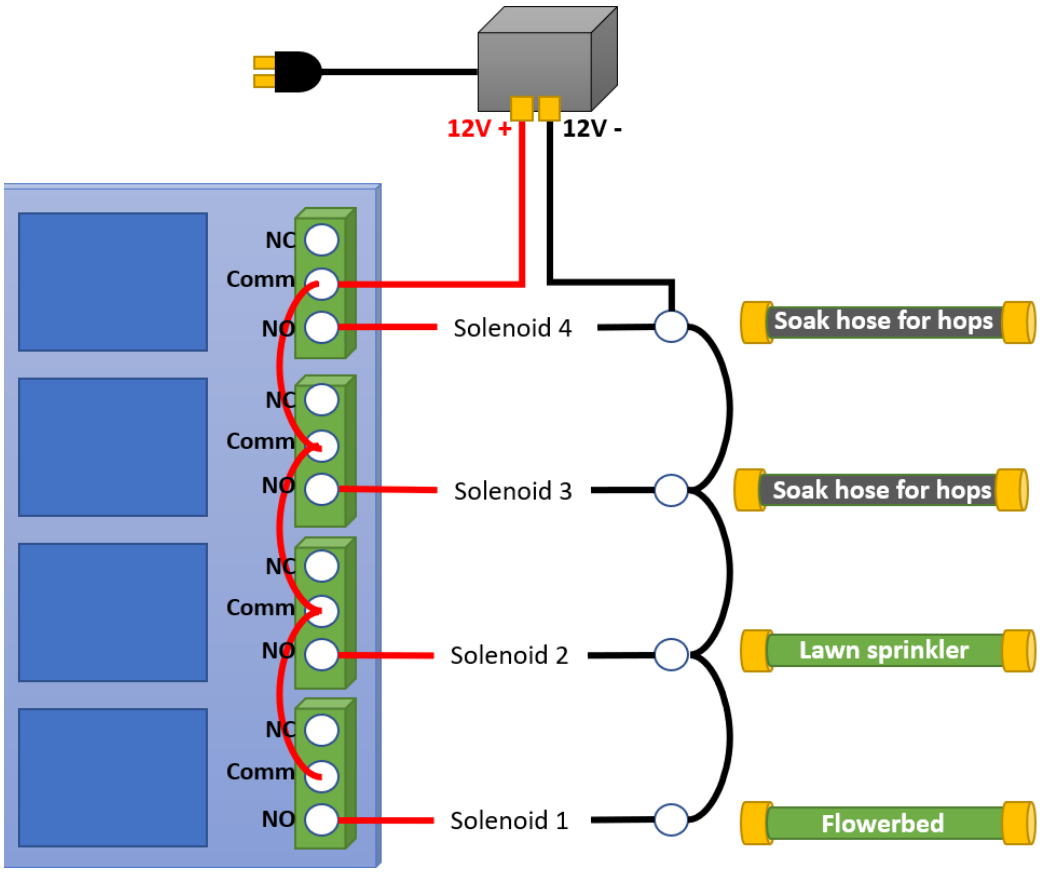
Notice how grommets secure electrical lines to the container and provide some protection from rain.



Solenoids and Relays

By now you are probably tired of hearing about these two devices. If I do not explain how these are wired togethers you will be frustrated as well.

Relays have three power ports to control devices. The three ports are labeled “NC” for Normally Closed; “NO” for Normally Open; and “Comm”. The positive terminal of the 12-volt power source is connected to one of the Comm ports. And all Comm ports are jumped together. Separately, each Solenoid was connected to a Relay though a positive (red) line to an available “Normally On” terminal. The 12-volt ground (negative) is connected to the solenoids directly, not through the relay. When trigged with a small voltage impulse from the Extender the relays connect the Comm port to the Normally On port, to allow power to flow.

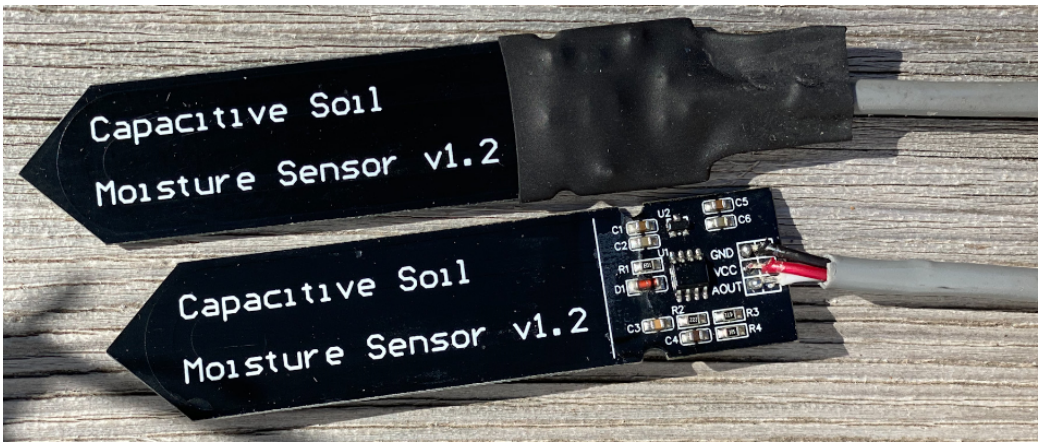


The Moisture Sensors

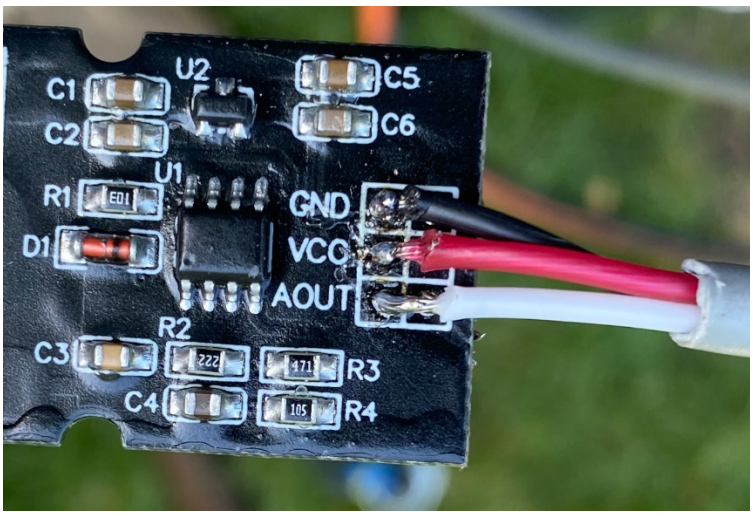
The moisture sensors do just that – report back to the Raspberry Pi the moisture of the soil. The are also able to trigger a watering event. At least one sensor is included in the kit. You will need four of these and other parts. I soldered the shielded cable moisture sensors to practice my soldering skills, though soldering is not necessary as show in this SwitchDoc Labs tutorial.

- Capacitive Soil Moisture Sensors (four)
- Heat shrink tubing (four – I purchased mine at my local Ace Hardware store, bringing the sensor with me to pick the right size)
- Shielded cable (enough to connect your Extender to each sensor)
- Spray can polyurethane (or clear nail hardener)

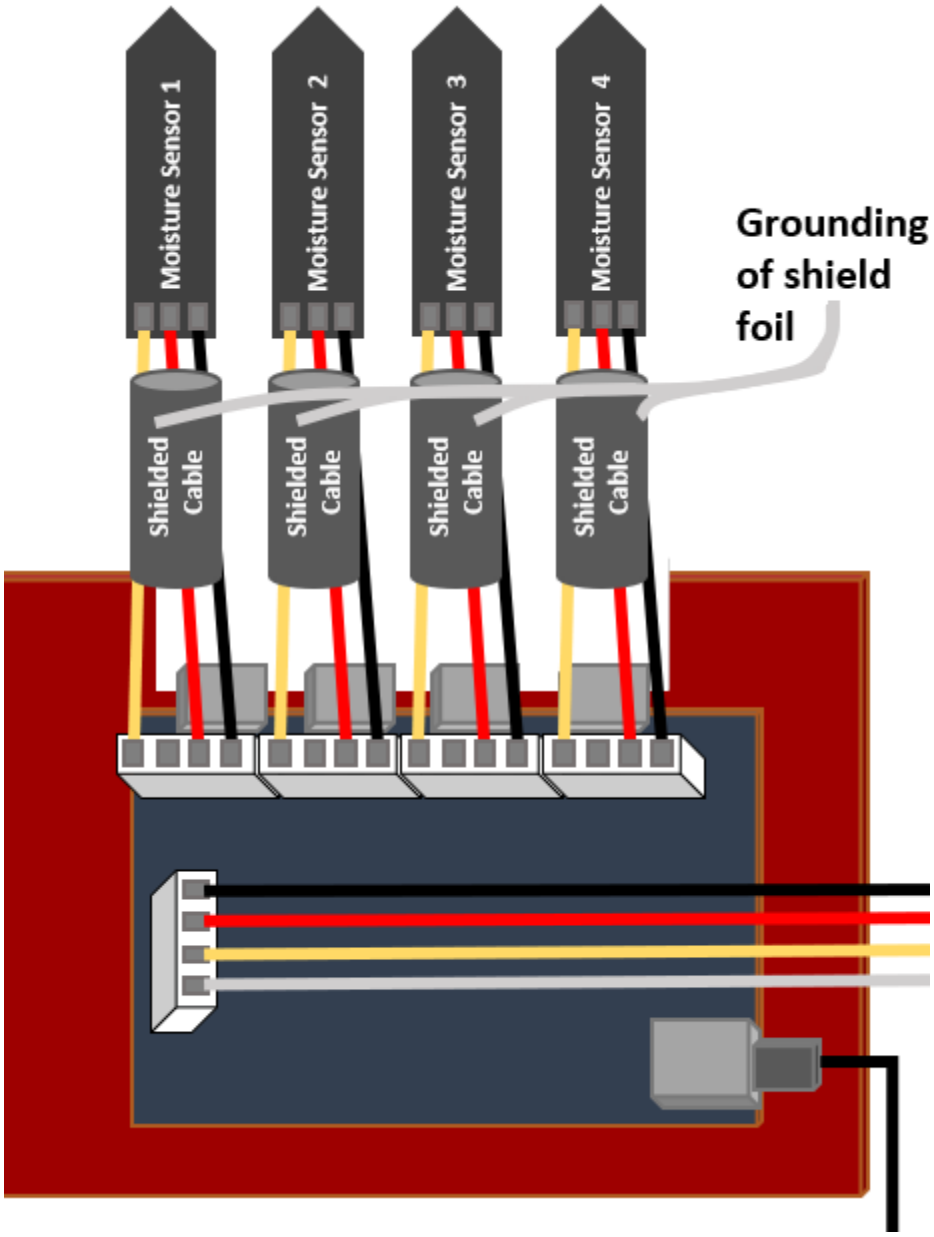
With and without shrink tubing



Soldering of the Red, Black, and White terminals. Circuity coated with polyurethane



Connection of the moisture sensors is straightforward compared what we just completed with the water valves. The four sensors connect to the Extender through Grove connectors. Between the two, we used the shielded three stranded, positive, negative, and white cables. The shielding protects the signal from interfering RF signals. I'm no expert in RF signal interference but somewhere I read that cable longer than 12 feet should be shielded.



The End Product

The hopyard, flowerbeds and lawns are now watered from anywhere on the planet at the click of a button on a cell phone. John Shovic, CEO of SwitchDoc Labs was thrilled to activate the sprinklers from Seattle, Washington, more than two thousand miles away from Chicago!

We hope you enjoyed this chronicle. Check out the accompanying video on www.switchdoc.com and SwitchDocLabs You Tube Channel. Visit us on SkyWeather: https://skyweather.weatherstem.com/hoppy