

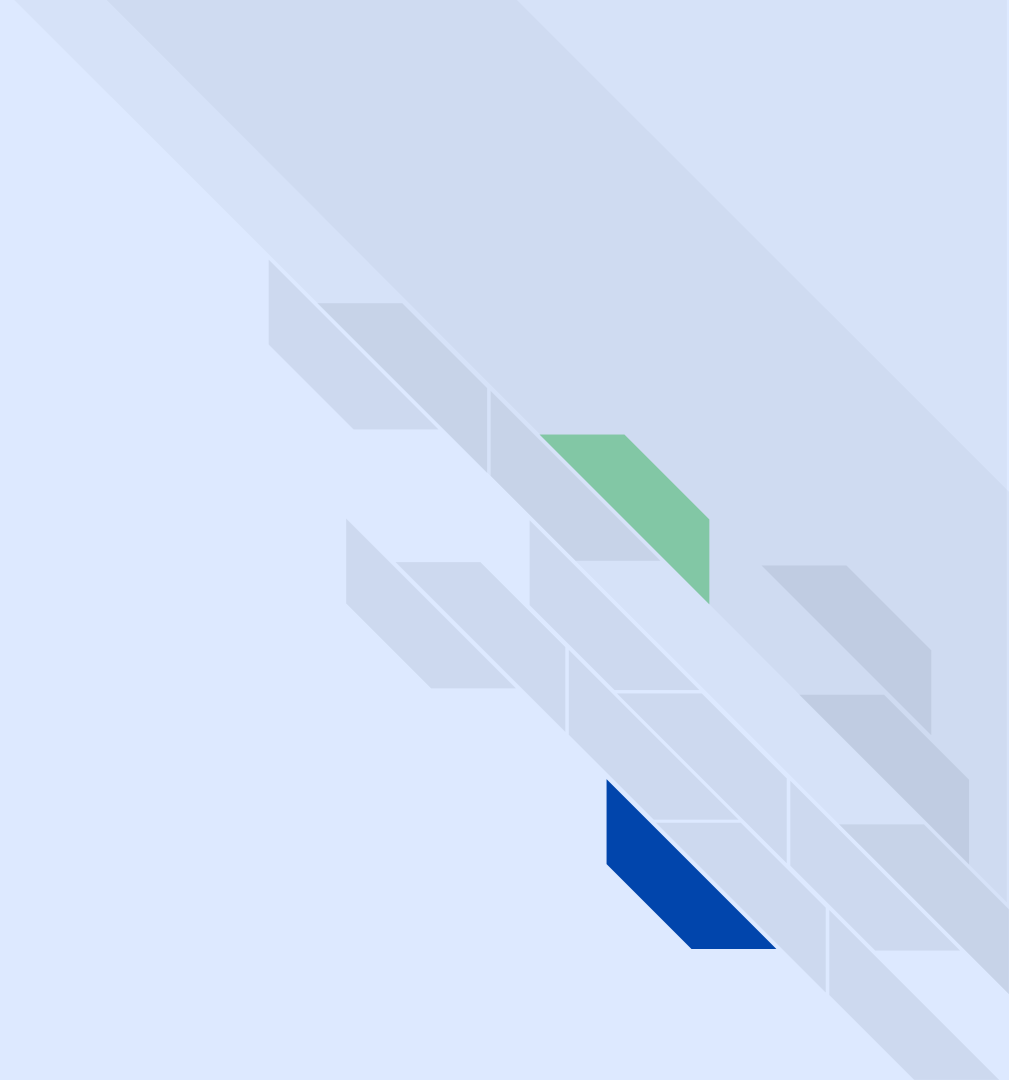


# **Open Acidification 2.0**

## An Overhaul

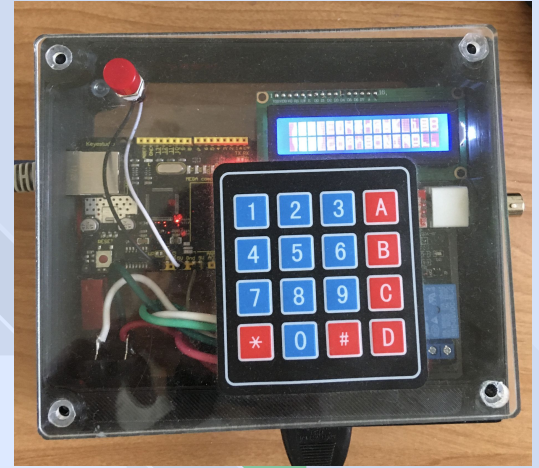
Cameron Bierwagen and Matthew Ma

# Introduction



# pH-Stat Devices

Matthew Ma



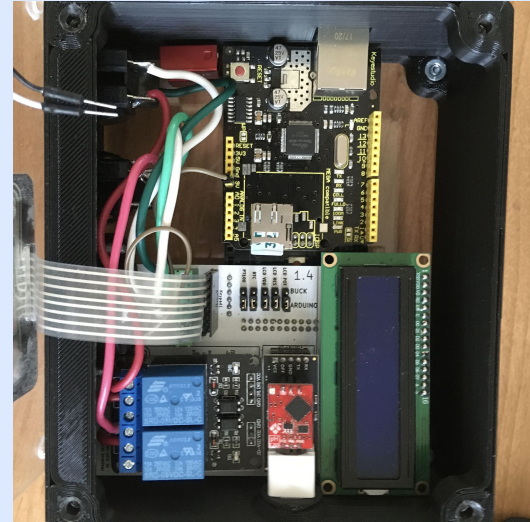
# Background

## Motivating factors

- Device assembly time
- Arduino limitations
- Static pH + temperature specification

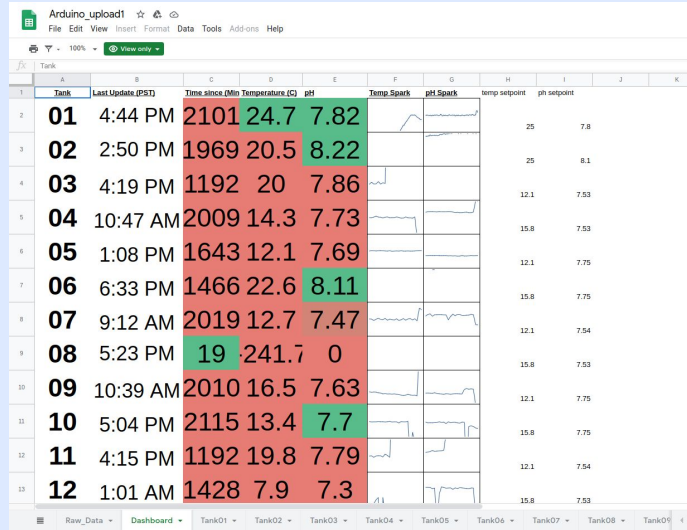
## Changes

- Data transmission via Ethernet
- Refactored directory structure and file usage
- Versatile JSON timeseries to guide endpoints



# Background (cont.)

- Tank Overview
  - Upload snapshot to Google Sheets every 15 minutes



- Previous method of setting temperature and pH setpoints:
  - Specify single, static setpoint via the device's keypad



# Development

## Tools

- Remote interactions

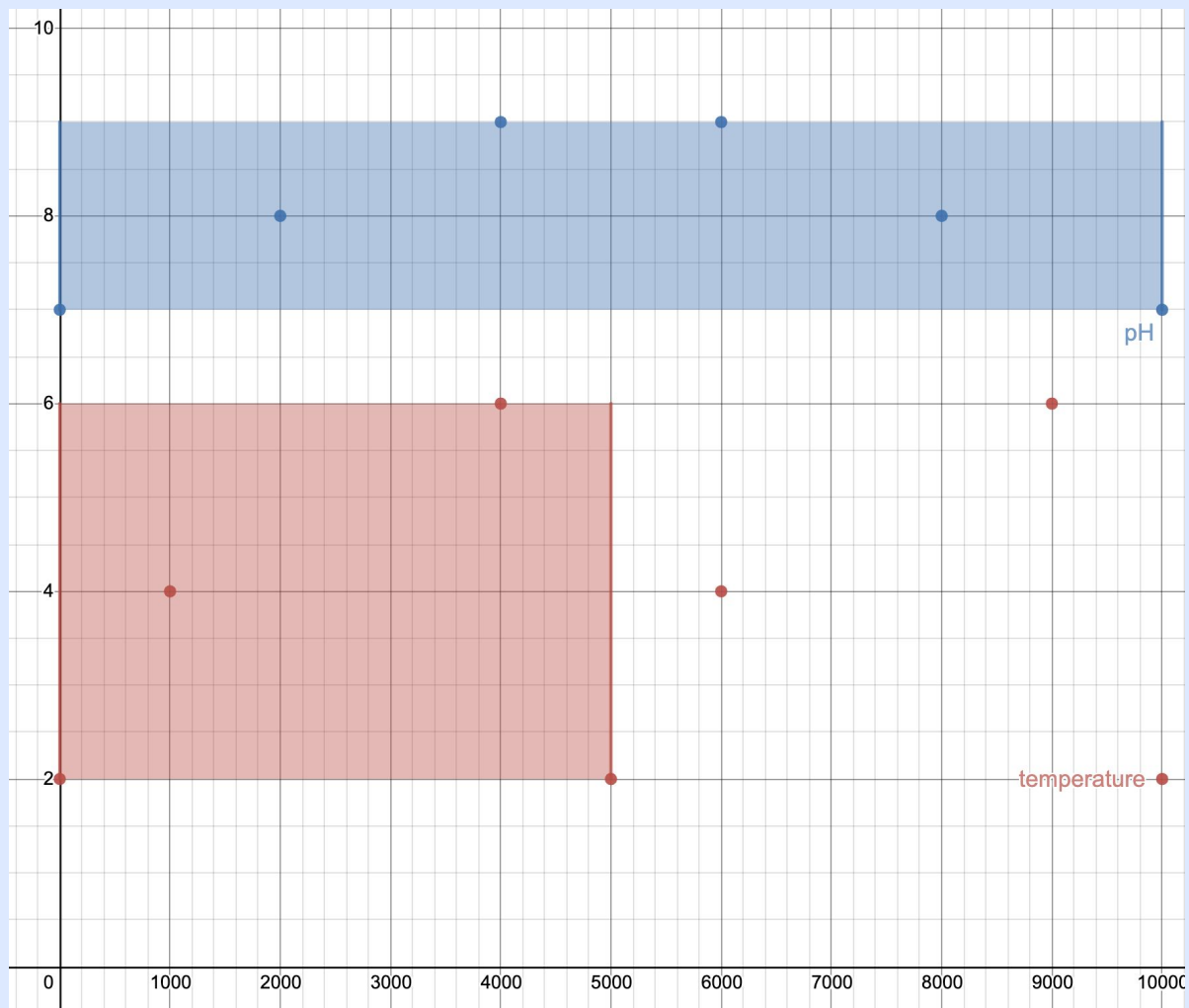
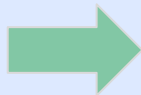
## Roadblocks

- Ethernet transmission cap
- Device memory limit

## Solutions

- Url parameter specification (start & num, and last)
- Accompanying lines file

```
1 {
2   "pH": {
3     "value": [
4       7,
5       8,
6       9,
7       9,
8       8
9     ],
10    "time": [
11      0,
12      2000,
13      4000,
14      6000,
15      8000
16    ],
17    "interval": 10000,
18    "delay": 0
19  },
20  "temp": {
21    "value": [
22      2,
23      4,
24      6
25    ],
26    "time": [
27      0,
28      1000,
29      4000
30    ],
31    "interval": 5000,
32    "delay": 0
33  }
34 }
```





# Future

## Cleanup Tasks:

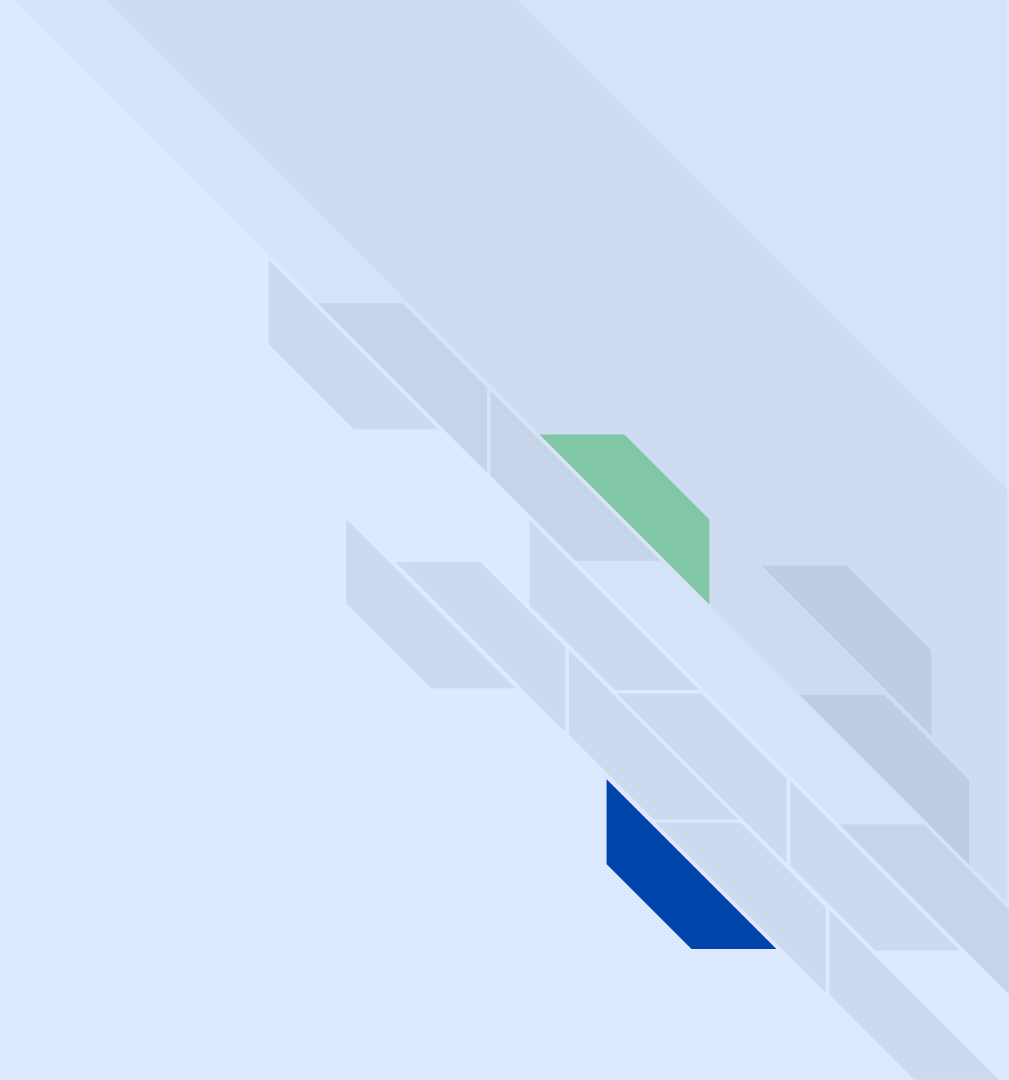
- Clean up codebase and remove debug statements

## Future Work (Open to Public Contribution):

- Add OTA Updates
- Add interface functionality for inserting timeseries
- Add E2E Arduino Tests that work on Github Actions
- Resolve open issues in Github  
([https://github.com/PlasmaIntec/Open\\_Acidification\\_pH-stat\\_arduino](https://github.com/PlasmaIntec/Open_Acidification_pH-stat_arduino))
- Add future changes to API Documentation  
(<https://app.swaggerhub.com/apis/Ocean-Acidification/device/1.0.0>)

# Central Server

Cameron Bierwagen





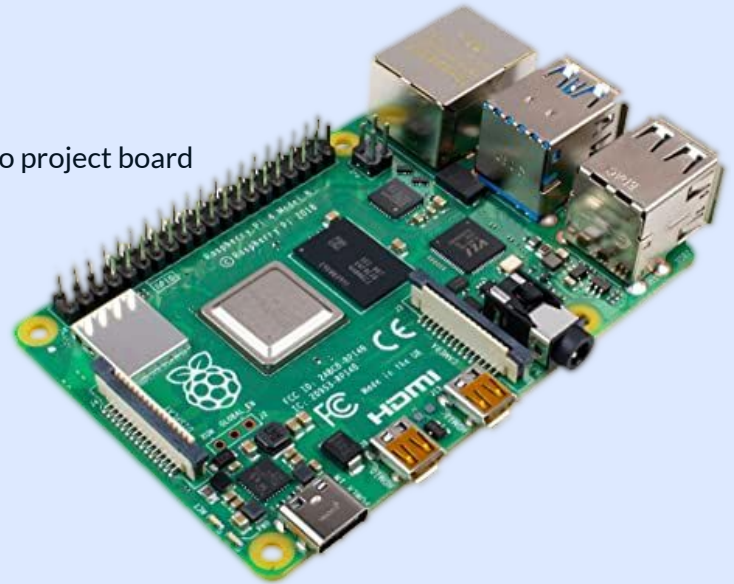
# Goal

Create a web application that will:

- Manage devices
  - Display device status
  - Automatically pull new data from devices
- Allow users to create custom time series (explicitly or through generating functions) and upload them to devices
- Manage tanks
  - Display status from most recent refresh
  - Display data in a downloaded CSV file

# Development

- Steps
  - Build RESTful API with Django
    - Specify necessary endpoints for the backend
      - /devices
      - /time\_series
      - /tanks
  - Construct user interface with Vue.js
  - Deploy to Raspberry Pi
- Additional Requirements
  - Enter new tasks into the GitHub issue tracker, and add to project board
  - Document frequently





# Future

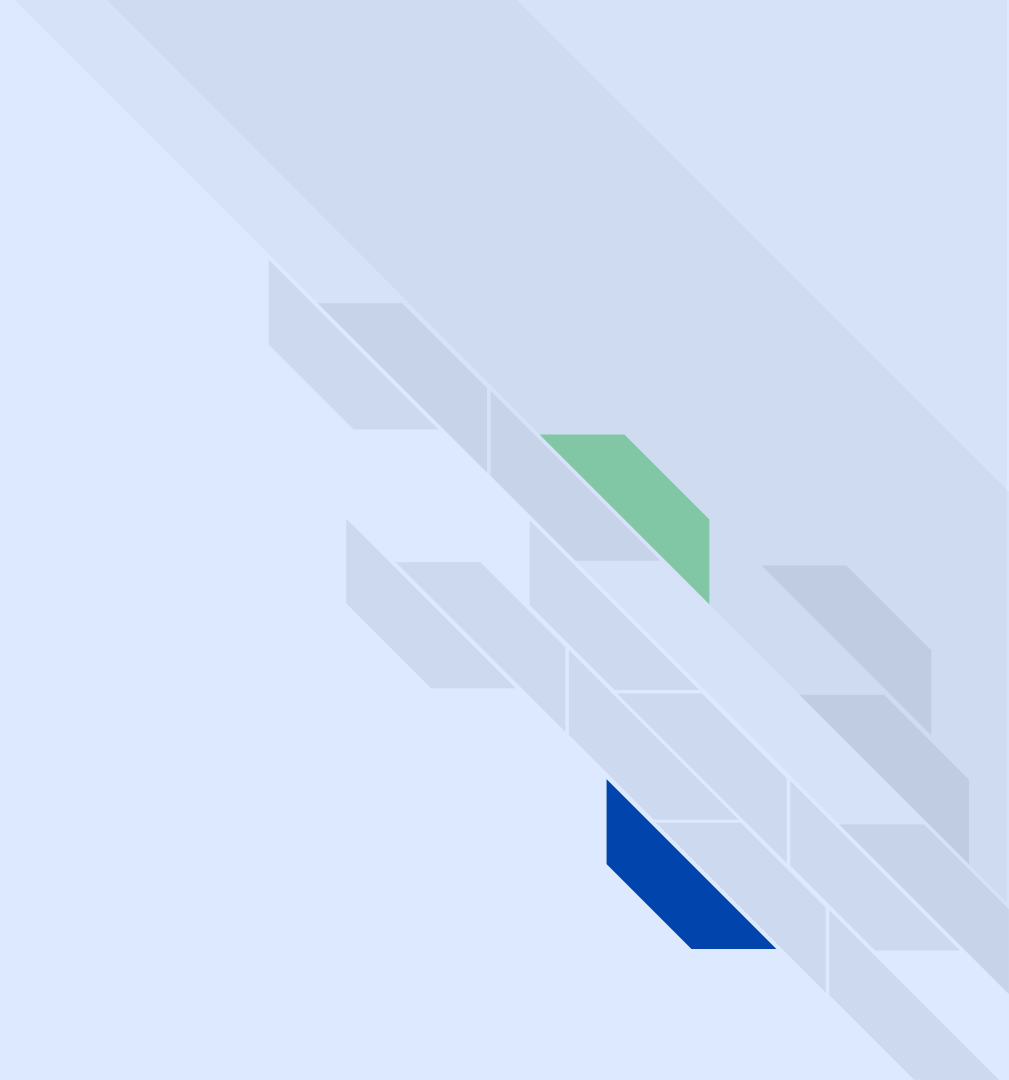
## Cleanup Tasks:

- Finalize documentation to enable future contributions to the project

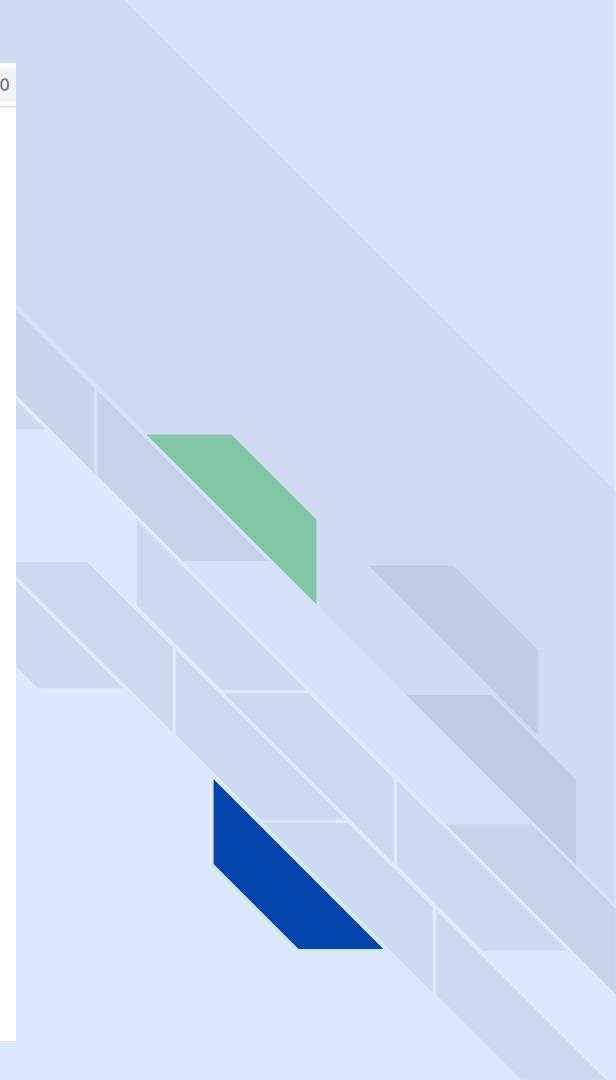
## Future Work (Open to Public Contribution):

- Major Updates
  - Enable visual data view and analytics
  - Enhance data refresh functionality
  - Over-the-air updates to pH-Stat units
  - Push notifications and/or text messages warning of readings outside of set thresholds
- All open issues are documented in GitHub  
([https://github.com/Open-Acidification/Open Acidification Server](https://github.com/Open-Acidification/Open-Acidification-Server))

# Demonstration



```
time,tankid,temp,temp setpoint,pH,pH setpoint,onTime
2020/6/1 1:15:06,8,24.17,876.00,0.000,12.000,0
2020/6/1 1:15:07,8,48.34,1185.00,0.000,20.000,0
2020/6/1 1:15:09,8,72.51,492.00,0.000,20.000,0
2020/6/1 1:15:10,8,96.68,1310.00,0.000,14.000,0
2020/6/1 1:15:12,8,120.85,266.00,0.000,6.000,0
2020/6/1 1:15:14,8,145.02,1439.00,0.000,2.000,0
2020/6/1 1:15:15,8,169.20,6.00,0.000,9.000,0
2020/6/1 1:15:17,8,193.37,1552.00,0.000,17.000,0
2020/6/1 1:15:18,8,217.54,112.00,0.000,20.000,0
2020/6/1 1:15:20,8,241.71,1655.00,0.000,17.000,0
2020/6/1 1:15:21,8,241.71,160.00,0.000,10.000,0
2020/6/1 1:15:23,8,241.71,1702.00,0.000,2.000,0
2020/6/1 1:15:24,8,241.71,229.00,0.000,6.000,0
2020/6/1 1:15:27,8,241.71,1260.00,0.000,16.000,0
2020/6/1 1:15:28,8,241.71,912.00,0.000,20.000,0
2020/6/1 1:15:30,8,241.71,1054.00,0.000,18.000,0
2020/6/1 1:15:31,8,241.71,1049.00,0.000,10.000,0
2020/6/1 1:15:33,8,241.71,786.00,0.000,2.000,0
2020/6/1 1:15:34,8,241.71,1164.00,0.000,5.000,0
2020/6/1 1:15:40,8,241.71,751.00,0.000,17.000,0
2020/6/1 1:15:42,8,241.71,1342.00,0.000,9.000,0
2020/6/1 1:15:43,8,241.71,903.00,0.000,1.000,0
2020/6/1 1:15:45,8,241.71,1100.00,0.000,7.000,0
2020/6/1 1:15:46,8,241.71,1022.00,0.000,15.000,0
2020/6/1 1:15:48,8,241.71,836.00,0.000,20.000,0
2020/6/1 1:15:49,8,241.71,1158.00,0.000,20.000,0
2020/6/1 1:15:51,8,241.71,524.00,0.000,12.000,0
2020/6/1 1:15:52,8,241.71,1300.00,0.000,4.000,0
2020/6/1 1:15:54,8,241.71,282.00,0.000,4.000,0
2020/6/1 1:15:56,8,241.71,1434.00,0.000,12.000,0
2020/6/1 1:15:57,8,241.71,18.00,0.000,19.000,0
2020/6/1 1:15:59,8,241.71,1548.00,0.000,20.000,0
2020/6/1 1:16:00,8,241.71,109.00,0.000,15.000,0
2020/6/1 1:16:02,8,241.71,1667.00,0.000,7.000,0
2020/6/1 1:16:03,8,241.71,225.00,0.000,1.000,0
2020/6/1 1:16:05,8,241.71,1766.00,0.000,8.000,0
2020/6/1 1:16:06,8,241.71,296.00,0.000,16.000,0
2020/6/1 1:16:08,8,241.71,1841.00,0.000,20.000,0
2020/6/1 1:16:10,8,241.71,387.00,0.000,19.000,0
2020/6/1 1:16:11,8,241.71,1931.00,0.000,11.000,0
2020/6/1 1:16:13,8,241.71,458.00,0.000,3.000,0
2020/6/1 1:16:14,8,241.71,2000.00,0.000,5.000,0
2020/6/1 1:16:16,8,241.71,547.00,0.000,12.000,0
2020/6/1 1:16:17,8,241.71,1814.00,0.000,20.000,0
2020/6/1 1:16:19,8,241.71,650.00,0.000,20.000,0
2020/6/1 1:16:20,8,241.71,1708.00,0.000,15.000,0
2020/6/1 1:16:22,8,241.71,721.00,0.000,7.000,0
2020/6/1 1:16:23,8,241.71,1446.00,0.000,1.000,0
2020/6/1 1:16:25,8,241.71,856.00,0.000,9.000,0
2020/6/1 1:16:27,8,241.71,1196.00,0.000,17.000,0
```



```
time,tankid,temp,temp_setpoint,pH,pH_setpoint,onTime
2020/6/1 20:01:38,8,241.71,1788.00,0.000,16.000,0
2020/6/1 20:01:40,8,241.71,808.00,0.000,20.000,0
2020/6/1 20:01:42,8,241.71,1323.00,0.000,16.000,0
2020/6/1 20:01:44,8,241.71,1948.00,0.000,5.000,0
2020/6/1 20:01:45,8,241.71,581.00,0.000,2.000,0
2020/6/1 20:01:47,8,241.71,1548.00,0.000,13.000,0
2020/6/1 20:01:50,8,241.71,452.00,0.000,20.000,0
2020/6/1 20:01:51,8,241.71,1330.00,0.000,19.000,0
2020/6/1 20:01:53,8,241.71,1801.00,0.000,8.000,0
2020/6/1 20:01:55,8,241.71,78.00,0.000,1.000,0
2020/6/1 20:01:57,8,241.71,1661.00,0.000,8.000,0
2020/6/1 20:01:58,8,241.71,1785.00,0.000,16.000,0
2020/6/1 20:02:00,8,241.71,180.00,0.000,20.000,0
2020/6/1 20:02:01,8,241.71,1468.00,0.000,18.000,0
2020/6/1 20:02:04,8,241.71,1982.00,0.000,5.000,0
2020/6/1 20:02:05,8,241.71,563.00,0.000,2.000,0
2020/6/1 20:02:08,8,241.71,1569.00,0.000,13.000,0
2020/6/1 20:02:09,8,241.71,1502.00,0.000,20.000,0
2020/6/1 20:02:11,8,241.71,805.00,0.000,20.000,0
2020/6/1 20:02:12,8,241.71,1448.00,0.000,14.000,0
2020/6/1 20:02:14,8,241.71,1967.00,0.000,6.000,0
2020/6/1 20:02:15,8,241.71,814.00,0.000,2.000,0
2020/6/1 20:02:17,8,241.71,1326.00,0.000,9.000,0
2020/6/1 20:02:18,8,241.71,1835.00,0.000,17.000,0
2020/6/1 20:02:20,8,241.71,684.00,0.000,20.000,0
2020/6/1 20:02:21,8,241.71,1199.00,0.000,18.000,0
2020/6/1 20:02:23,8,241.71,1714.00,0.000,10.000,0
2020/6/1 20:02:25,8,241.71,628.00,0.000,2.000,0
2020/6/1 20:02:26,8,241.71,1226.00,0.000,6.000,0
2020/6/1 20:02:28,8,241.71,1593.00,0.000,13.000,0
2020/6/1 20:02:29,8,241.71,1278.00,0.000,20.000,0
2020/6/1 20:02:31,8,241.71,863.00,0.000,20.000,0
2020/6/1 20:02:33,8,241.71,1819.00,0.000,8.000,0
2020/6/1 20:02:35,8,241.71,2.00,0.000,1.000,0
2020/6/1 20:02:36,8,241.71,1537.00,0.000,7.000,0
2020/6/1 20:02:38,8,241.71,1697.00,0.000,15.000,0
2020/6/1 20:02:40,8,241.71,702.00,0.000,20.000,0
2020/6/1 20:02:41,8,241.71,1215.00,0.000,19.000,0
2020/6/1 20:02:43,8,241.71,1590.00,0.000,12.000,0
2020/6/1 20:02:44,8,241.71,1380.00,0.000,4.000,0
2020/6/1 20:02:46,8,241.71,865.00,0.000,4.000,0
2020/6/1 20:02:47,8,241.71,1473.00,0.000,12.000,0
2020/6/1 20:02:49,8,241.71,1991.00,0.000,19.000,0
2020/6/1 20:02:50,8,241.71,834.00,0.000,20.000,0
2020/6/1 20:02:52,8,241.71,1348.00,0.000,15.000,0
2020/6/1 20:02:53,8,241.71,1861.00,0.000,8.000,0
2020/6/1 20:02:55,8,241.71,709.00,0.000,0.000,0
2020/6/1 20:02:57,8,241.71,1222.00,0.000,8.000,0
2020/6/1 20:02:58,8,241.71,1730.00,0.000,15.000,0
2020/6/1 20:03:00,8,241.71,536.00,0.000,20.000,0
```

← → ↻ 🏠 ⓘ Not Secure | 172.18.16.86/goal




```
{"phValues": [7, 8, 9, 9, 8], "phTimes": [0, 2000, 4000, 6000, 8000], "phInterval": 10000, "phDelay": 0, "tempValues": [2, 4, 6], "tempTimes": [0, 1000, 4000], "tempInterval": 5000, "tempDelay": 0}
```

### 06 (Tank ID)

Last updated 16:49 (45 minutes ago)


Temperature: 8.5878 °C (Setpoint: 8.5878 °C)      pH: 8.5878 (Setpoint: 8.5878)



### 08 (Tank ID)

Last updated 09:53 (460 minutes ago)

Temperature: 241.71 °C (Setpoint: 19 °C)      pH: 0 (Setpoint: 7)



### View data from tank #8:

Device: Matthew's Test Device ⚙️

Frequency	Cutoff	Total
0	0	0

DOWNLOAD CSV

Open Acidification Contr... linux crop screenshot - G... +

localhost:8081/#/devices/90:a2:da:1e:a1:f9


OPEN OLD PROJ

TANKS DEVICES TIME SERIES

**Matthew's Test Device**  
8 (Current Tank)  
✓

**Fake Device With Long Name**  
6 (Current Tank)  
✗

ADD DEVICE

**Configure device with MAC address 90:a2:da:1e:a1:f9** 

Name  
Matthew's Test Device 21 / 32

IP Address  
172.18.16.86

Temperature Variance Threshold: 5      pH Variance Threshold: 1

Notes  
Test!

UPDATE DEVICE      RESET FORM

**Choose time series:**

Temperature      pH

Temperature Delay: 0      pH Delay: 0

APPLY TIME SERIES

Temperature +

Sine Test 



Test 1 



Test 2 



pH +

Ramp Test 



Create New Temperature Time Series

- Hold
- Ramp
- Sine
- Custom

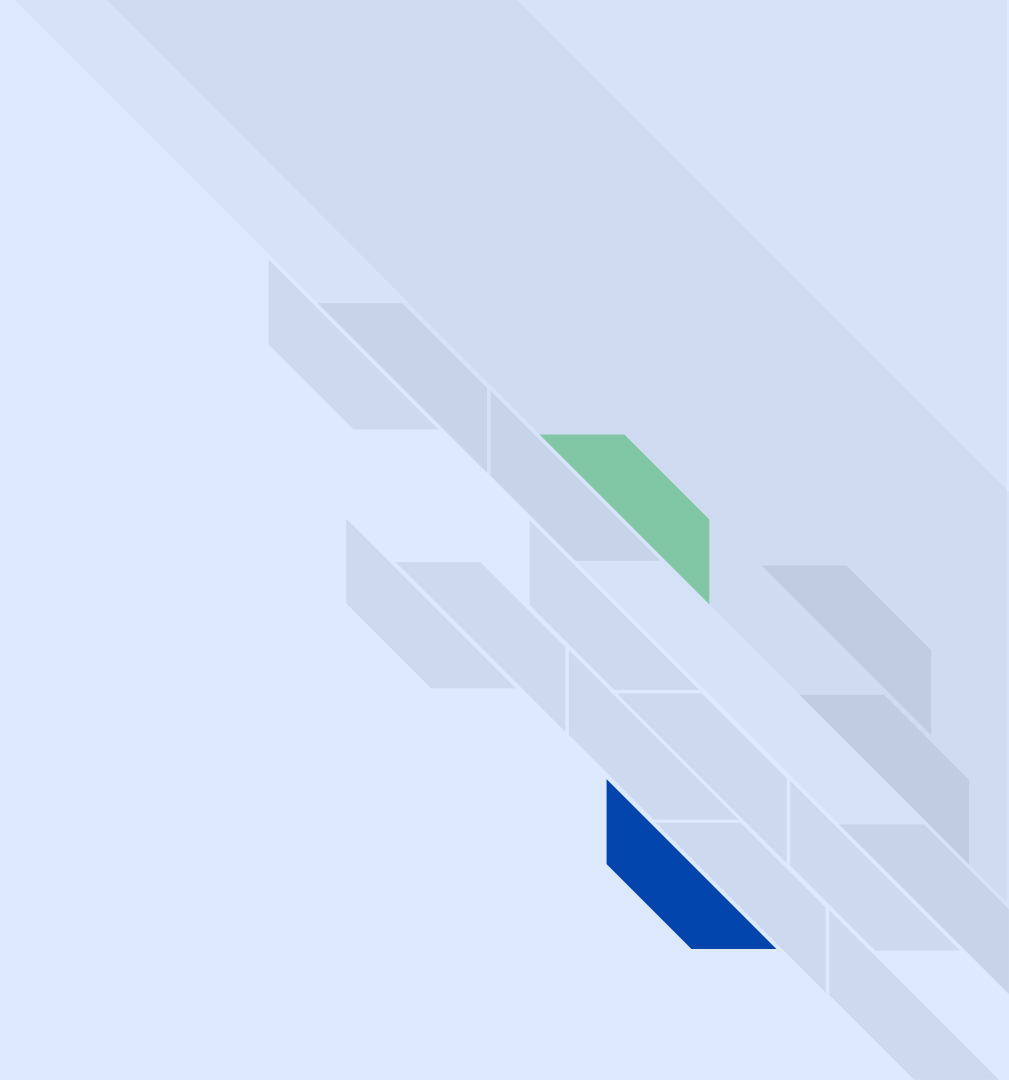
Name  
My Sine Wave

Frequency	Amplitude	Offset (x)	Offset (y)	12 / 32
600	s 15	°C 0	s 30 °C	

CREATE TIME SERIES

CLEAR FORM

**Live Demo**



# Conclusion

