Mars Rover Presentation

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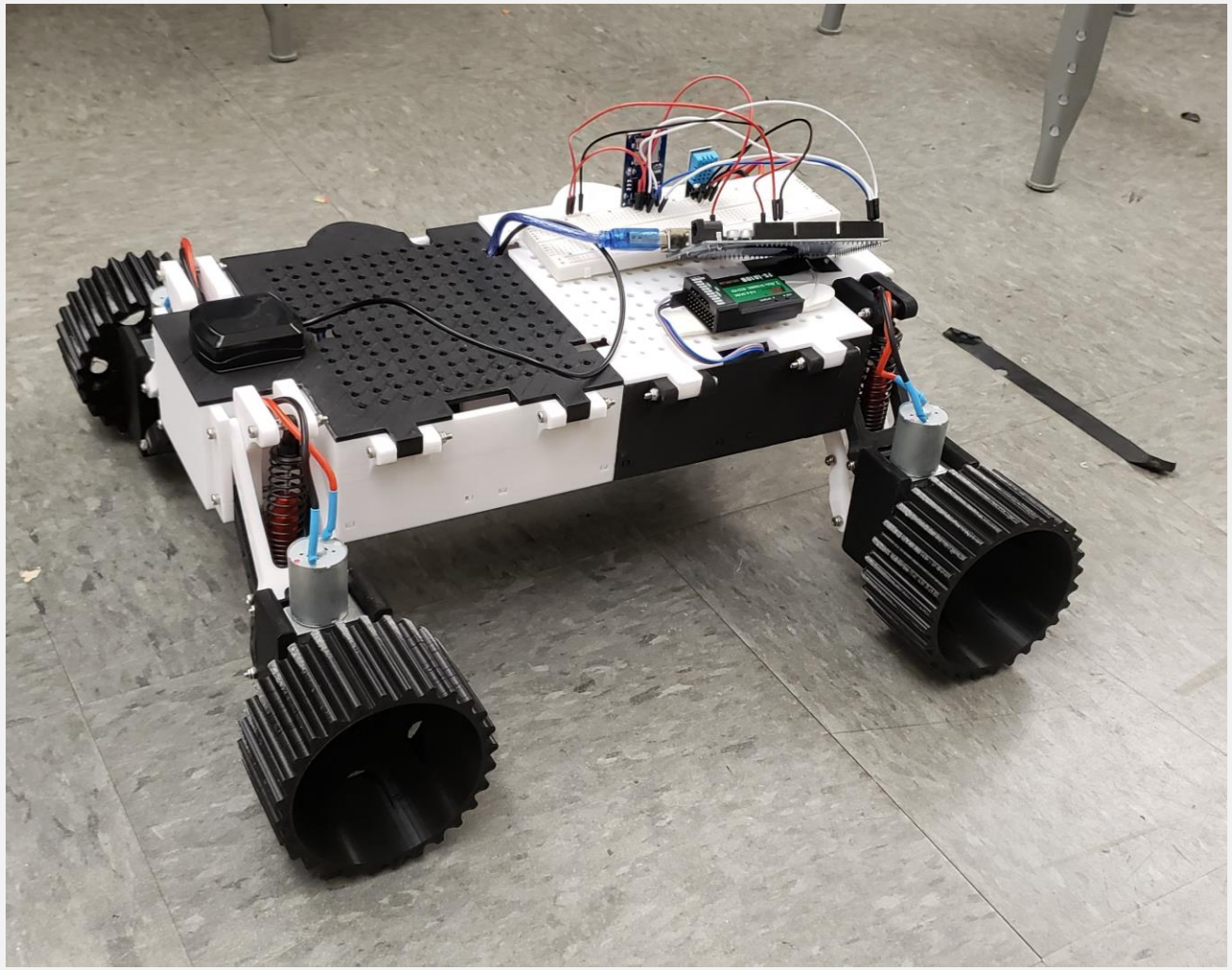
Overview

- Construction and Programming
- DHT-11 Analysis
- Waypoint Analysis

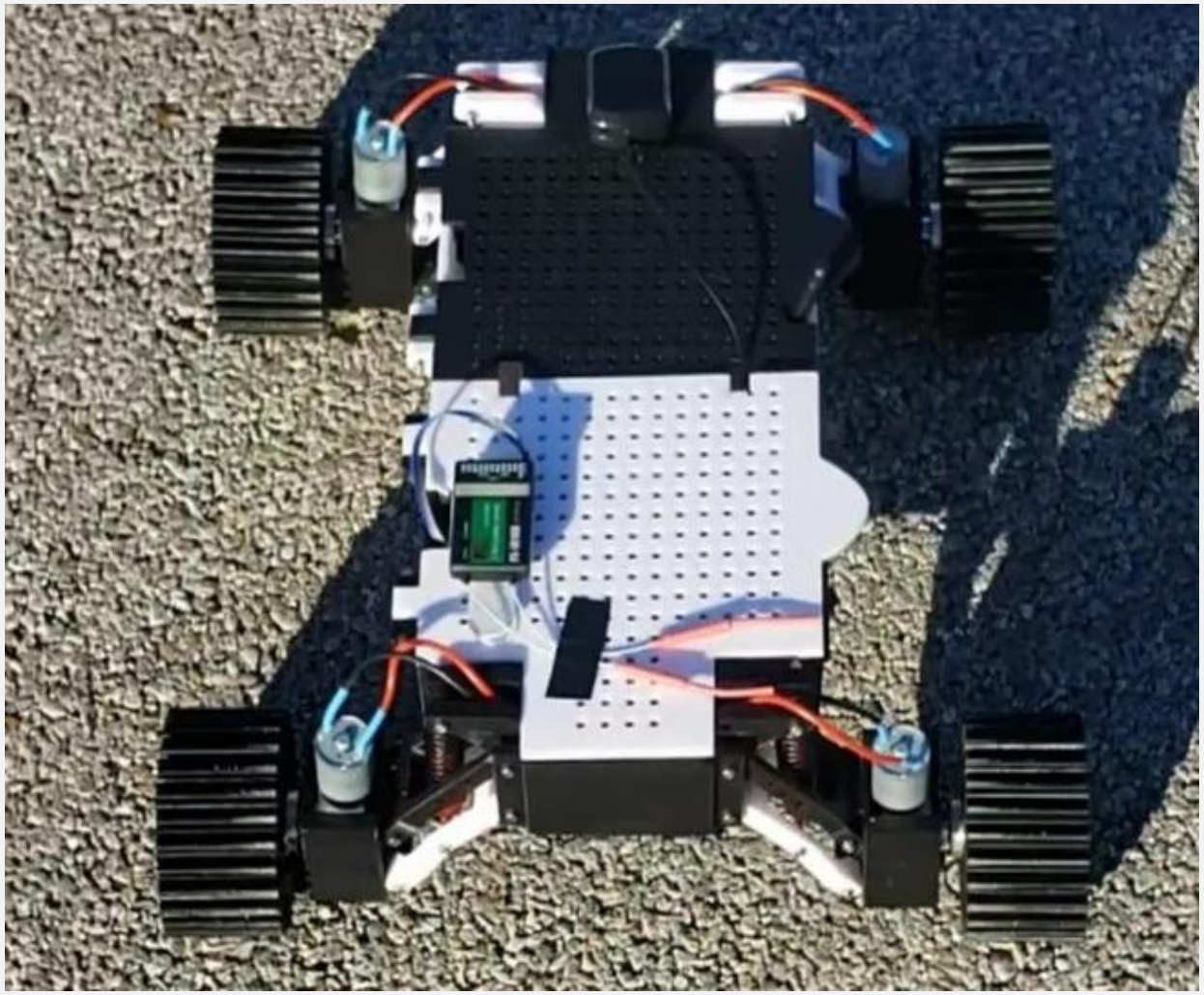
Construction & Programming

- Methods followed from instructions
  - Few issues which were easily resolved
- Arduino inclusion
  - DHT-11
  - SD Card Module



Position Integral Derivative (PID) Tuning

- Adjusted over 7 runs
- Position tuning
  - 0.5
- Integral tuning
  - 0.02
- Derivative tuning
  - 0



Task 1

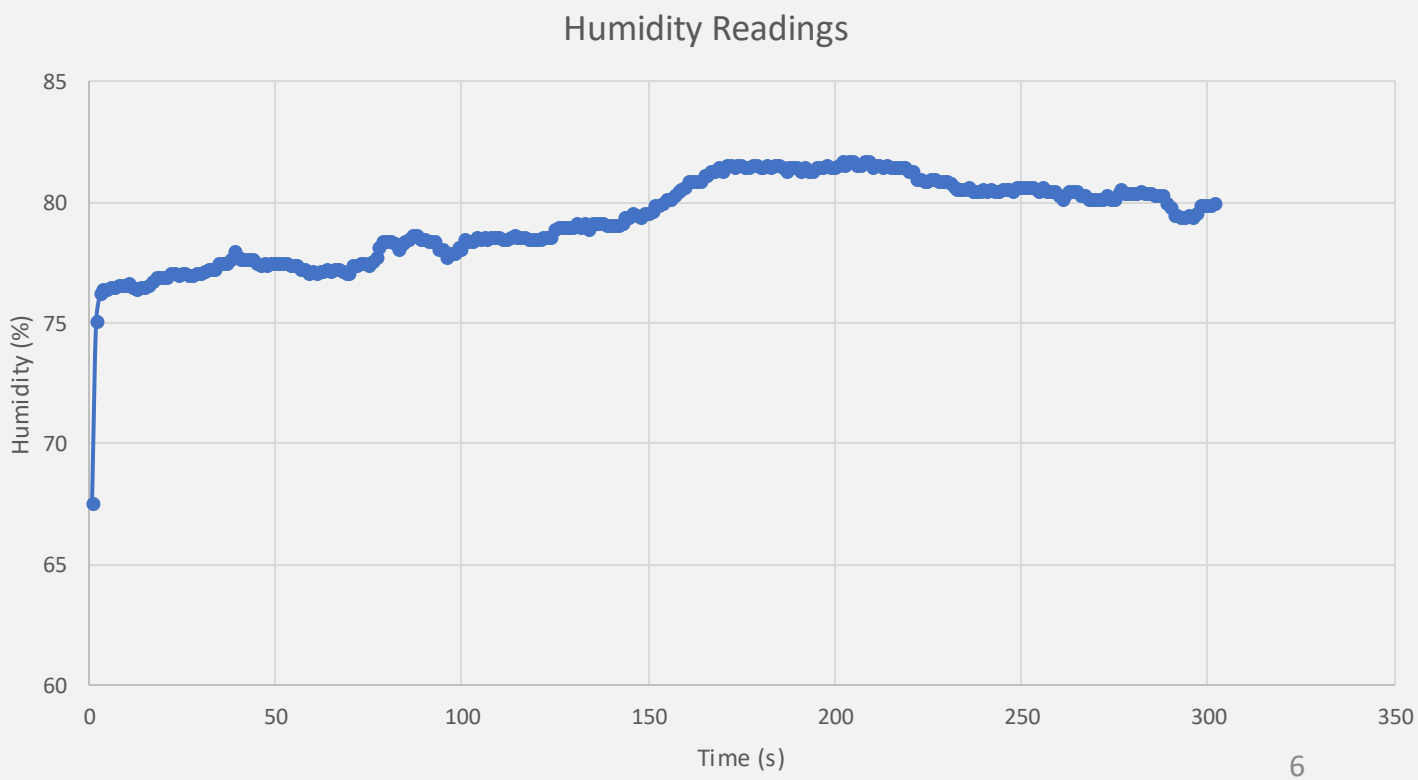
- Examining additional DHT-11 Sensor vs. Onboard systems
- Baro Pressure and Altitude Calculation
- Comparison between the sensors and ground truth
- Ground truth from weather data

Humidity

2:50 PM	53.6	81.88
1:50 PM	53.6	87.57
12:50 PM	51.8	93.55

- Humidity similar to ground truth
- Functional Addition

Link Ground Truth (https://www.localconditions.com/weather-edwardsville-illinois/62025/past.php)

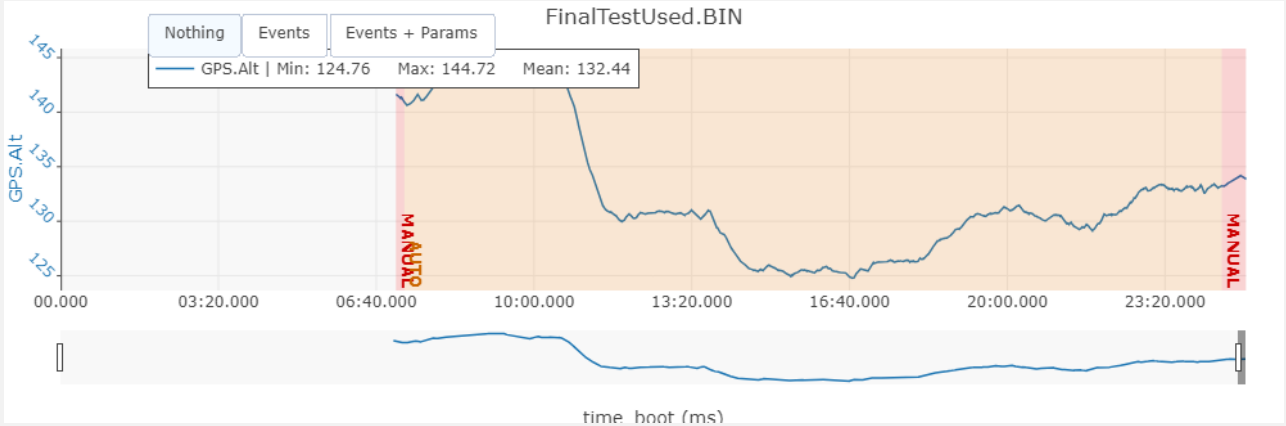


Altitude/Pressure Comparison

Link (https://www.visualcrossing.com/weather/weather-data-services/Edwardsville,%20Il/metric/2023-12-01/2023-12-01#)

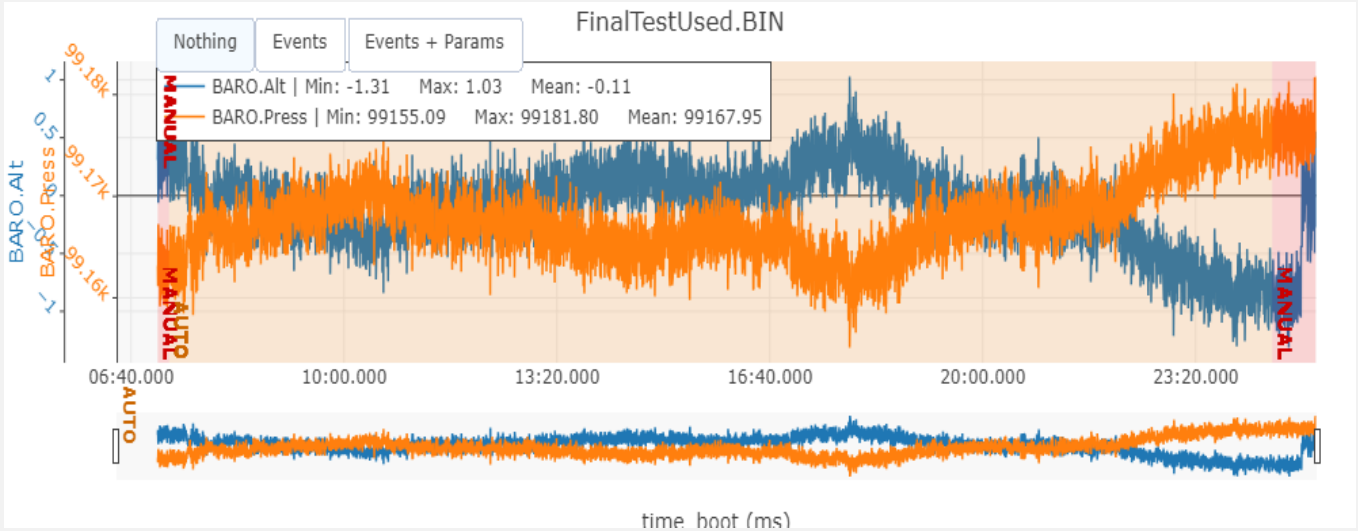
Actual

- Actual pressure from millibar to pascal is about 1005 to 100.005kpa
- Elevation sourced from CalcMaps (range is about 1.5m between max and min) avg 135-136m



Baro / GPS

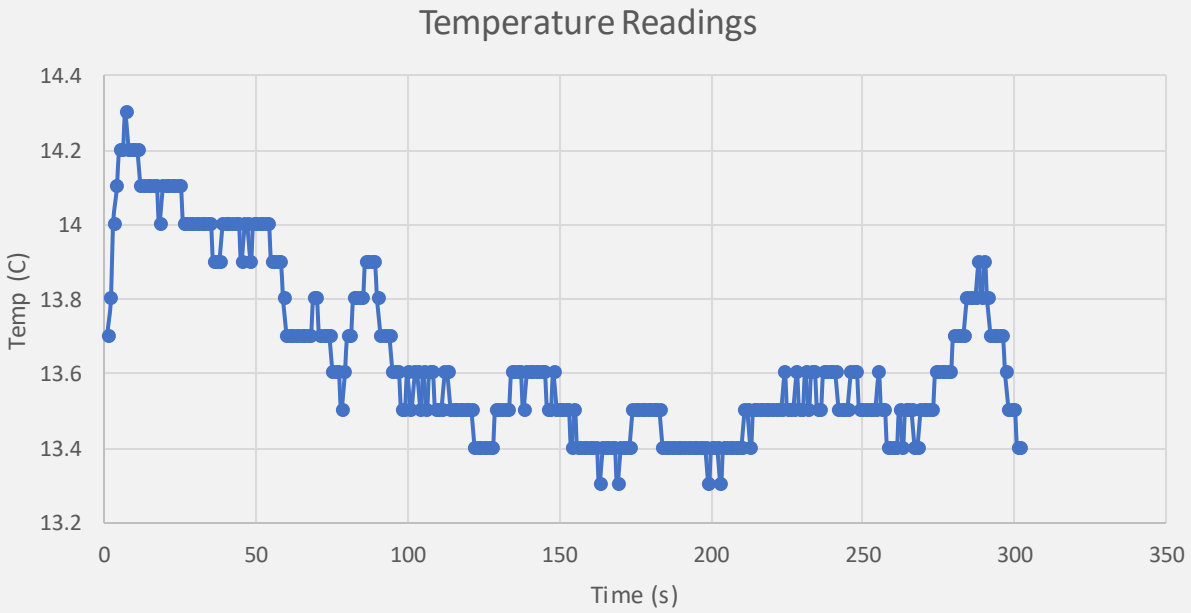
- Measured Press about 99kpa
- Works on Inverse Relationship
- Gps Altitude



Temperature Comparison

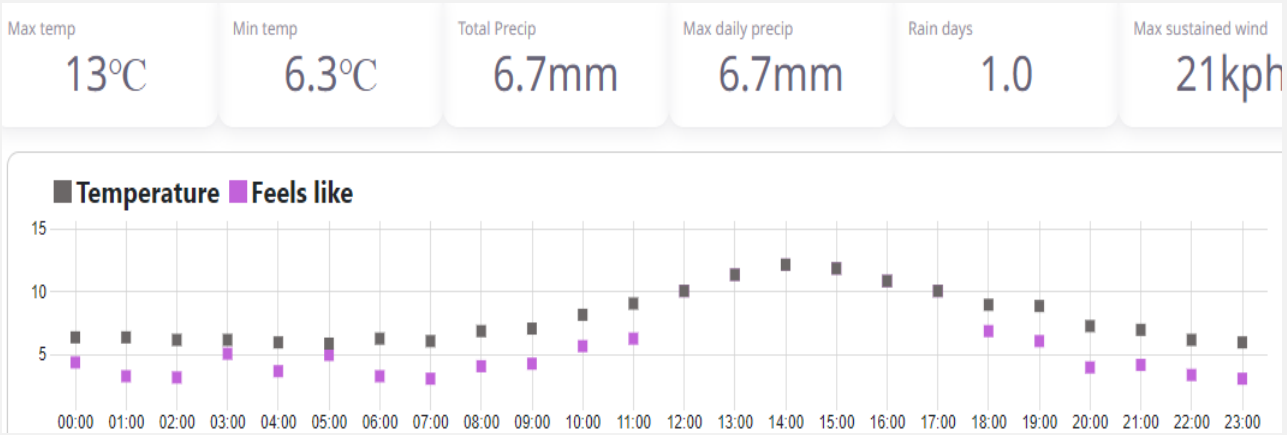
- Ground truth range (13-14 degrees Celsius)
- DHT-11 within acceptable range
- Baro/IMU issues and Relationship

DHT-11

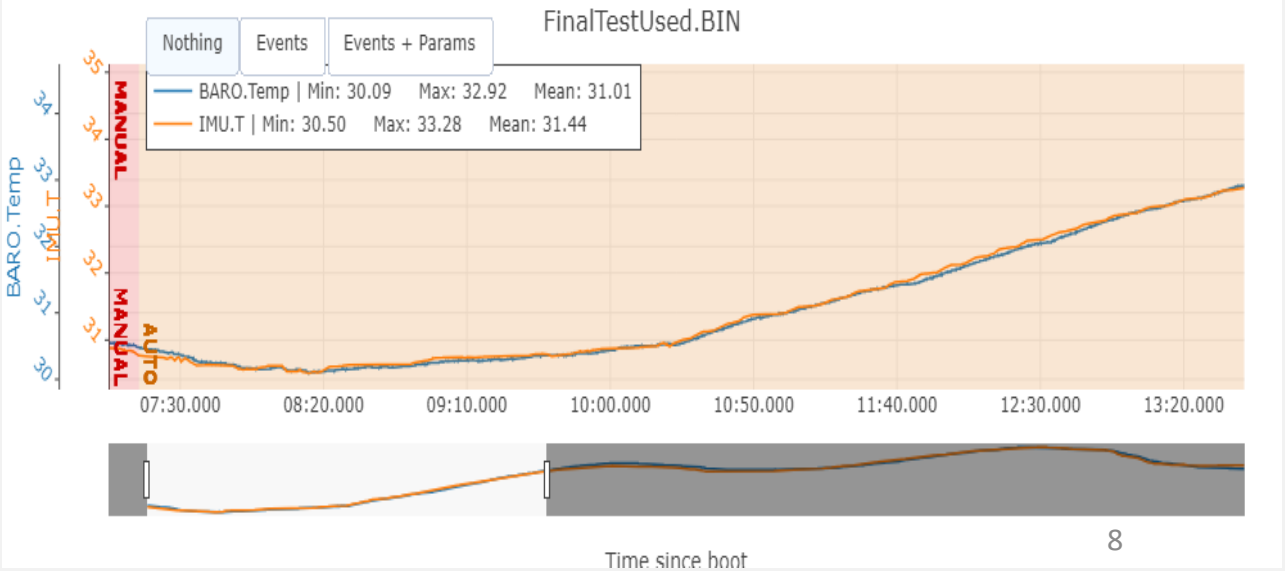


Ground Measurements

Link (https://www.visualcrossing.com/weather/weather-data-services/Edwardsville,%20Il/metric/2023-12-01/2023-12-01#)

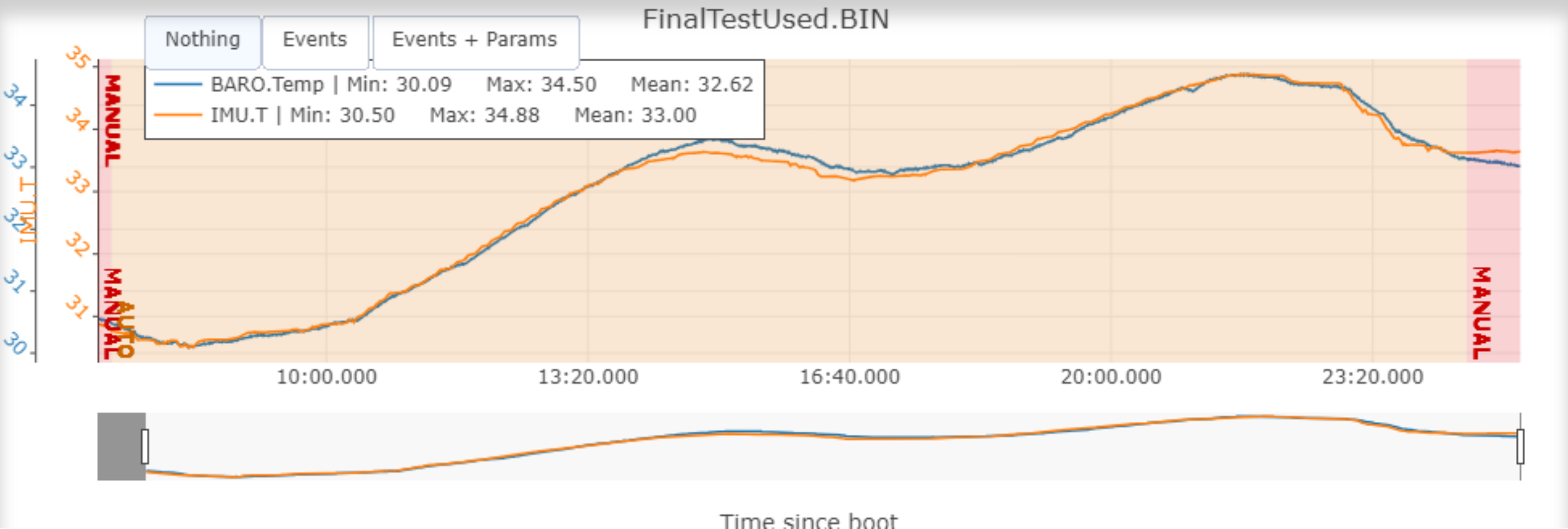


Baro/IMU



Conclusions of Task 1

- Issues on Temp measurement
- Easy enough solution – Baro temp minus IMU (Software), Allow the Barro access to environment (Hardware)
- DHT-11 successful introduction, work on wiring



Task 2

- Total time it takes to complete the path.
- Errors (distance) from the designed path.
- Distance from Waypoints.

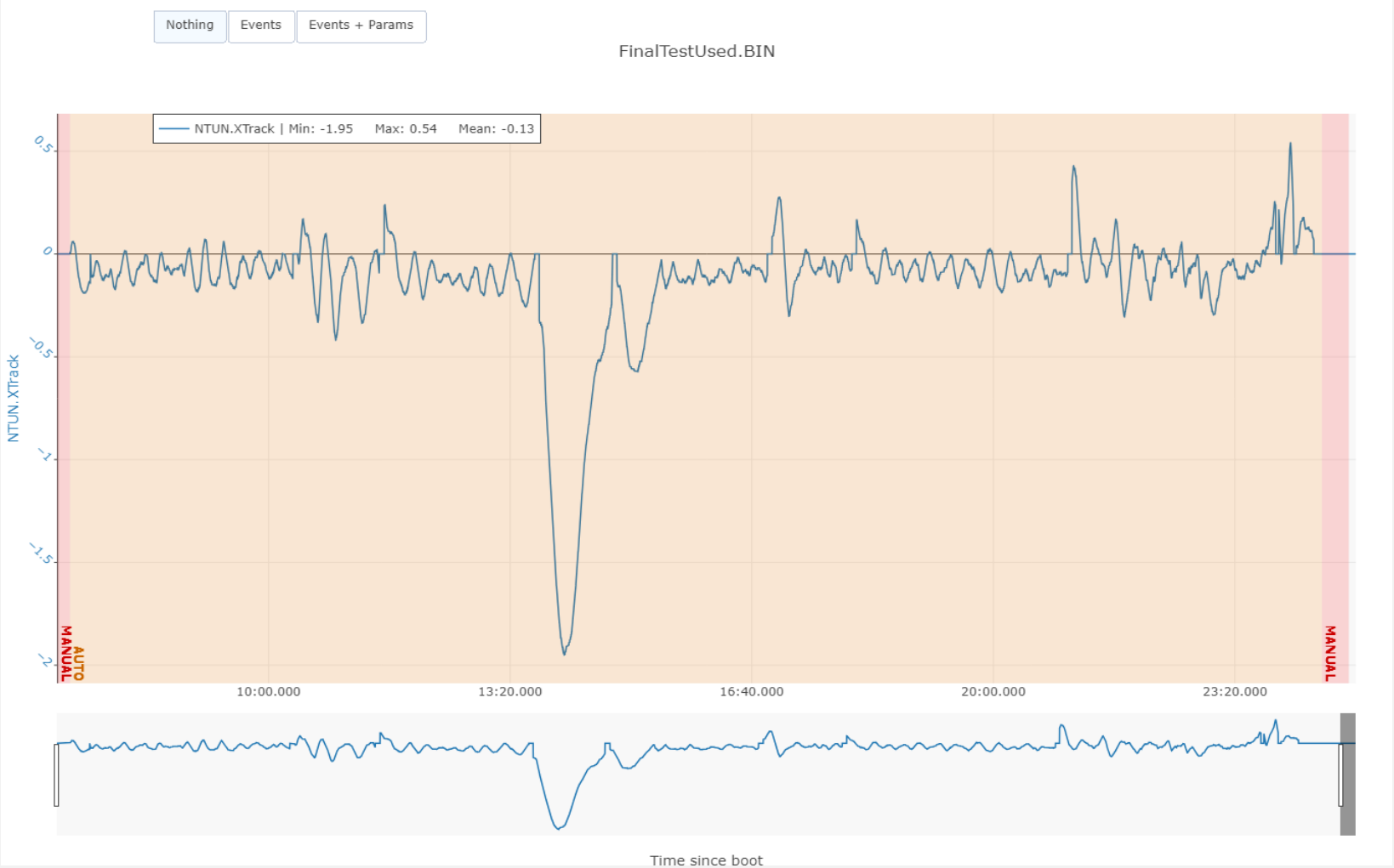
Total time it takes

About 17:17

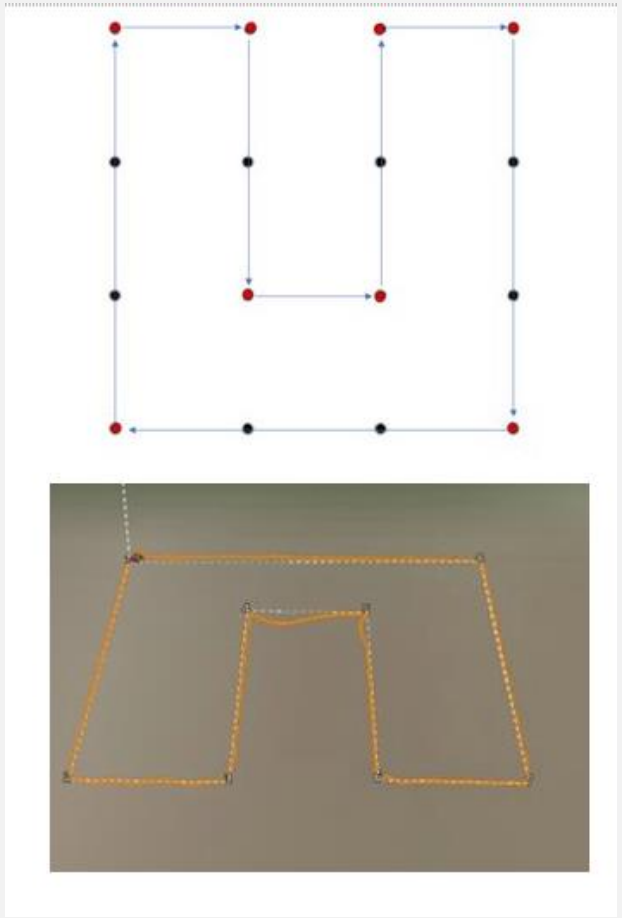
Errors from designed path

Maxmium：1.94m

Average：0.0029m



Distance from Waypoints



This is a diagram of the orbit that our Mars rover should follow in theory and in practice.

Analysis of distance from waypoints

Distance from waypoints

2.199522

29.91452

10.60449

21.81858

9.640605

20.95116

9.89059

30.21557

30.10595

- From this picture, we can clearly see the distance of the Mars rover from waypoints at different stages, we can obtain that Mars rover travelled 165.340987 meters by adding up these data. This value is nearly 4.66 meters lower than the theoretical 170 meters. The reason for these errors, is not only related to PID tuning, but also the weather when the experiment was cloudy and windy. I think the experiment can be improved by doing it under clear, windless conditions.