Internal Use Only

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# Sensors Stations bi-weekly Report

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## Abstract

Due to the new sensors requirments and cost constrained, a new proposal is written to resolve part of challenges that the previous system exist.

Previous challenges was unable to unable to gather moisture data from the garden. Incompatibility when using rasperry pi as add-on sensors for the new system. Risks of inconsistency of dataset due to downtime of the station. Real-time data is limited because weewx service and cloud integration is seperated and shipped as different components. Database team has the success of organizing dataset with different timestamp.

To this end, having both Davis Weather Station and ECOWITT wireless gateway will help to add moisture sensors data.

## 1 Client Requirement

This is a draft for new combination of previous Davis Weather Station and ECOWITT sensors gateway. As mentioned before, the goal is to maximize the values that the sensors station can provide. Values of the sensors such as rainfall, wind, temp, humidity, moisture, and barometer will be served as input for the project. However, this values will rely Features of apps would be provided. Ideally, the goal of the project is to reduce complexity and number of components and maximize the values of t he sensors data. The consistency of dataset uploading will affect the integrity of the apps.

Additionally, the begin time of the data have to be decided for sensors to compute. This assure the tracebility of the dataset.

Like any other IoT Projects, what we tries to deliver has the constraints of the project cost, schedule, and scope. If we decide to have increase dataset volume and deliverable as soon as possible. This lock us in the features that the vendor provided, and customization is limited.

## 2 System Constraints

This project was previously rely on 4G LTE network, which incurring costs of the stations in the long term. To be nimble of about the project, wifi was recommended as alternatives to bring down the cost of internet connection of IoT devices.

As side note, this 4G LTE Device has wifi capability.

To maintain the security of devices the only format is sent to the cloud is JSON. Since this is an IoT project, mqtt protocol will be used to send the message subscription model.

Table 1: Operating Cost to Support 1 weather station with 4G lte

| | **Cost** | **Interval** |
|---|---|---|
| **Internet Cost** | $30 | Monthly |
| **Cloud Cost** | $45 | Monthly |

## 3 Sensors Development

### 3.1 Integrate Raspberry Pi as Add-on sensors

Figure 1: Raspberry Pi based Sensor

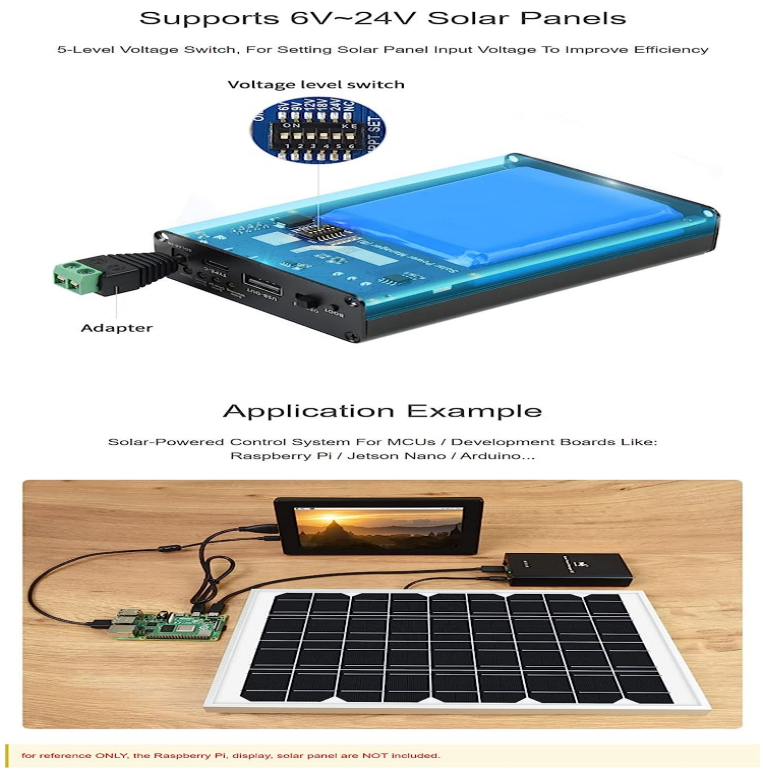


Figure 2: Raspberry Pi Sensors with required component

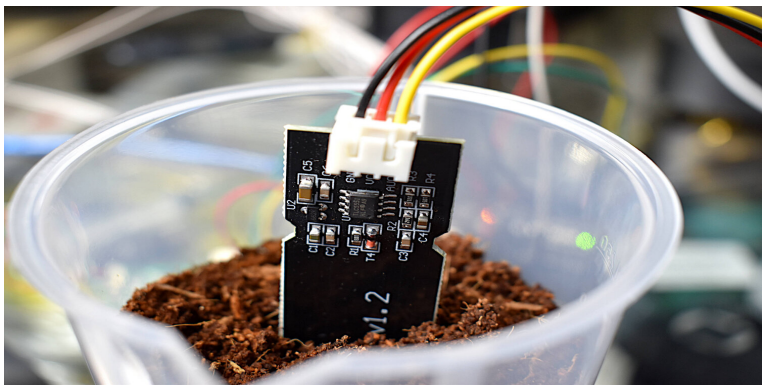


Figure 3: Raspberry Pi Soil Moisture Sensor

The use of raspberry pi as sensors node which is deployed in the garden. The parts are accessible and supported by the community. Housing of the raspberry pi is required. This the the continue work of Melvin since he had some python code to operate the sensors. But, the sensors are only able to operate indoor enviroment such as green houses. Therefore, all the component need water sealant.

Steps to build the sensors.

1. Submit the interfaces part.
2. Prepare the junction box.
3. Trim and grimp the wire.
4. Drilling for wire accessibility.
5. Test Mini Solar Station.

Table below reflect the cost to build such sensor.

| Part Name | Description | Cost |
|---|---|---|
| **Junction Box** | Housing Raspberry Pi | $28.39 |
| **MPPT solar part** | Solar Power Management Module for 6V 24V Solar Panel | $14 |
| **Solar Panel** | ECO-WORTHY 12V Solar Panel 10W | $28.94 |
| **Capacitive Moisture Sensors** | Moisture sensors for Raspberry pi | $11.99 |
| **Water Sealant** | Waterproof the moisture sensors | $17.97 |
| **Total cost** | - | $101.26 |

Table 2: Cost of building Raspberry Pi Sensors

Addtionally, while having this raspberry pi sensor installed, we can add pump control for the irrigation system.

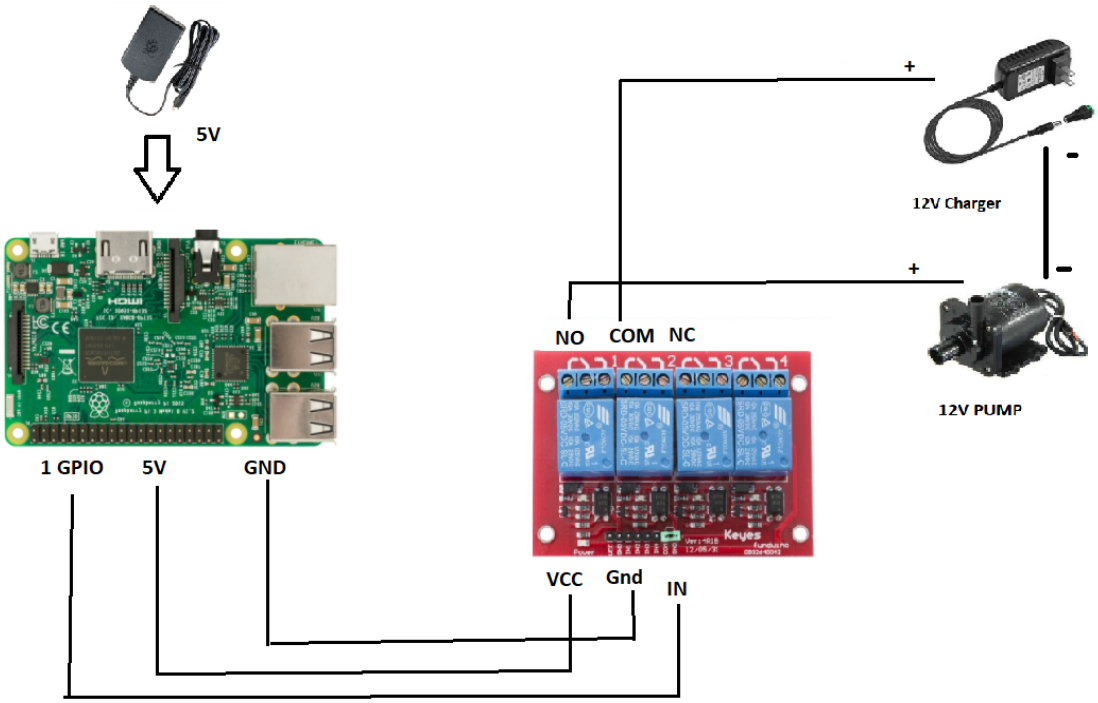


Figure 4: 12V pump control with Raspberry Pi 4

### 3.2 Davis Soil Moisture Sensor

Figure 5: Davis Soil Moisture and Leafwetness Sensor kit

This soil moitsture require the upgrade of new Davis Envoy Box from wire to wireless version.

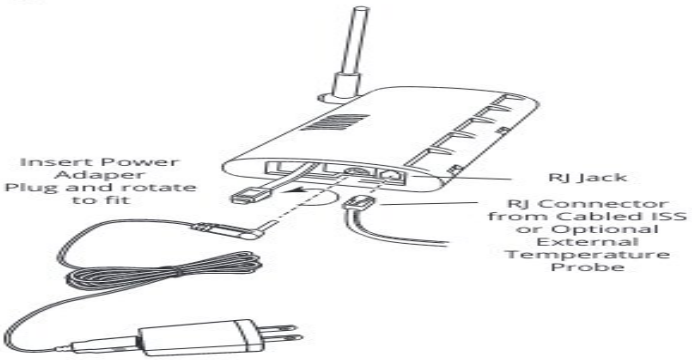


Figure 6: Davis Wireless ISS Transmitter

| Part Name | Description | Cost |
|---|---|---|
| **Davis Soil Moisture and Leafwetness Sensor Kit** | Sensors hub for leaf sensors and soil sensor | $637.27 |
| **Davis Wireless Envoy** | Receiver for soil sensors stations | $189.77 |
| **Total cost** | - | $827.04 |

Table 3: Cost of building Raspberry Pi Sensors

Since the whole sensor system is relied on Davis Weather Station, only one raspberry pi needed to deploy as only one database is stored and distribute to the dynamoDB cloud service.

### 3.3 ECOWITT Moisture Sensor


Figure 7: ECOWITT Moiture Sensor Kit


Figure 8: ECOWITT Moiture Sensor with wireless gateway (GW1100)

Specification of device:

- This is wireless soil moisture sensors that collect moisture data within 72 seconds with inserted to the soil.
- The sensors support real tiem data.
- Reporting distance is within 300feet/100m(in open area).
- This sensors is powered by AA" battery (not included, lithium recommended).
- Battery change (Lithium) every 50 day.
- IP66 water resistant rated.

**Installation: This devices will be installed with weewx as main software to archive the sensor data.** The Wi-Fi gateway( GW1000/GW1100 ) can support max 8 soil moisture sensors. Each new sensor will be recognized as a new channel according to the Power-on sequence.

Please do not touch the stone or hard rock soil. If the soil is too hard and dry, it is possible to damage the sensor.

In order to work, this require two raspberry pis having weewx installed. Thus, there are two seperate database file exits on the pis.

The cost is $53 for both wifi gateway (GW1100) and moisture sensors. We can also add uv sensors kit for extra $62.97.


Figure 10: ECOWITT Moiture Sensor with wireless gateway (GW1100)

## 4 Sensor Break-down Analysis

| | **Raspberry pi add-on** | **Ecowitt soil sensors** | **Davis Wireless sensors** |
|---|---|---|---|
| **Solar required** | Yes | No | No (solar built-in) |
| **Battery required** | Yes | Yes (AA battery) | No |
| **Weewx compatible** | No | Yes | Yes |
| **Back-up database** | optional | Yes | Yes |
| **Cost** | $101.26 | $53 | $827.04 |

Table 4: Sensors Comparison

## 5 Recommendation

After evaluating multiple solution, the compatibility of weewx is also a main requirement since they provide a backup local database.The assertation was made is to have both ECOWITT and Davis Weather Station running.

Decide the time frame for database to begin.

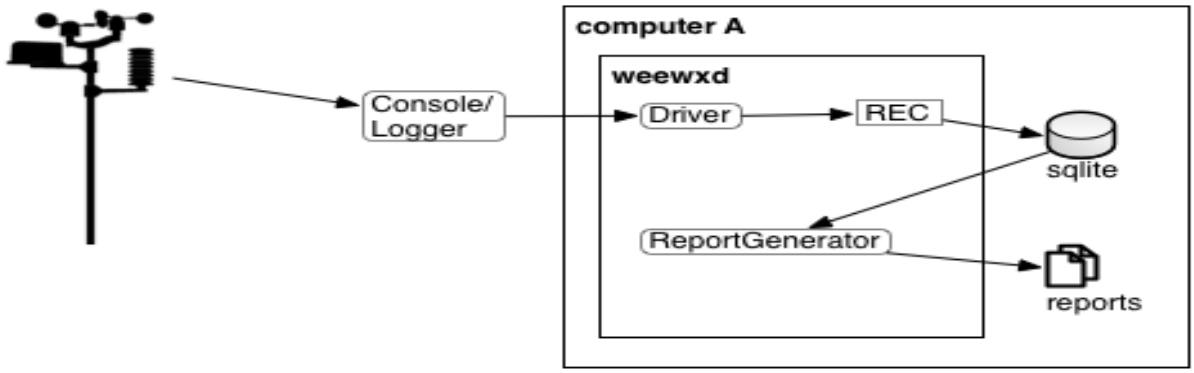


Figure 11: Weex Data Logging

## 6 Inspection Instruction

| Item Name | Tasks | Status |
|---|---|---|
| **Terminal or Bus Bar** | Check if the ciruit is closed or openned | - |
| **MCB for solar controller** | Test for continunity of solar and battery charging | |
| **Battery Charging Voltage** | Check if the mppt overcharge the battery | - |
| **Drill Hole for Solar junction box** | Check if solar connector is waterproof | - |

Table 5: Solar System Inspection Form