Low-Cost Microclimate Monitoring System

New York Department Of Environmental Conservation

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Introduction

- Our developments into our Data Acquistion Subsystem for the field unit for the Low-Power Microclimate System.

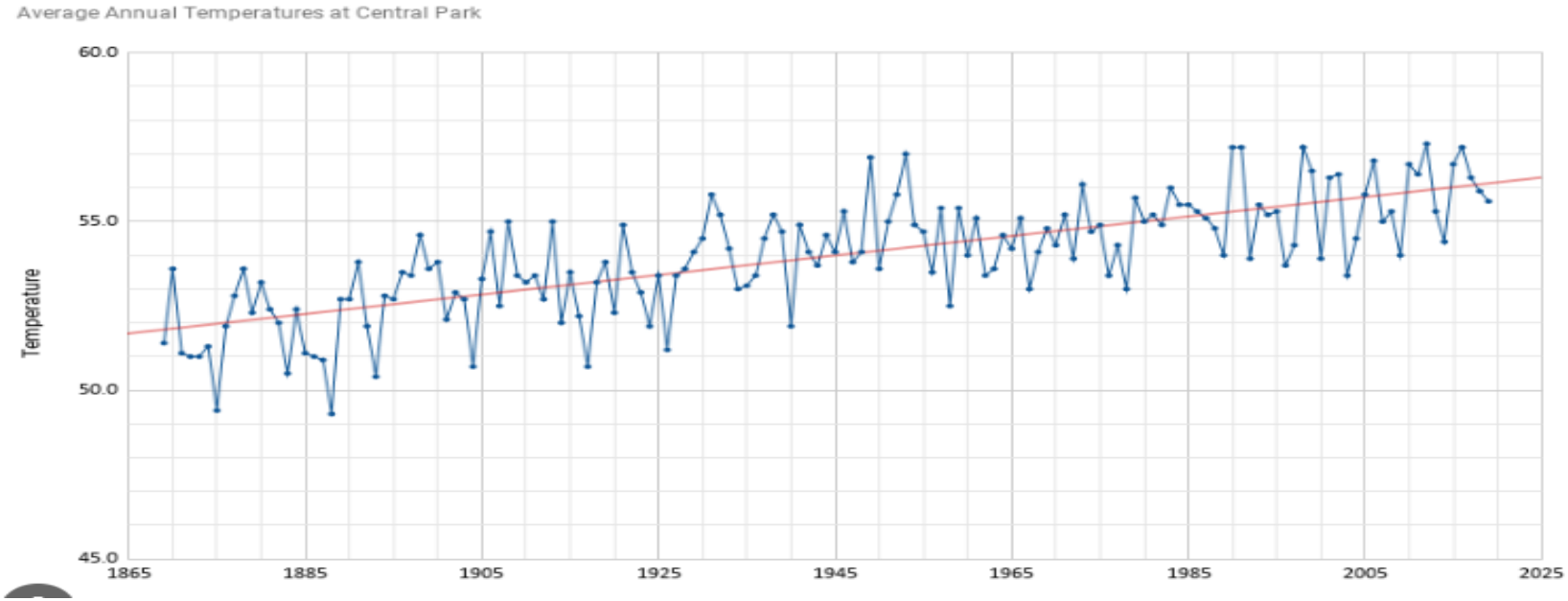
- Why is this important
  - Knowing how climate change affects microclimates helps us better protect local environments and agriculture.

Background

- Climate change is an issue that has caused abnormal weather, wildfires, and poor air quality
- More studies are being done to address and resolve the issue behind climate change
- Many costly weather systems exist that can record and analyze different parts of the weather
- Our weather monitoring system stands out as an affordable design for gathering and sharing weather data

Problem Statement

- The New York Department of Environmental Conservation seeks to develop a cost-effective weather monitoring system to analyze the effects of climate change on microclimates in New York State.



Key System Requirements

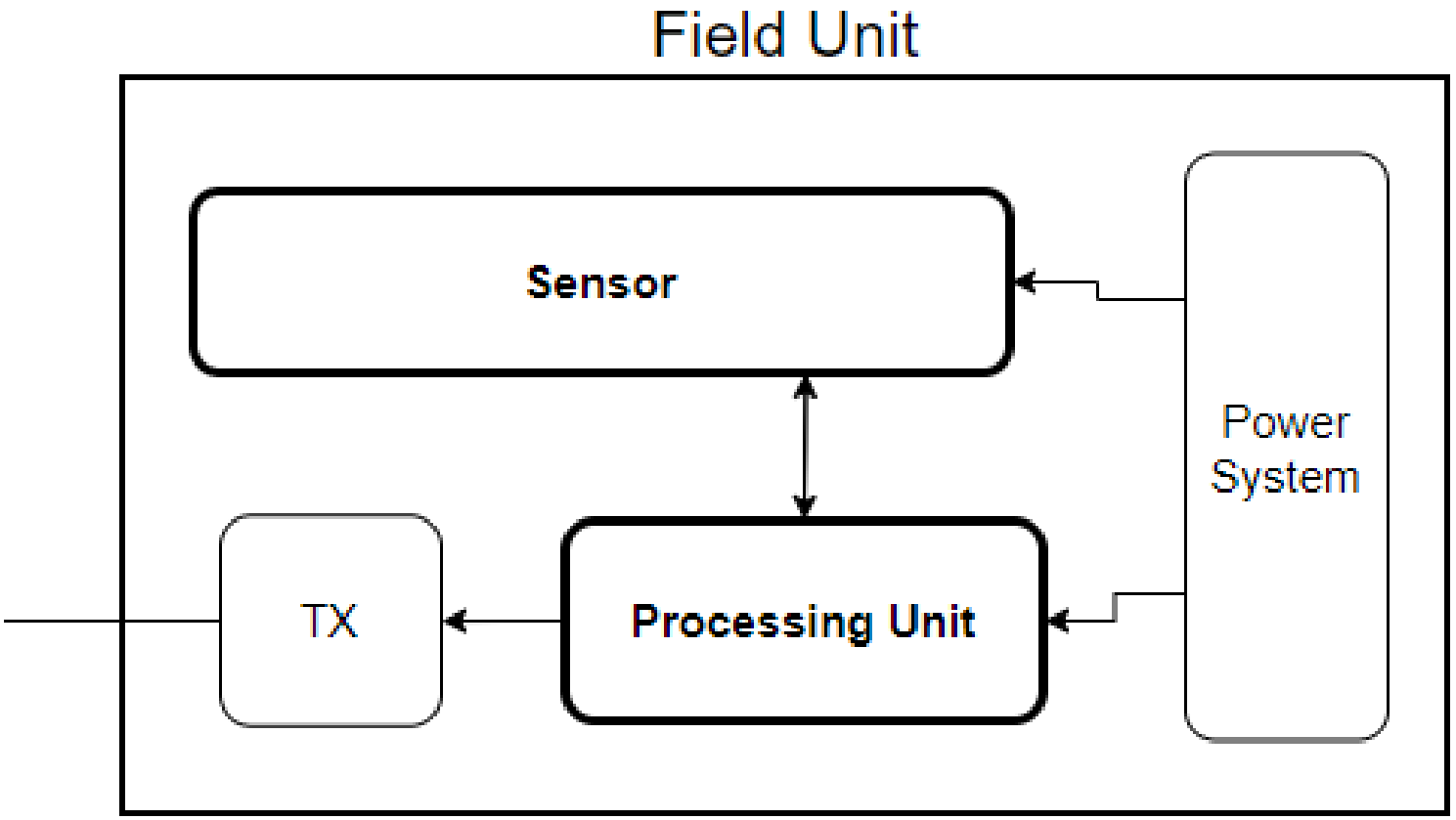
Functional Requirements

- Accuracy
  - Temperature +/- 5°C
  - +/- 5% relative humidity
- Scalability
  - Easy integration of additional sensors

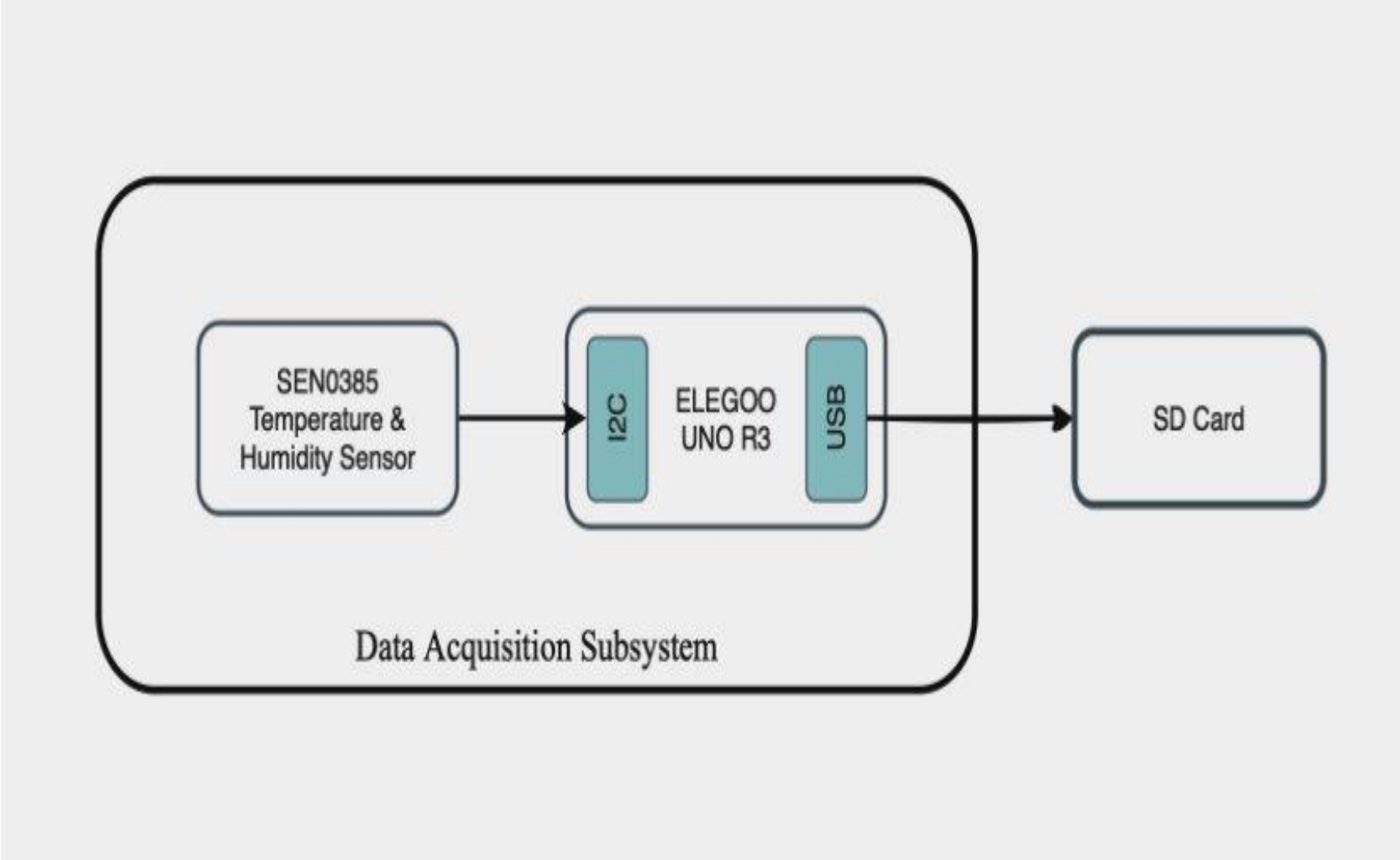
Non-functional Requirements

- Durability
  - Withstand weather conditions

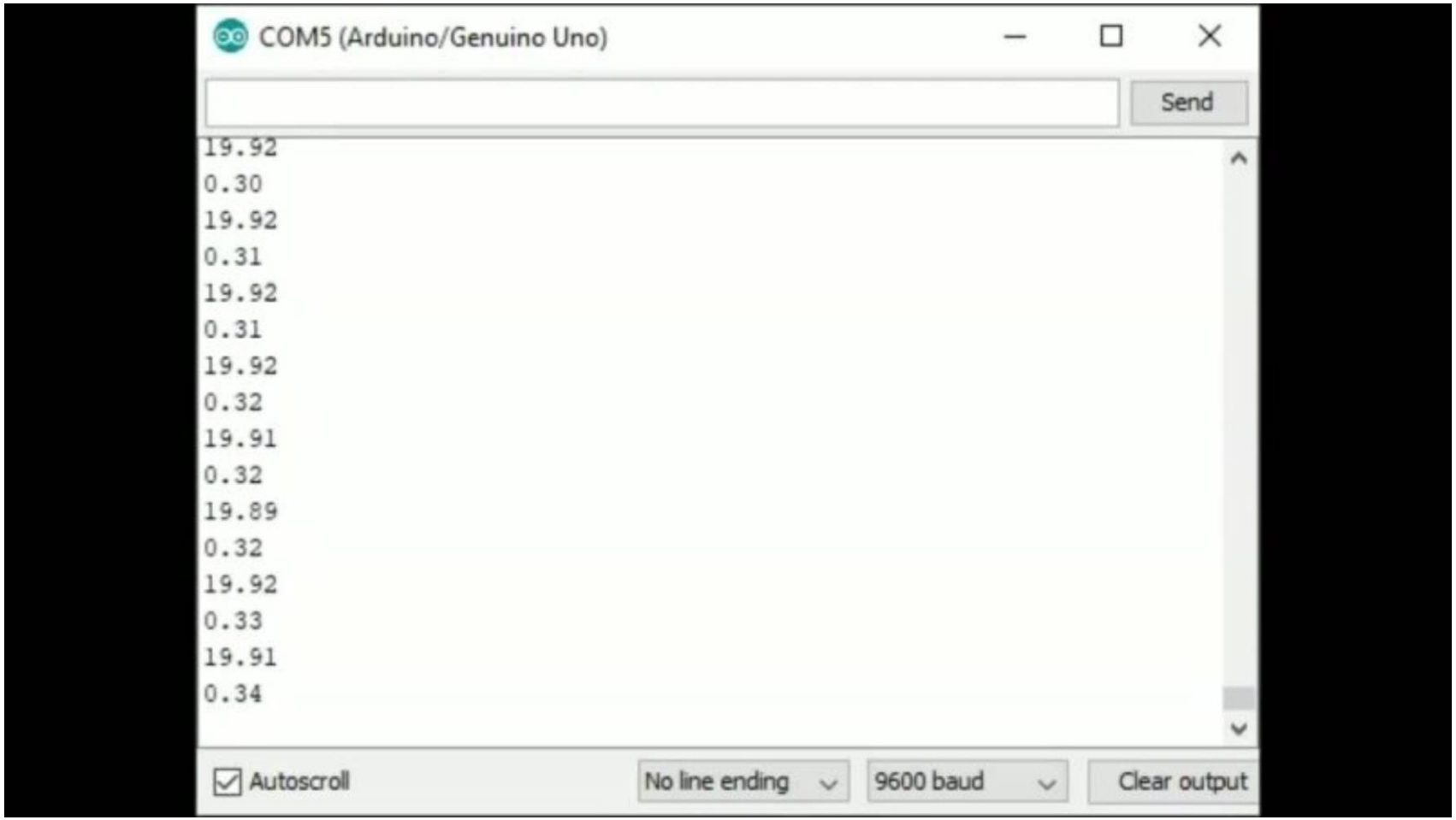
Logical Design



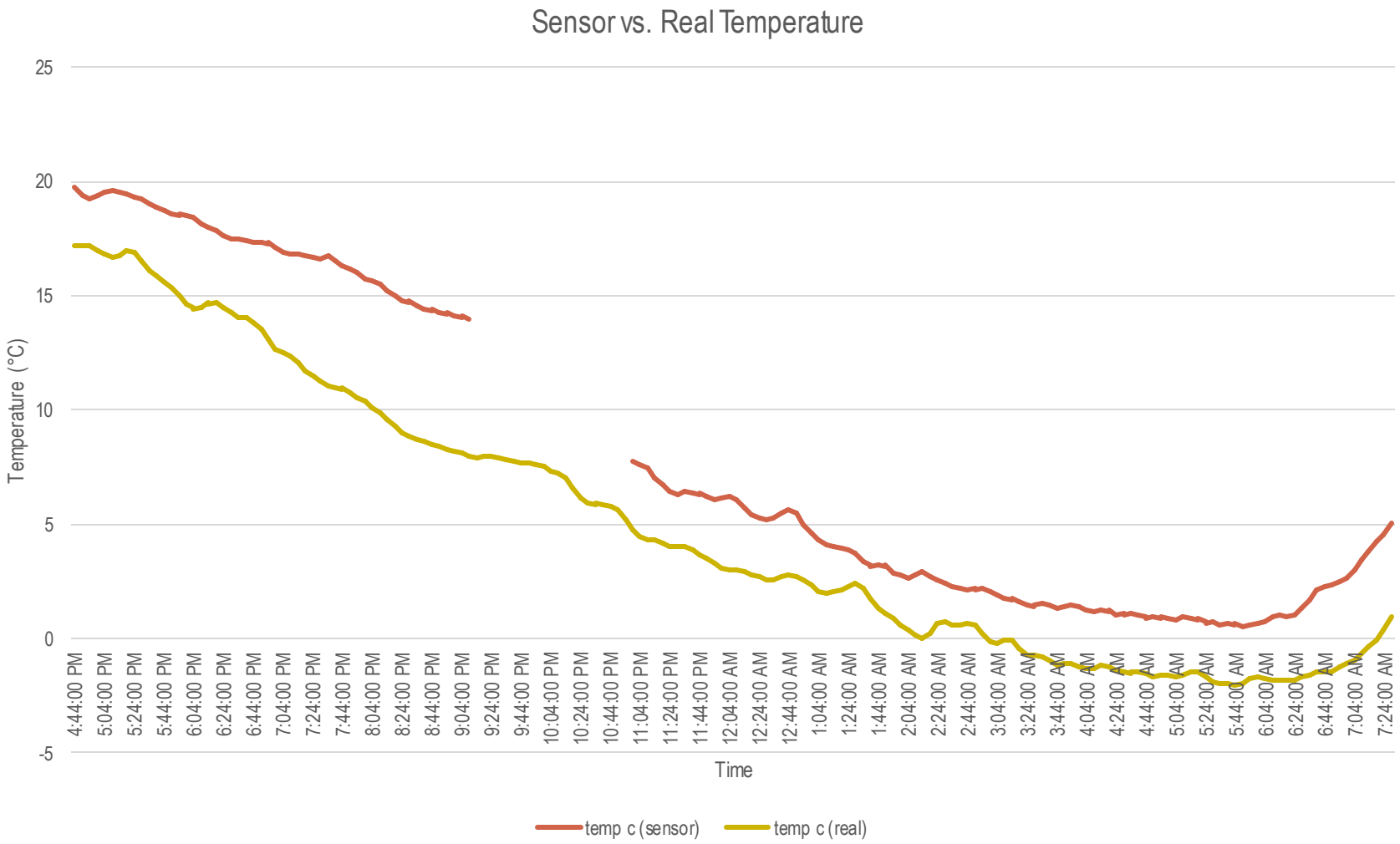
Physical Design



System Demonstration



Data and Results



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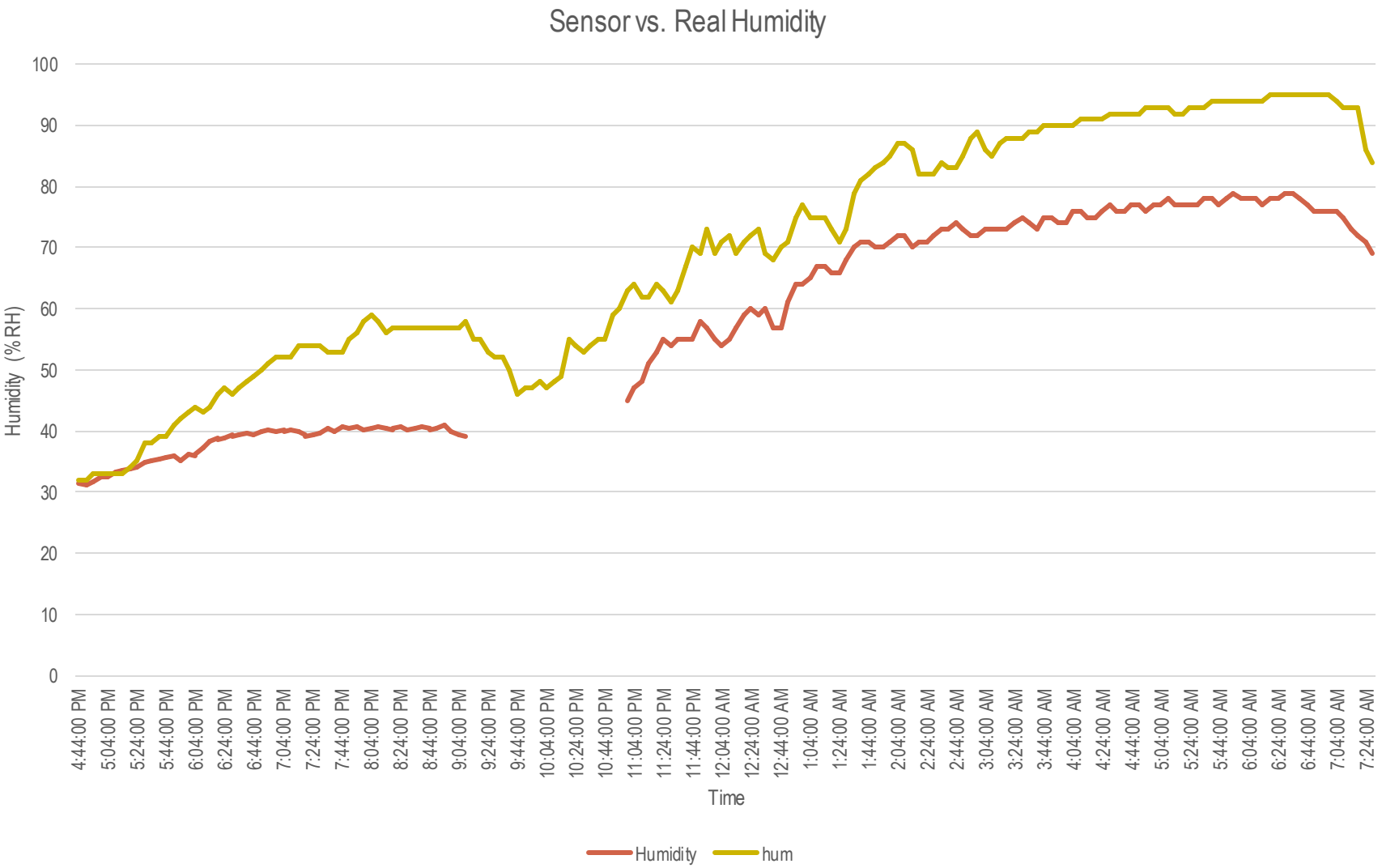


Analysis and Discussion

- Initial Testing
  - Collected 100 samples every ~5 mins
  - System placed by a window for tests
- Average difference between sensor and underground data
  - 3.16C and 12.63 %RH
- Potential inaccuracies in sensor measurements due to window placement

Limitations

- Limitations
  - Time and Cost
  - Sensor accuracy, limited spatial coverage, temporal resolution
- Challenges
  - Unresponsive system due to failed system/chip initialization
  - Memory management
  - Measurement outlier detection / filtering

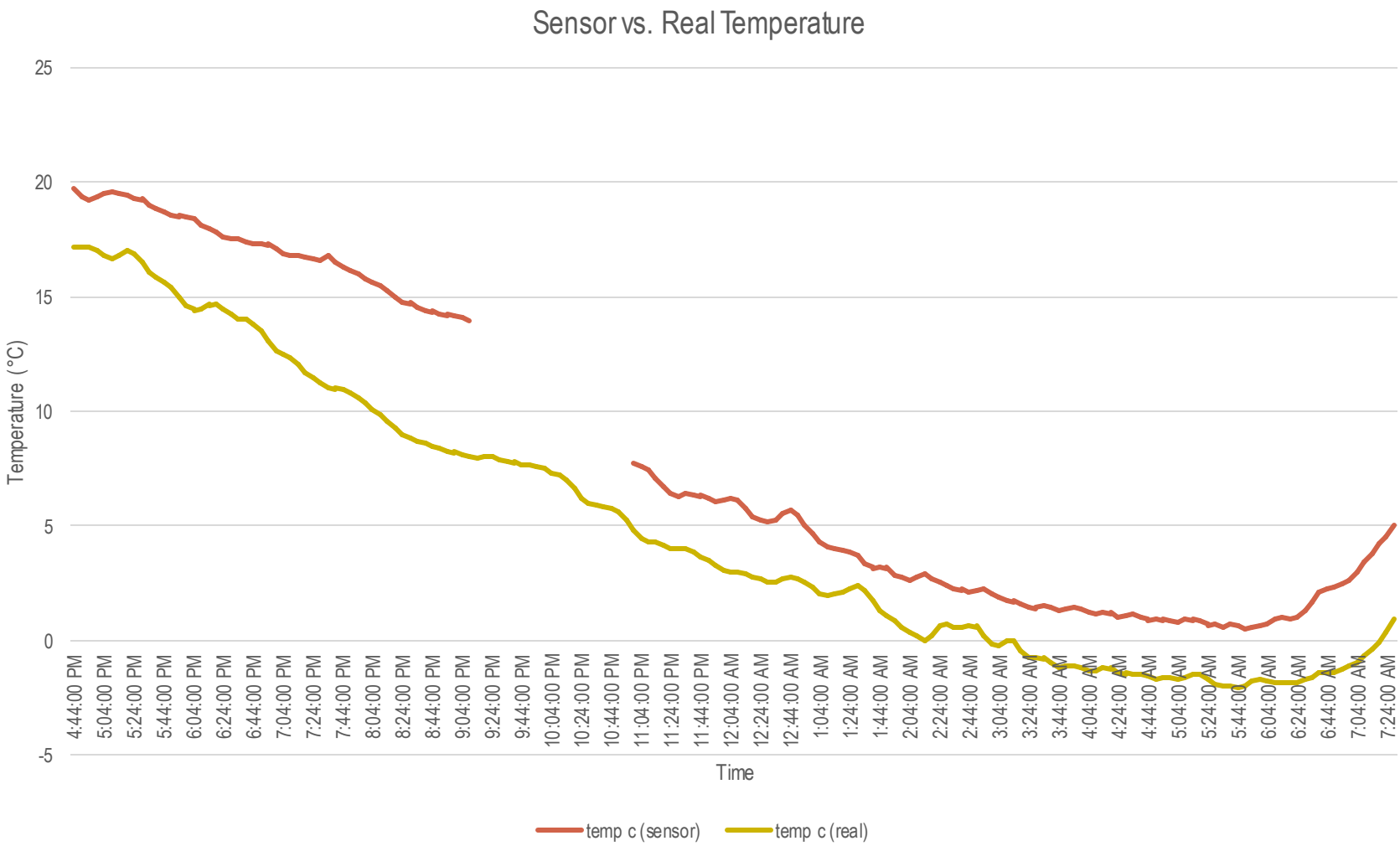
Recommendations for Future Work

- Test system outside and analyze data for accuracy/reliability using multiple datasets
- Develop criteria for identifying discrepancy vs. microclimate variation
- Re-print enclosure with weather-proof material such as ABS Plastic or Polycarbonate

Conclusions

- Significant variations observed in NYS compared to locally available data
  - Avg temp difference: 3.16 °C
  - Avg humidity difference: 12.63%
- Despite discrepancies, the data acquisition monitoring system demonstrates potential for cost-effective microclimate monitoring (total cost ~ $35)
- Implications
  - Scalability
  - Robust enclosure design
  - Provides insights into microclimates for DEC's mission

Questions


Sensor vs. Real Temperature
Temperature (°C)
25
20
15
10
5
0
-5
4:44:00 PM
5:04:00 PM
5:24:00 PM
5:44:00 PM
6:04:00 PM
6:24:00 PM
6:44:00 PM
7:04:00 PM
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Time
temp c (sensor)
temp c (real)