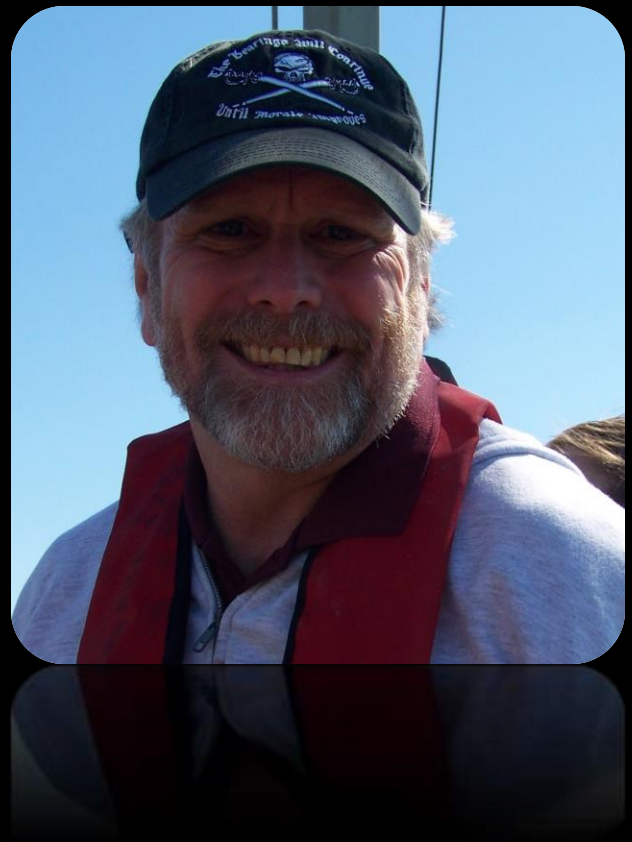
TEC-V

MILESTONE 3

By: Michael Dowling & Zealand Brennan

CLIENT

- DR. Wood
  - **Professor** | Ocean Engineering and Marine Sciences
  - **Program Chair for Ocean Engineering**

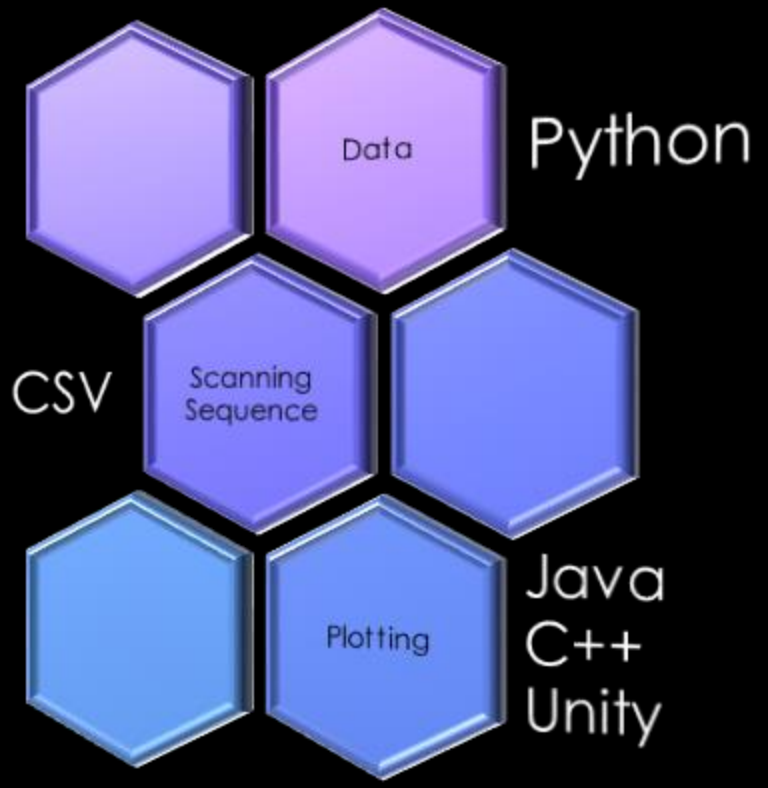


MILESTONE 2 OVERVIEW

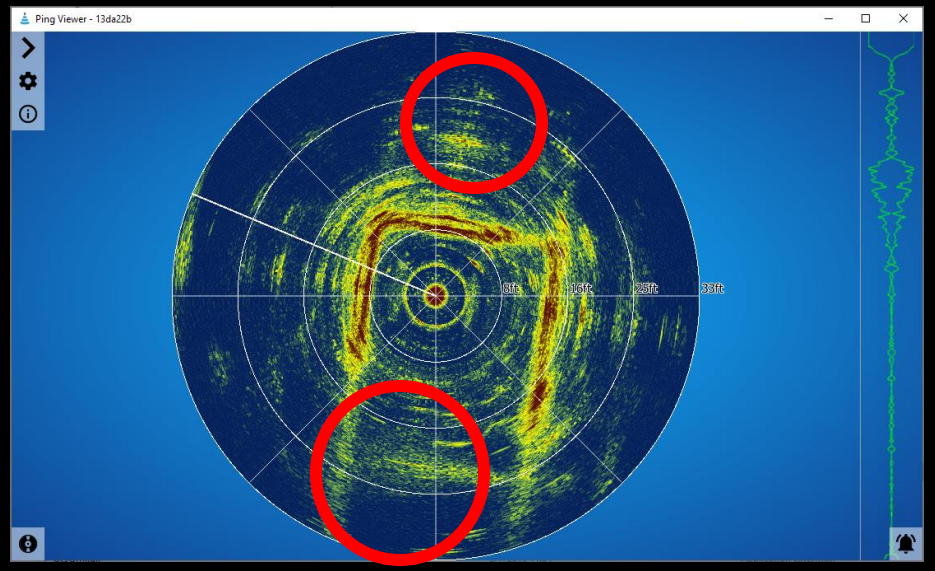
- False Data
- Depth Finder
- Compass and Telemetry
- Cloud Plot Application

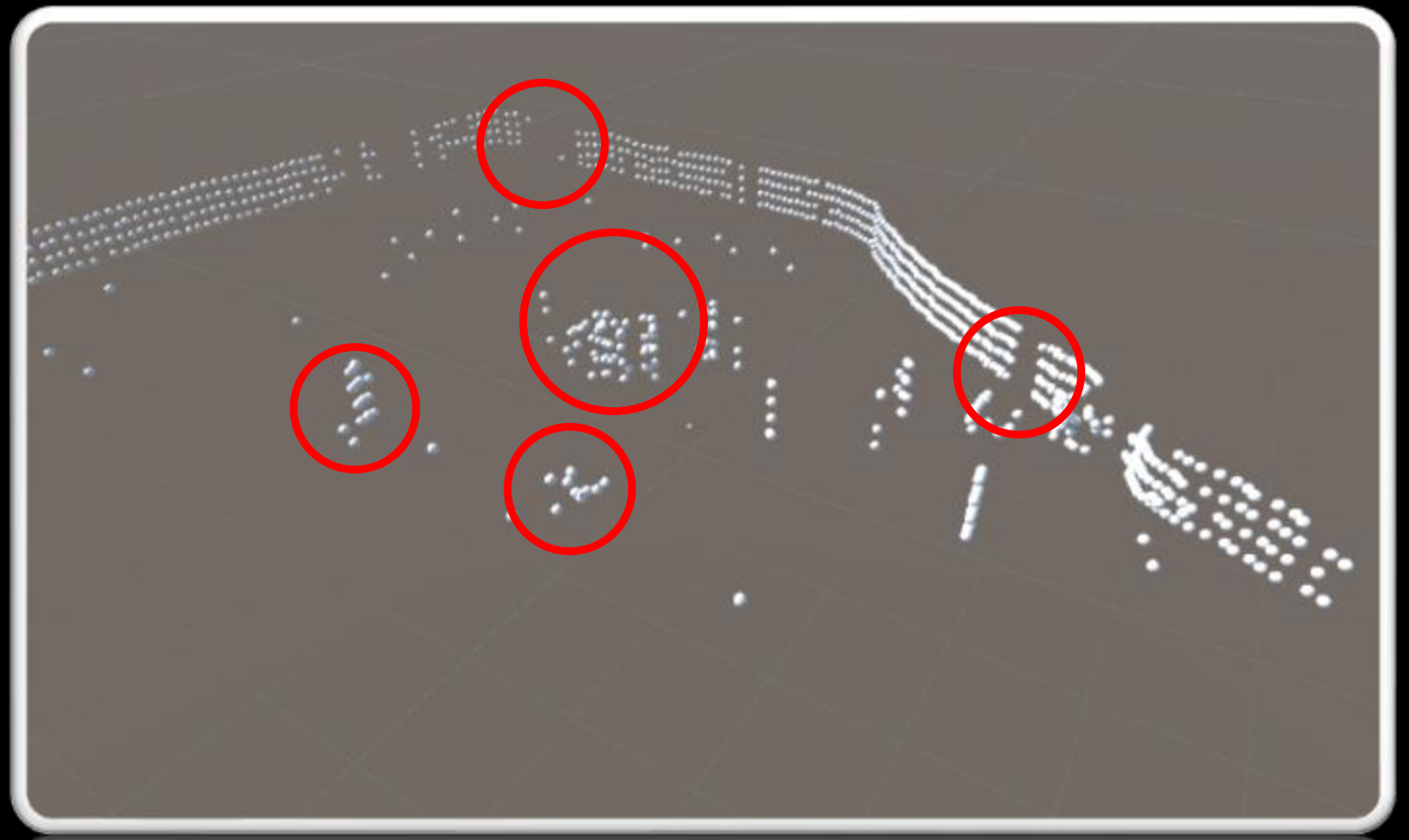
TOOLS

- Data: Python
  - Sonar
  - Telemetry
- Plotting: Unity / C++



FALSE DATA





FALSE DATA

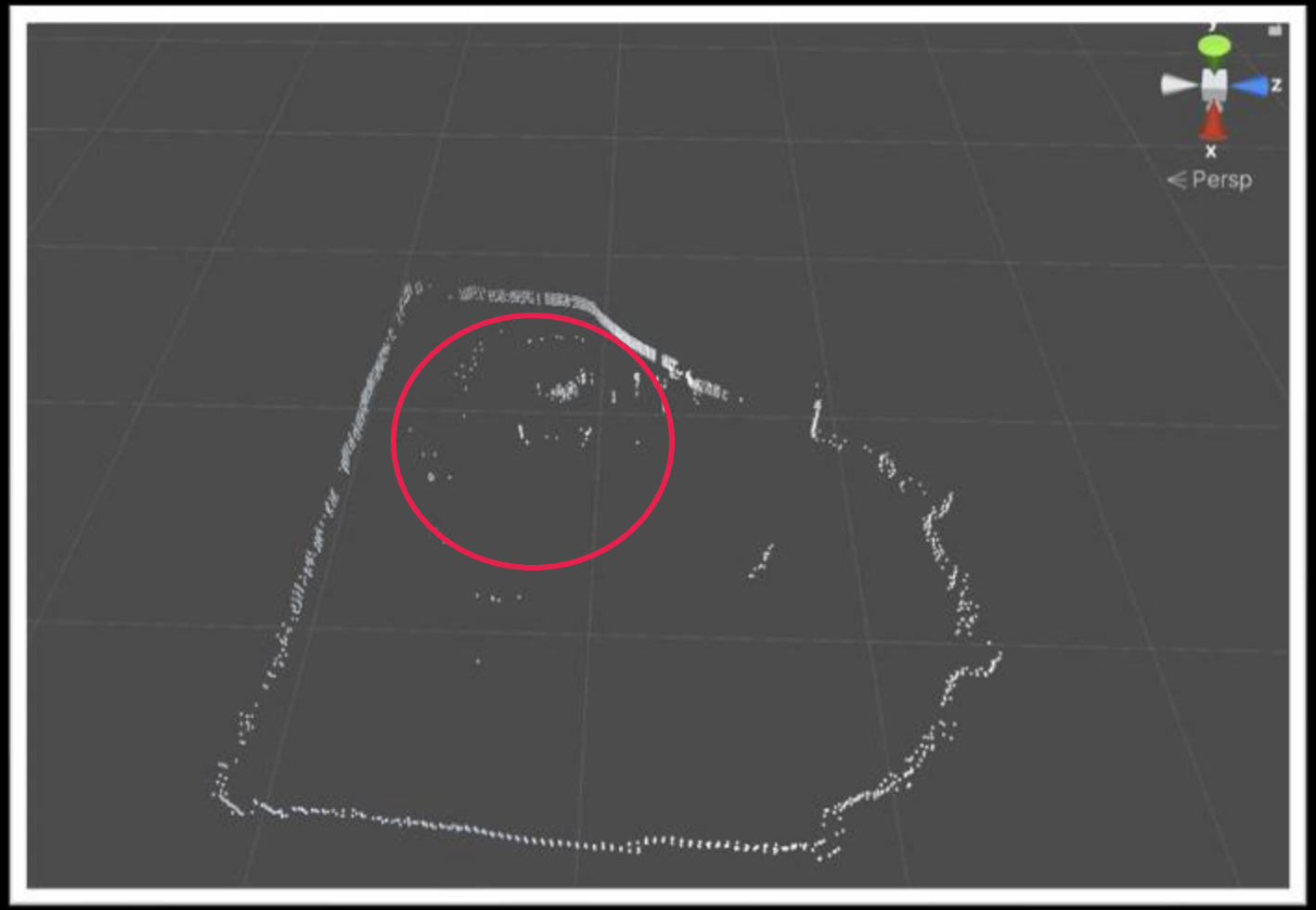
```
// Check if the current data and the data before and after it are within 1 meter range
if (i > 0 && i < dataLines.Count - 1)
{
    string priorLine = dataLines[i - 1];
    string nextLine = dataLines[i + 1];

    string[] priorData = priorLine.Split(',');
    string[] nextData = nextLine.Split(',');

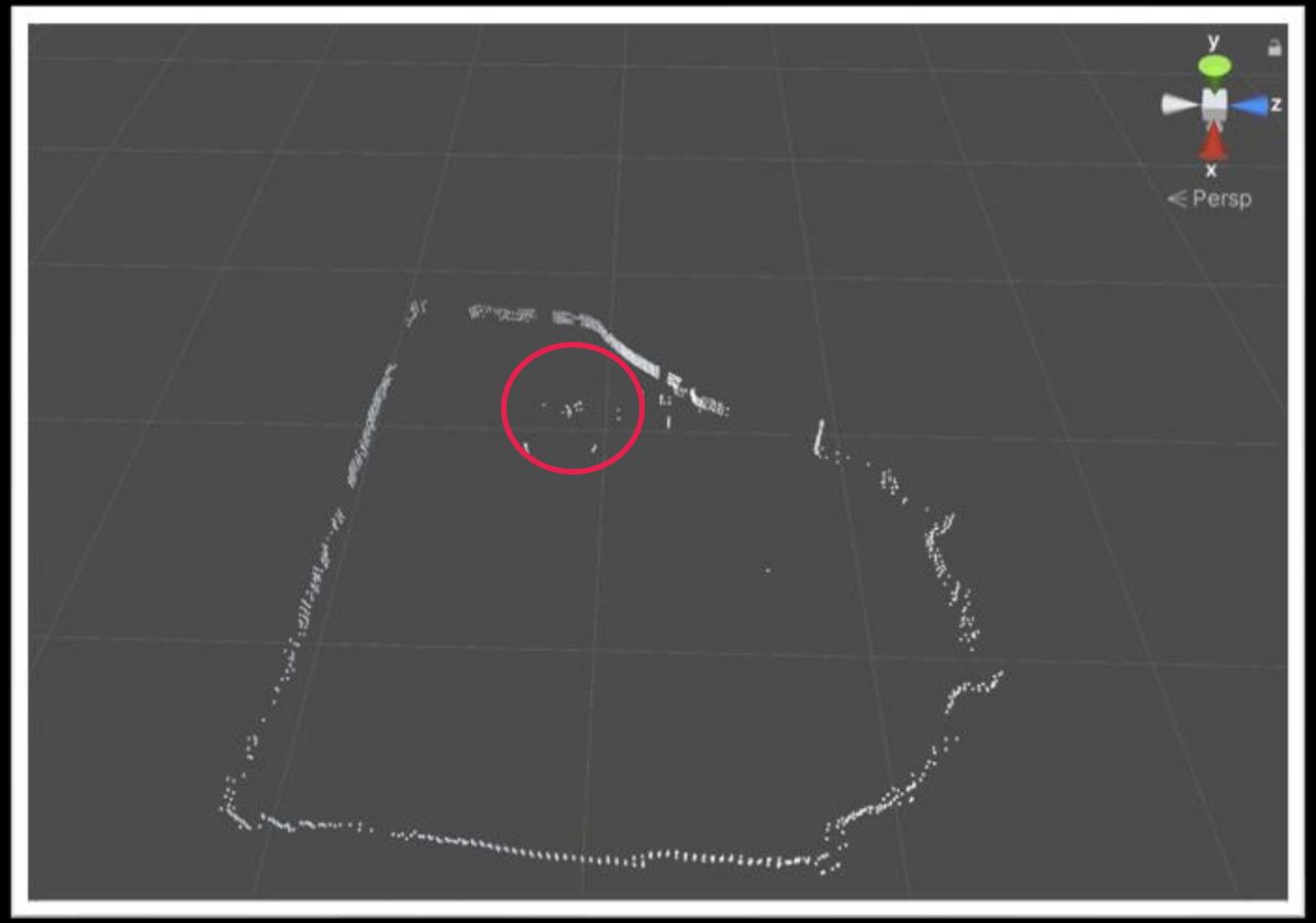
    float currentThirdValue = float.Parse(currentData[2]);
    float priorThirdValue = float.Parse(priorData[2]);
    float nextThirdValue = float.Parse(nextData[2]);

    if (Mathf.Abs(currentThirdValue - priorThirdValue) <= 1f && Mathf.Abs(currentThirdValue - nextThirdValue) <= 1
    {
        // Data is within 1 meter range, instantiate sphere
        InstantiateSphere(currentData, scale);
    }
```

FALSE DATA



FALSE DATA



TELEMETRY

GETTING TELEMETRY

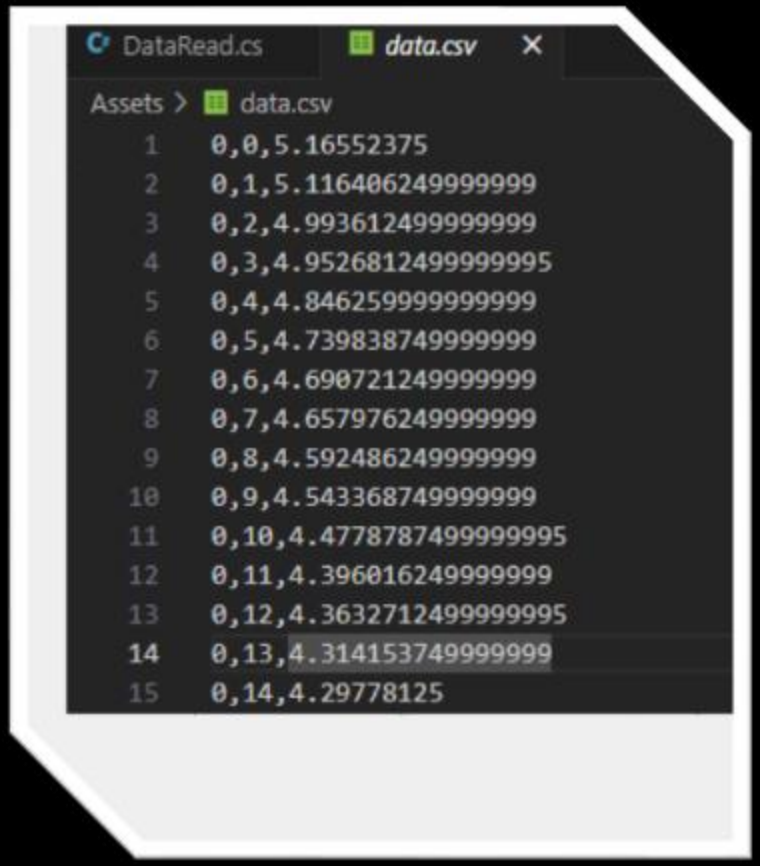
Main Components

- Depth
- Compass Heading
- Roll
- Pitch
- Yaw

ORIGINAL FORMAT

Data.csv

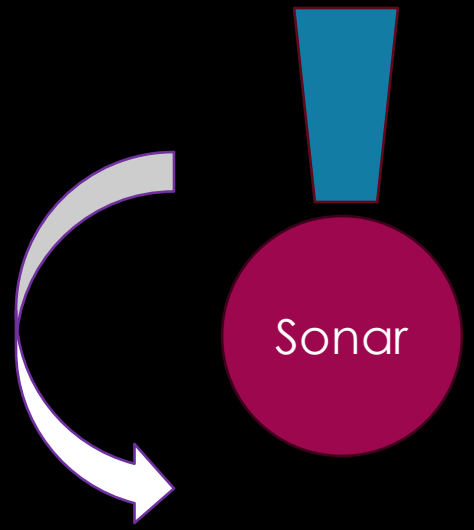
- Three categories
  - Depth (in progress)
  - Angle
  - Most likely distance to object

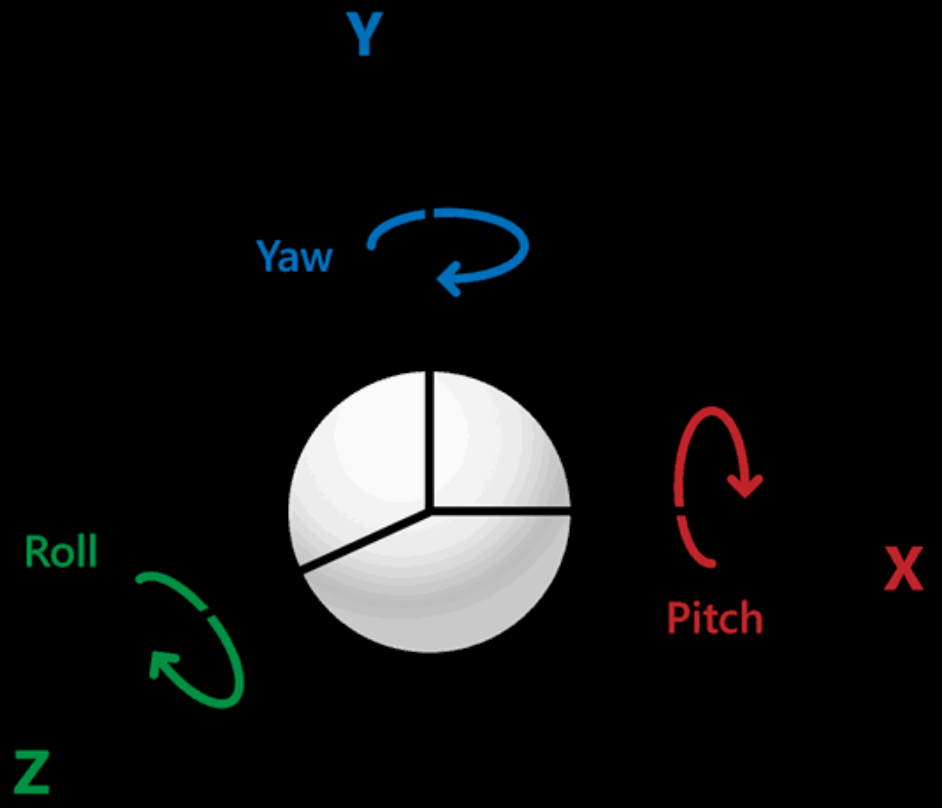


WHY TELEMETRY DATA?

Rotation

- During sonar scan:
  - If(rotate occurs)
  - Where am I looking?

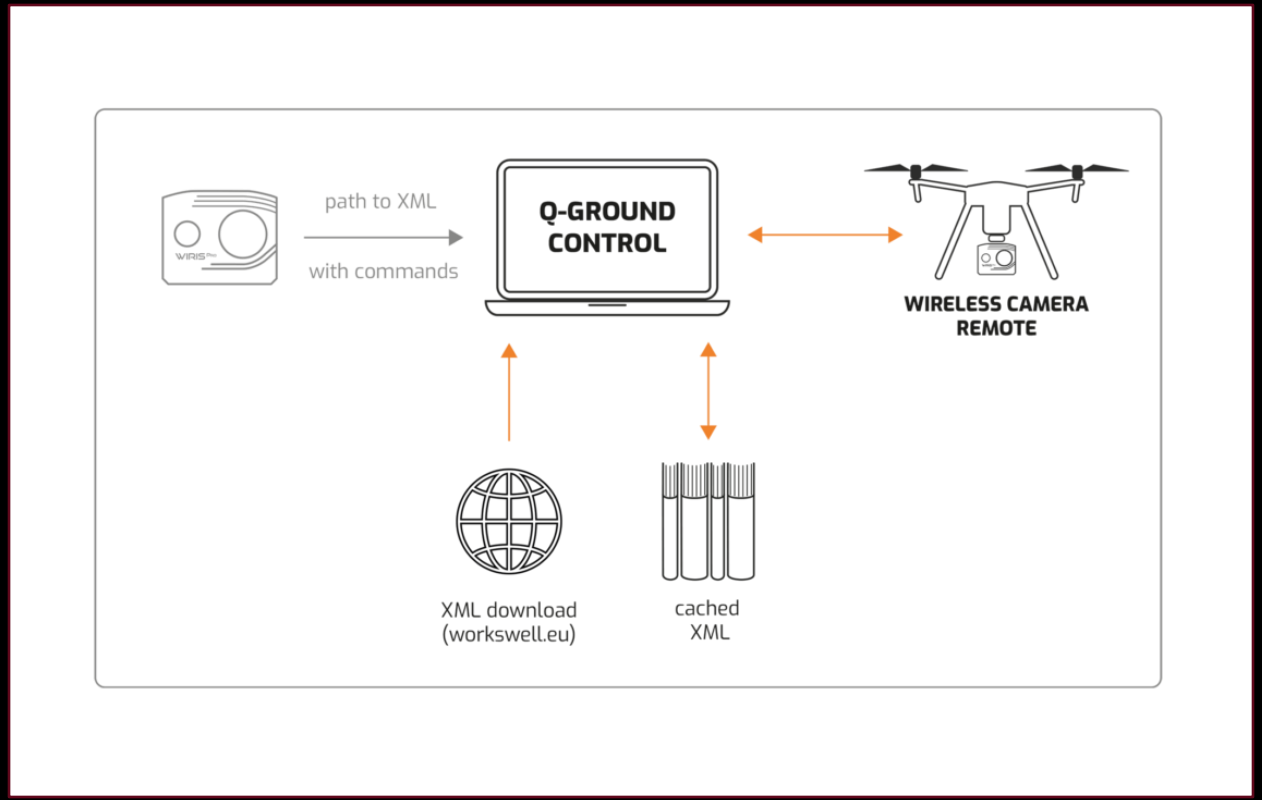




GETTING TELEMETRY

Attempt Number 1

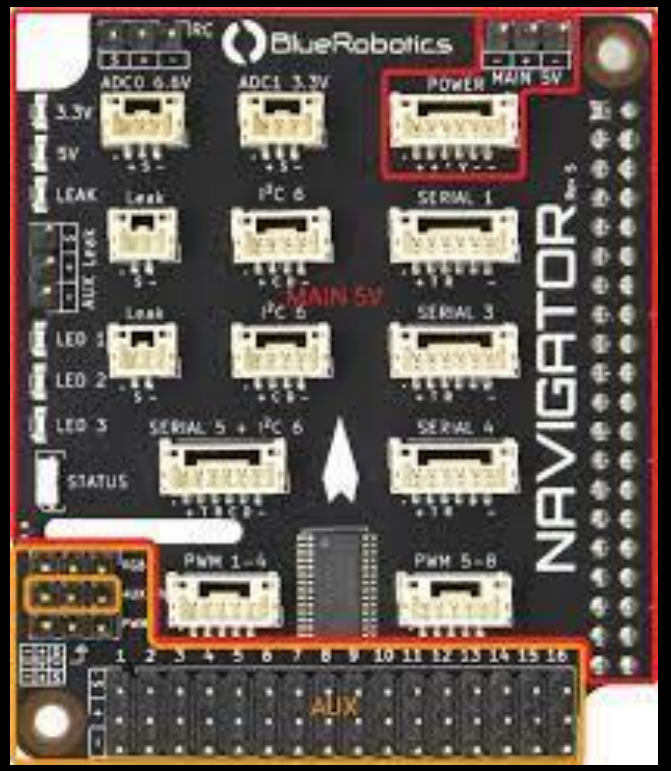
- Using the source “Mavlink”
  - Allows the user to take information directly from the flight control software on topside receiver.



GETTING TELEMETRY

Attempt Number 2

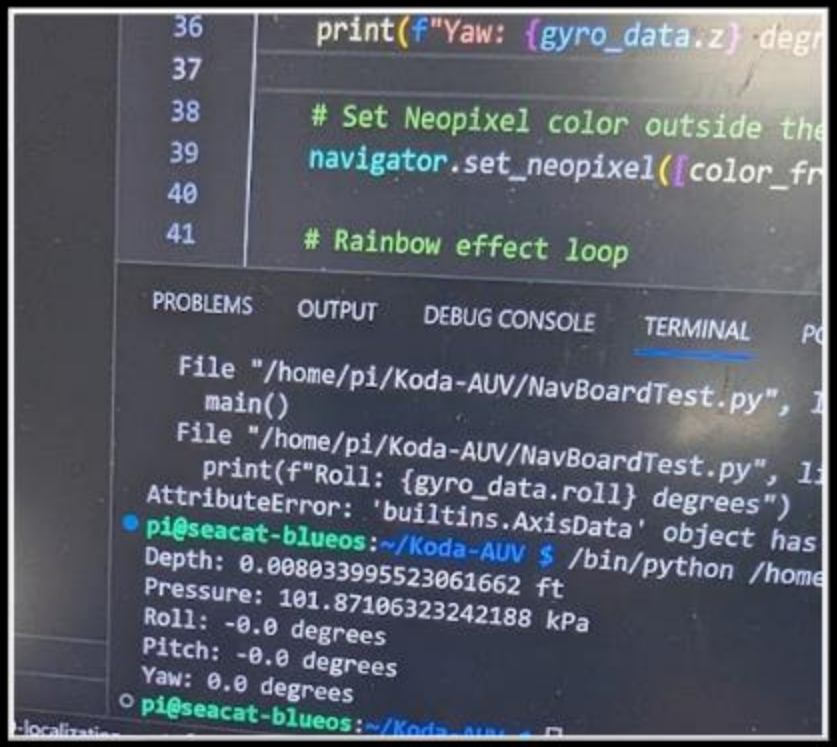
- Blue Robotics Nav Board
  - Get information directly
  - Real time
  - Can save data to same csv file as sonar.



GETTING TELEMETRY

Attempt Number 2

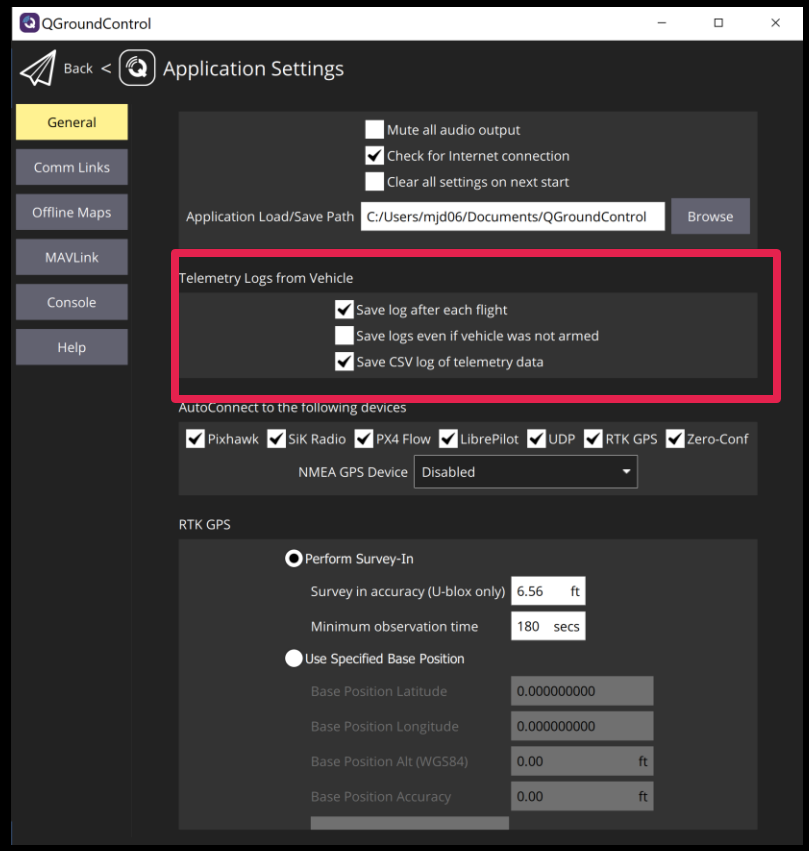
- Blue Robotics Nav Board
  - Pros:
    - Real time
  - Cons:
    - Creates huge delay in topside information



GETTING TELEMETRY

Attempt Number 3

- Q-Ground: (Flight control app)
  - Saves telemetry data during flight



GETTING TELEMETRY

DATA11.CSV

data.csv | data11.csv | merged_data.csv

data11.csv

```
Depth,Angle,Distance,Timestamp
0,0,2.9375085937499996,2023-11-20 15:42:44.905183
0,1,2.9375085937499996,2023-11-20 15:42:44.906065
0,2,2.9334707812499996,2023-11-20 15:42:44.906411
0,3,2.9334707812499996,2023-11-20 15:42:44.906672
0,4,2.9334707812499996,2023-11-20 15:42:44.906959
0,5,2.9334707812499996,2023-11-20 15:42:44.907263
0,6,2.9294329687499996,2023-11-20 15:42:44.907493
0,7,2.9334707812499996,2023-11-20 15:42:44.907700
0,8,2.9334707812499996,2023-11-20 15:42:44.907898
0,9,2.9334707812499996,2023-11-20 15:42:44.908126
0,10,2.9294329687499996,2023-11-20 15:42:44.908343
0,11,2.9294329687499996,2023-11-20 15:42:44.908528
0,12,2.9294329687499996,2023-11-20 15:42:44.908772
0,13,2.9375085937499996,2023-11-20 15:42:44.909017
0,14,2.9455842187499996,2023-11-20 15:42:44.909225
0,15,2.9496220312499997,2023-11-20 15:42:44.909485
0,16,2.9496220312499997,2023-11-20 15:42:44.909758
0,17,2.9617354687499997,2023-11-20 15:42:44.910002
0,18,2.9698110937499997,2023-11-20 15:42:44.910237
0,19,2.98192453125,2023-11-20 15:42:44.910526
0,20,2.99403796875,2023-11-20 15:42:44.911648
0,21,3.00211359375,2023-11-20 15:42:44.911843
0,22,3.01826484375,2023-11-20 15:42:44.911945
0,23,3.02634046875,2023-11-20 15:42:44.912038
```

VEHICLE1.CSV

vehicle1.csv

```
Timestamp,roll,pitch,heading,rollRate,pitchRate,yawRate,groundSpeed
2023-11-20 15:48:45.219,7.7,6.3,37,0.0,0.0,0.0,0.7,0.0,0.000,-0.2,
2023-11-20 15:48:46.216,-0.1,10.0,36,0.0,0.0,0.0,0.9,0.0,0.000,-0.0
2023-11-20 15:48:47.215,-3.2,13.7,38,0.0,0.0,0.0,1.4,0.0,0.000,0.0,
2023-11-20 15:48:48.216,2.3,12.7,48,0.0,0.0,0.0,2.6,0.0,0.000,0.0,
2023-11-20 15:48:49.224,1.5,2.0,57,0.0,0.0,0.0,2.7,0.0,0.000,-0.0,
2023-11-20 15:48:50.216,4.1,2.8,62,0.0,0.0,0.0,2.1,0.0,0.000,-1.2,
2023-11-20 15:48:51.216,4.6,-10.4,58,0.0,0.0,0.0,1.3,0.0,0.000,-0.5
2023-11-20 15:48:52.221,-1.2,-1.1,53,0.0,0.0,0.0,0.9,0.0,0.000,-0.0
2023-11-20 15:48:53.217,-1.2,-0.4,51,0.0,0.0,0.0,0.7,0.0,0.000,-0.0
2023-11-20 15:48:54.217,-0.9,3.2,50,0.0,0.0,0.0,0.7,0.0,0.000,-0.0,
2023-11-20 15:48:55.221,-0.0,6.4,50,0.0,0.0,0.0,0.8,0.0,0.000,-0.0,
2023-11-20 15:48:56.216,1.7,11.1,49,0.0,0.0,0.0,1.6,0.0,0.000,0.1,
2023-11-20 15:48:57.217,1.9,2.5,45,0.0,0.0,0.0,1.4,0.0,0.000,-0.0,
2023-11-20 15:48:58.220,2.2,0.8,37,0.0,0.0,0.0,1.6,0.0,0.000,0.0,-2
2023-11-20 15:48:59.218,5.0,4.9,29,0.0,0.0,0.0,2.2,0.0,0.000,-0.0,
2023-11-20 15:49:00.217,0.7,-3.7,7,0.0,0.0,0.0,2.0,0.0,0.000,-0.1,
2023-11-20 15:49:01.218,-0.3,2.5,358,0.0,0.0,0.0,2.0,0.0,0.000,0.0,
2023-11-20 15:49:02.218,0.0,-0.9,45,0.0,0.0,0.0,2.2,0.0,0.000,-0.1,
2023-11-20 15:49:03.217,-1.6,-0.7,45,0.0,0.0,0.0,2.6,0.0,0.000,0.0,
2023-11-20 15:49:04.217,0.2,4.8,23,0.0,0.0,0.0,2.5,0.0,0.000,0.1,-2
2023-11-20 15:49:05.218,2.2,7.8,16,0.0,0.0,0.0,2.5,0.0,0.000,0.0,-2
2023-11-20 15:49:06.216,2.1,4.3,12,0.0,0.0,0.0,2.6,0.0,0.000,0.0,-2
2023-11-20 15:49:07.217,1.7,4.8,7,0.0,0.0,0.0,2.5,0.0,0.000,0.0,-2.
2023-11-20 15:49:08.219,2.5,5.9,8,0.0,0.0,0.0,2.5,0.0,0.000,0.0,-2.
2023-11-20 15:49:09.217,1.3,6.0,5,0.0,0.0,0.0,2.5,0.0,0.000,0.0,-2.
2023-11-20 15:49:10.218,1.6,5.3,0,0.0,0.0,0.0,2.4,0.0,0.000,0.0,-2.
2023-11-20 15:49:11.219,2.4,4.7,3,0.0,0.0,0.0,2.3,0.0,0.000,0.0,-2.
2023-11-20 15:49:12.218,2.3,6.2,9,0.0,0.0,0.0,2.2,0.0,0.000,0.0,-2.
2023-11-20 15:49:13.218,1.7,6.0,15,0.0,0.0,0.0,2.0,0.0,0.000,0.0,-2
2023-11-20 15:49:14.217,1.2,6.6,15,0.0,0.0,0.0,1.9,0.0,0.000,0.0,-2
2023-11-20 15:49:15.218,1.7,6.1,12,0.0,0.0,0.0,1.7,0.0,0.000,0.0,-2
2023-11-20 15:49:16.218,2.5,5.5,14,0.0,0.0,0.0,1.5,0.0,0.000,0.0,-2
2023-11-20 15:49:17.219,1.3,6.4,17,0.0,0.0,0.0,1.2,0.0,0.000,0.0,-2
2023-11-20 15:49:18.219,0.8,6.9,17,0.0,0.0,0.0,1.0,0.0,0.000,0.0,-2
2023-11-20 15:49:19.218,1.8,6.3,15,0.0,0.0,0.0,0.8,0.0,0.000,0.0,-2
2023-11-20 15:49:20.225,1.4,6.8,12,0.0,0.0,0.0,0.6,0.0,0.000,0.0,-2
2023-11-20 15:49:21.217,0.9,7.2,8,0.0,0.0,0.0,0.5,0.0,0.000,0.0,-2.
2023-11-20 15:49:22.218,1.4,6.8,5,0.0,0.0,0.0,0.4,0.0,0.000,0.0,-2.
```

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2023-11-20 15:48:48.216,2.3,12.7,48,0.0,0.0,0.0,2.6,0.0,0.000,0.0,
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2023-11-20 15:48:53.217,-1.2,-0.4,51,0.0,0.0,0.0,0.7,0.0,0.000,-0.0
2023-11-20 15:48:54.217,-0.9,3.2,50,0.0,0.0,0.0,0.7,0.0,0.000,-0.0,
2023-11-20 15:48:55.221,-0.0,6.4,50,0.0,0.0,0.0,0.8,0.0,0.000,-0.0,
2023-11-20 15:48:56.216,1.7,11.1,49,0.0,0.0,0.0,1.6,0.0,0.000,0.1,-
2023-11-20 15:48:57.217,1.9,2.5,45,0.0,0.0,0.0,1.4,0.0,0.000,-0.0,-
2023-11-20 15:48:58.220,2.2,0.8,37,0.0,0.0,0.0,1.6,0.0,0.000,0.0,-2
2023-11-20 15:48:59.218,5.0,4.9,29,0.0,0.0,0.0,2.2,0.0,0.000,-0.0,-
2023-11-20 15:49:00.217,0.7,-3.7,7,0.0,0.0,0.0,2.0,0.0,0.000,-0.1,-
2023-11-20 15:49:01.218,-0.3,2.5,358,0.0,0.0,0.0,2.0,0.0,0.000,0.0,
2023-11-20 15:49:02.218,0.0,-0.9,45,0.0,0.0,0.0,2.2,0.0,0.000,-0.1,
2023-11-20 15:49:03.217,-1.6,-0.7,45,0.0,0.0,0.0,2.6,0.0,0.000,0.0,
2023-11-20 15:49:04.217,0.2,4.8,23,0.0,0.0,0.0,2.5,0.0,0.000,0.1,-2
2023-11-20 15:49:05.218,2.2,7.8,16,0.0,0.0,0.0,2.5,0.0,0.000,0.0,-2
2023-11-20 15:49:06.216,2.1,4.3,12,0.0,0.0,0.0,2.6,0.0,0.000,0.0,-2
2023-11-20 15:49:07.217,1.7,4.8,7,0.0,0.0,0.0,2.5,0.0,0.000,0.0,-2.
2023-11-20 15:49:08.219,2.5,5.9,8,0.0,0.0,0.0,2.5,0.0,0.000,0.0,-2.
2023-11-20 15:49:09.217,1.3,6.0,5,0.0,0.0,0.0,2.5,0.0,0.000,0.0,-2.
2023-11-20 15:49:10.218,1.6,5.3,0,0.0,0.0,0.0,2.4,0.0,0.000,0.0,-2.
2023-11-20 15:49:11.219,2.4,4.7,3,0.0,0.0,0.0,2.3,0.0,0.000,0.0,-2.
2023-11-20 15:49:12.218,2.3,6.2,9,0.0,0.0,0.0,2.2,0.0,0.000,0.0,-2.
2023-11-20 15:49:13.218,1.7,6.0,15,0.0,0.0,0.0,2.0,0.0,0.000,0.0,-2
2023-11-20 15:49:14.217,1.2,6.6,15,0.0,0.0,0.0,1.9,0.0,0.000,0.0,-2
2023-11-20 15:49:15.218,1.7,6.1,12,0.0,0.0,0.0,1.7,0.0,0.000,0.0,-2
2023-11-20 15:49:16.218,2.5,5.5,14,0.0,0.0,0.0,1.5,0.0,0.000,0.0,-2
2023-11-20 15:49:17.219,1.3,6.4,17,0.0,0.0,0.0,1.2,0.0,0.000,0.0,-2
2023-11-20 15:49:18.219,0.8,6.9,17,0.0,0.0,0.0,1.0,0.0,0.000,0.0,-2
2023-11-20 15:49:19.218,1.8,6.3,15,0.0,0.0,0.0,0.8,0.0,0.000,0.0,-2
2023-11-20 15:49:20.225,1.4,6.8,12,0.0,0.0,0.0,0.6,0.0,0.000,0.0,-2
2023-11-20 15:49:21.217,0.9,7.2,8,0.0,0.0,0.0,0.5,0.0,0.000,0.0,-2.
2023-11-20 15:49:22.218,1.4,6.8,5,0.0,0.0,0.0,0.4,0.0,0.000,0.0,-2.
```

MERGE DATA

Time Stamp

```
Timestamp
6,2023-11-20 15:42:44.905183
6,2023-11-20 15:42:44.906065
 2023-11-20 15:42:44.906411
```

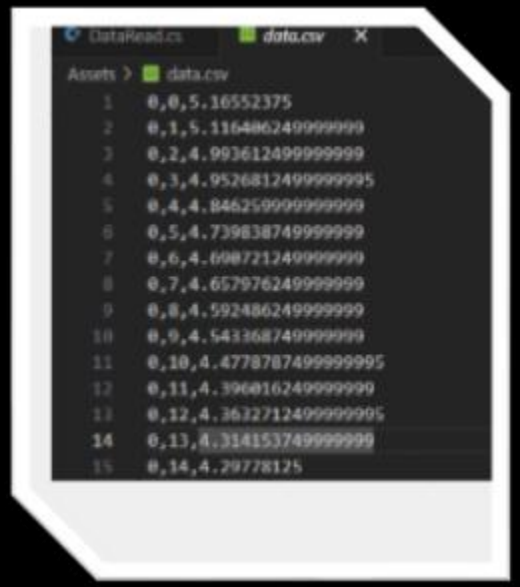
```
Timestamp,roll,pitch,heading,rollRate,pitchRate,yawRate,
2023-11-20 15:48:45.219,7.7,6.3,37,0.0,0.0,0.0,0.7,0.0,0
2023-11-20 15:48:46.216,-0.1,10.0,36,0.0,0.0,0.0,0.9,0.0
2023-11-20 15:48:47.215,-3.2,13.7,38,0.0,0.0,0.0,1.4,0.0
```

MERGING DATA

All_Data.csv

- Components:
  - Sonar
  - Telemetry data
- Based off timestamp
  - Time stamp not correct

UNITY

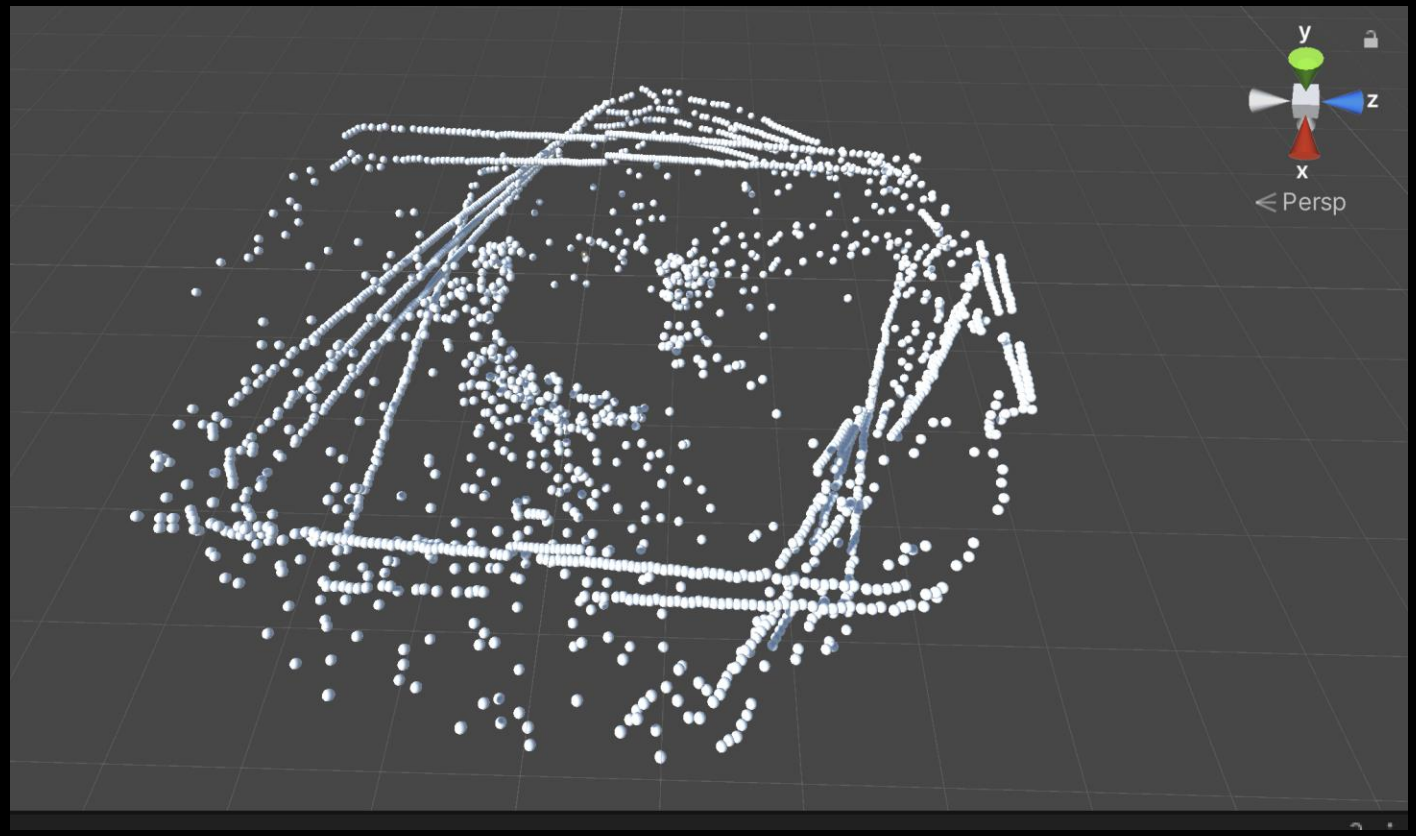



```
while (!endoffile)
{
    string Data_String = stReader.ReadLine();
    if (Data_String == null)
    {
        endoffile = true;
        break;
    }
    var datavalues= Data_String.Split(',');
    Debug.Log(datavalues[0].ToString() +','+ datavalues[1].ToString() + ','+datavalues[2].ToString());
    Instantiate(sphere, new Vector3(Mathf.Cos(float.Parse(datavalues[1])*
                (Mathf.PI/200))*scale*-1* float.Parse(datavalues[2]),
                float.Parse(datavalues[0])*scale/5, Mathf.Sin(float.Parse(datavalues[1])
                * (Mathf.PI / 200)) * scale *float.Parse(datavalues[2])),
                new Quaternion(1, 1, 1,1));
}
```

UNITY

11-22-23

- Rotation Test



TESTING

11-22-23

- Melbourne commons 10 a.m. to 1 p.m.

- Goal:
  - Test sonar data retrieval
  - Collect Data for Cloud Plotting
  - Roll rate for next sonar upgrade

MILESTONE 3:

Task	Michael	Zealand
False Data	Create an algorithm to remove false data points / fill in the shadows within the data to create a cleaner image.	
Depth Finder	Identify the protocols to find and retrieve this data, may need to be done through Arduino. The goal for this is to have accurate measurements of the current depth.	
Compass and Telemetry	Identify the protocols to find, retrieve, and save the information. This is so that once we start rotating the AUV we can track the current heading to assist with data transcription.	
Cloud Plot Application		Work on creating an environment that will transpose the data and allow for Autonomous testing in a virtual environment.

MILESTONE 4:

Task	Michael	Zealand
False Data Improvements	Create an algorithm to remove all false data points.	
Rotation Algorithm	Create a function to tun the two scans into the same orientation	
AUTONOMY	Use Gazebo to test partial pathing for current data sets	

Demo:

https://www.youtube.com/watch?v=VTigK4eMFWs

WEBPAGE LINK

TEC-V

https://bluecodehydra.github.io/FIT_Project-TEC_V/data.html