



1. Introduction

REQUIREMENTS FOR HYDROPONIC CROP MAINTENANCE

- Proper temperature and humidity control are essential for successful hydroponic gardening. \*1
- The ideal temperature range for most hydroponic crops is between 18-27°C. \*1
- Humidity levels should be maintained between 50-70% to promote transpiration and nutrient uptake. \*1
- 5 hPa ~ 10 hPa negative air pressure compared to the surrounding air is beneficial for hydroponic crop growth. \*2

CURRENT SITUATION

- A specimen of *Lactuca sativa* cultivated at a dormitory room environment is in a weakening state, both in color and shape, 10 days after sowing

2. Methods

MEASUREMENT ENVIRONMENT

LOCATION 1 (LOCAL: ROOM)

- DHT11 Humidity & Temperature Sensor x1 (Temperature Range: 0°C to 50°C, Humidity Range: 20% to 90%)
- BME280 Pressure & Humidity & Temperature Sensor x1 (Temperature Range: -40°C to 85°C, Pressure range: 300 hPa to 1100 hPa)
- Raspberry pi Model 3b+ Computer

LOCATION 2 (REMOTE: CAMPUS)

- BME280 Pressure & Humidity & Temperature Sensor x1 ( / )
- Raspberry pi Model 4 Computer

MEASUREMENT PLAN

- Temperature, humidity, and atmospheric pressure data for 48 hours with 1 minute interval will be measured consecutively and simultaneously in both locations.
- Measured data will be instantly uploaded to the server storage via ISAK-S Wi-Fi, with distinction of sensor ID and time when measured.

SYSTEM DIAGRAM

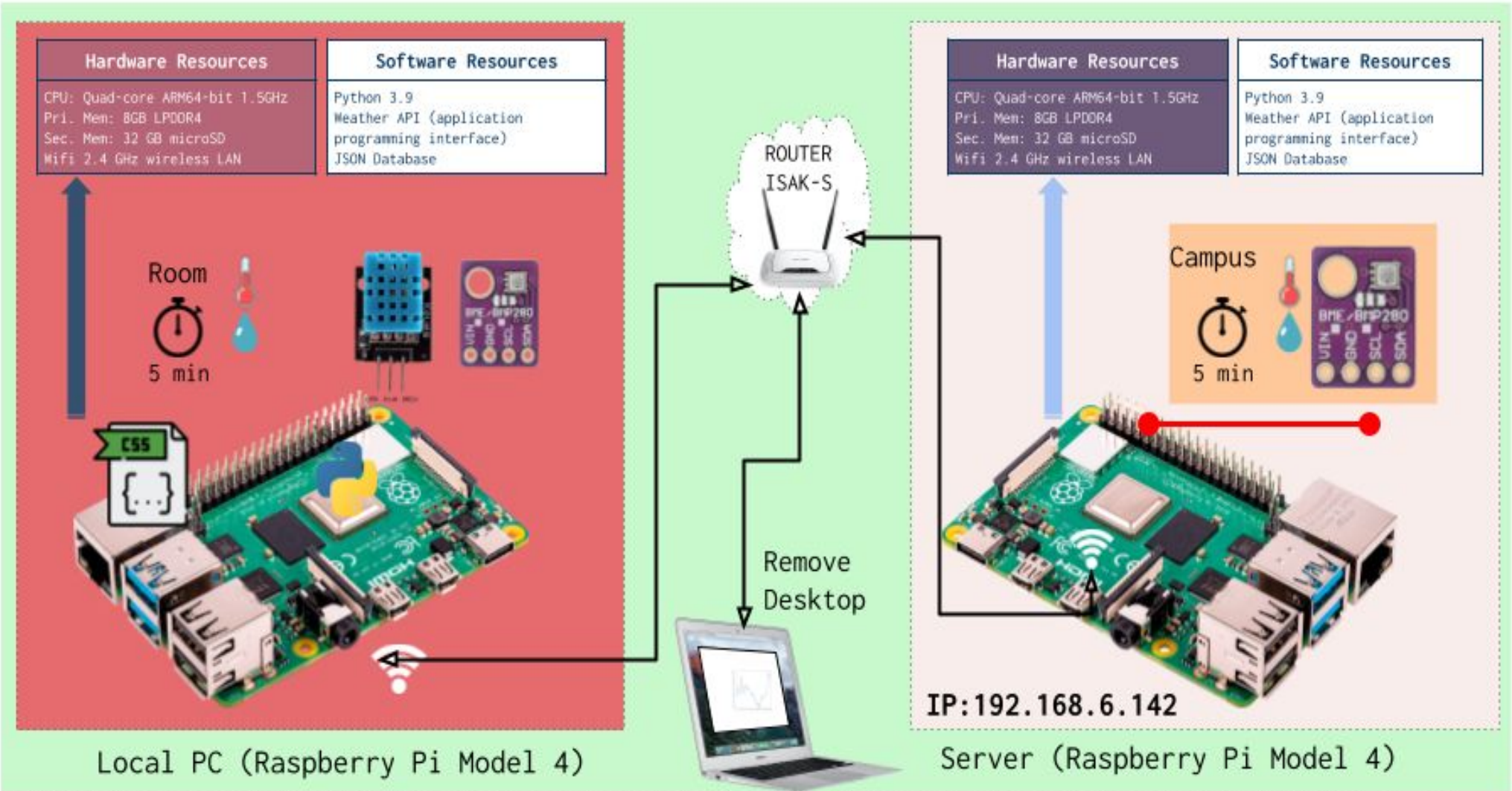
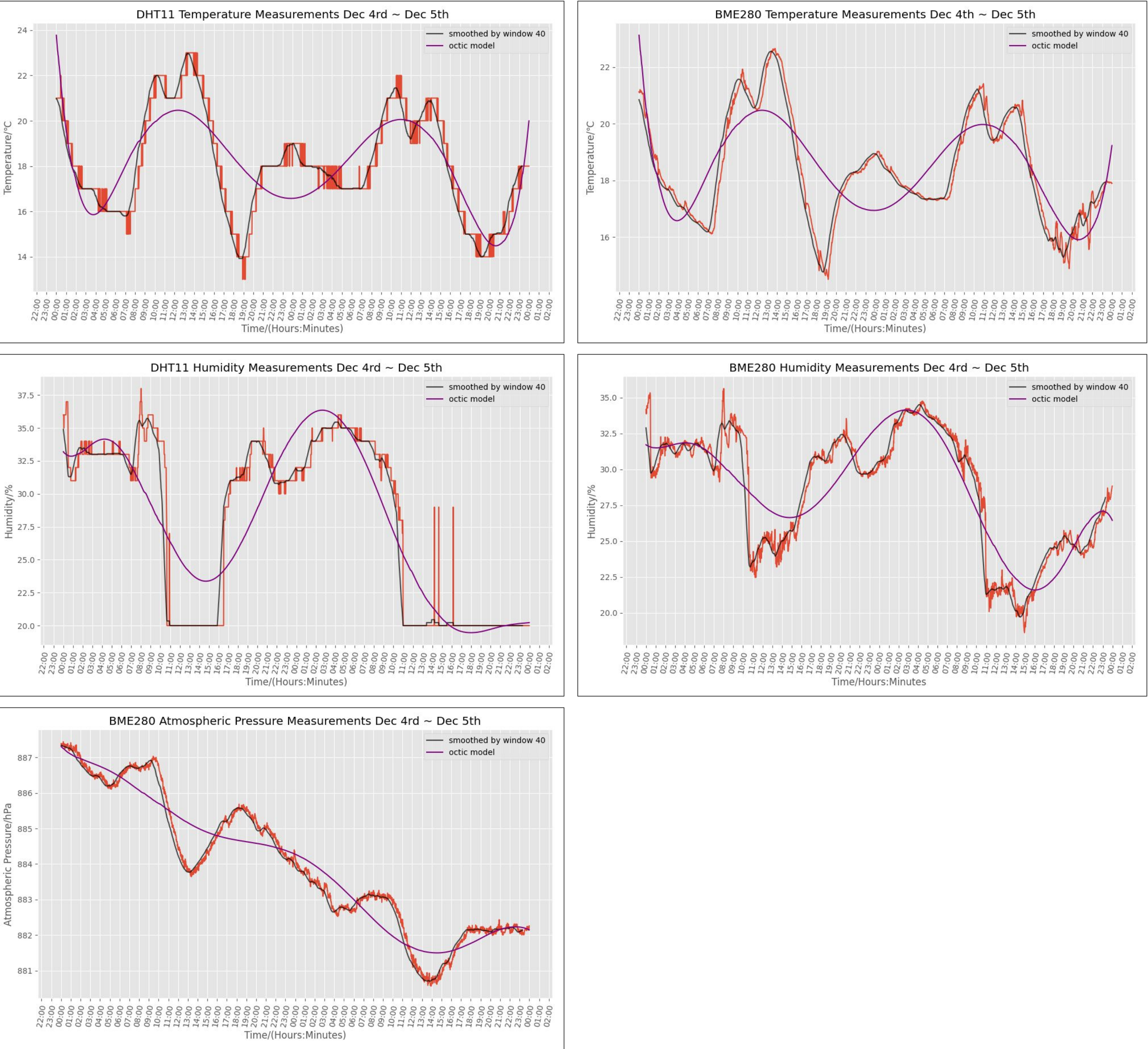


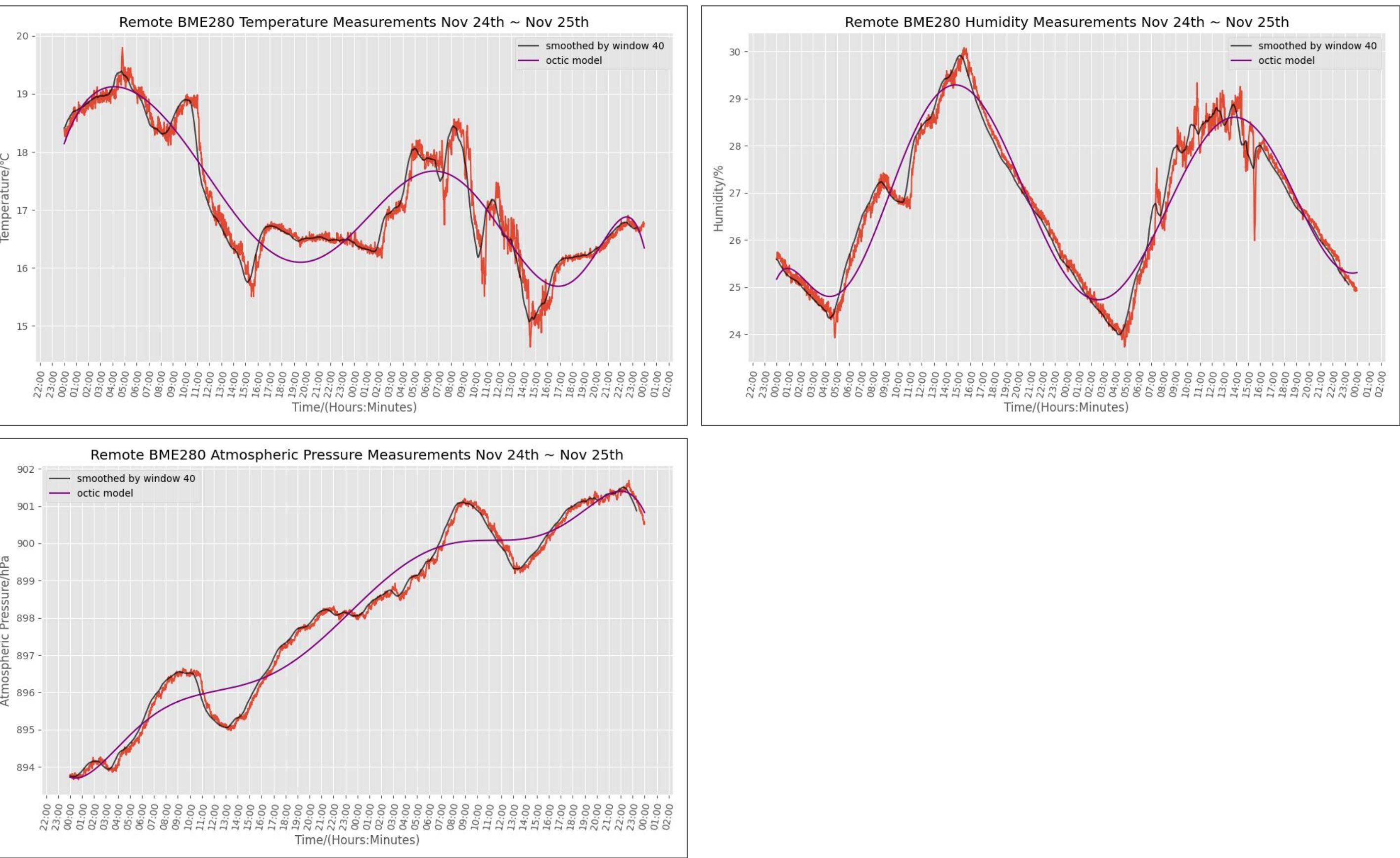
Fig. 3 System diagram (HL+) for the proposed system to visualize and analyze temperature and humidity data in our campus. Physical variables measured with a network of DHT11/BMP280 sensors locally on a Raspberry Pi. A remote server provides and API for remote monitoring and storage (192.162.6.142) via the ISAK-S network. A laptop for remote work is included.

3. Results / Implications

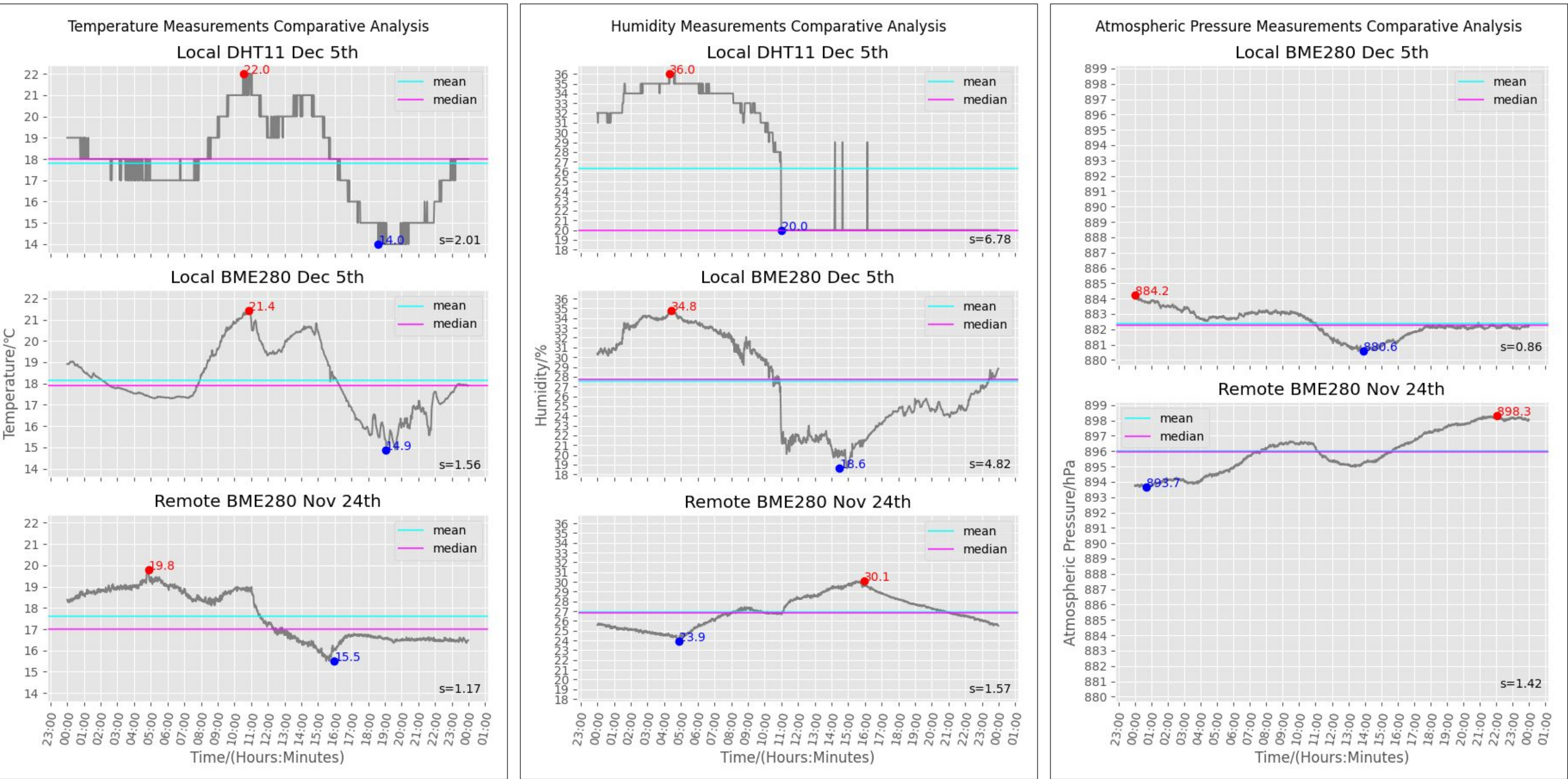
LOCATION 1 (LOCAL: ROOM)



LOCATION 2 (REMOTE: CAMPUS)



COMPARATIVE ANALYSIS (24 HOURS)



- Temperature and humidity values in location 2 are largely less disperse compared to location 1, based on their standard deviation index.
- The mean of the temperature of both locations are nearly equal or less than the minimum temperature required (18°C)
- The mean of the humidity of both locations are approximately 56% of the minimum humidity required (50%)
- Location 1 is negatively air pressured by approximately 10 hPa on average compared to location 2.

4. Conclusion

ISSUE OBSERVED

- The specimen of *Lactuca sativa* is not being cultivated in an environment with suitable temperature: the temperature at the current environment is at approximately 80% of temperature required at both locations.
- The specimen of *Lactuca sativa* is not being cultivated in an environment with suitable humidity: the humidity at the current environment is at approximately 45% of humidity required at both locations.
- The specimen of *Lactuca sativa* is being cultivated in an ideal environment at location 1 with a negative air pressure of approximately 10 h Pa, compared to location 2.

5. Recommendations

POSSIBLE ALTERATIONS TO THE ENVIRONMENTS

1. Always use location 1 to receive the positive impact of negative air pressure.
  2. Increase the general temperature of location 1 by having windows closed as much as possible, and increasing the magnitude of the heating facility.
  3. Increase the general humidity of location 1 by having windows closed as much as possible, and implementing a humidifier.
  4. By doing alterations 2 and 3, dispersion of temperature and humidity should become less intense, which would be beneficial for the maintenance of the environment.
  5. Orchestrate alterations 2 and 3 regularly based on the data and prediction of the Weather Station system. (e.g. fig 5.1, fig 5.2)
- \*Since the tendency in atmospheric pressure shows that the value of location 1 is relatively suitable, absolute prediction is not required.

PREDICTION SAMPLES

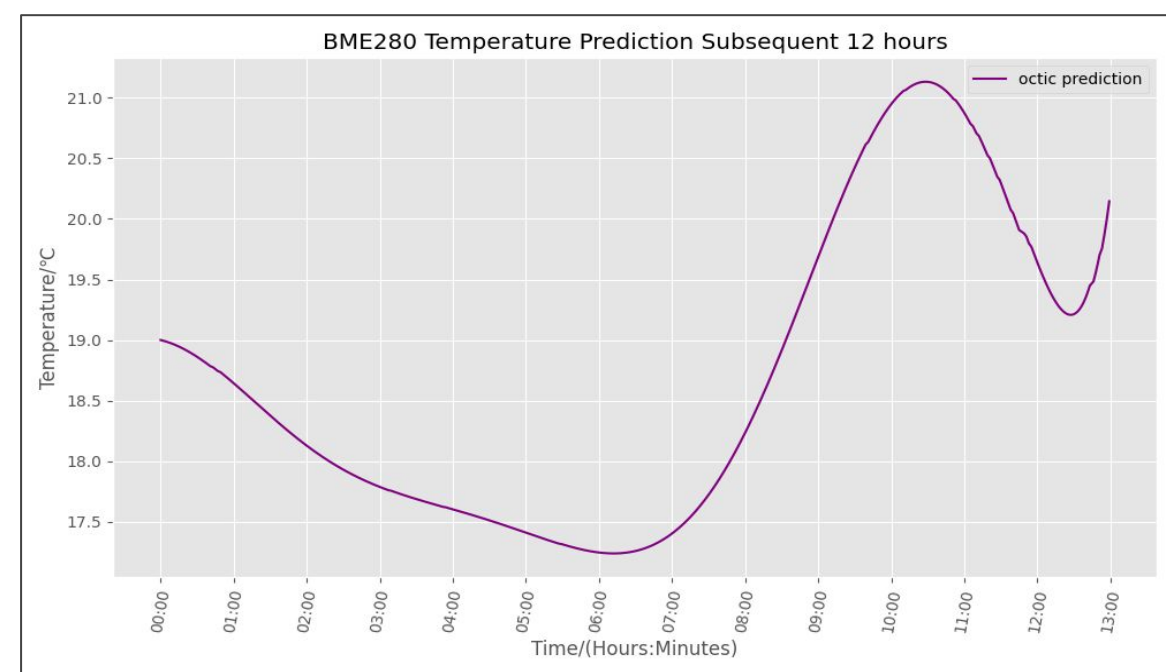


fig 5.1

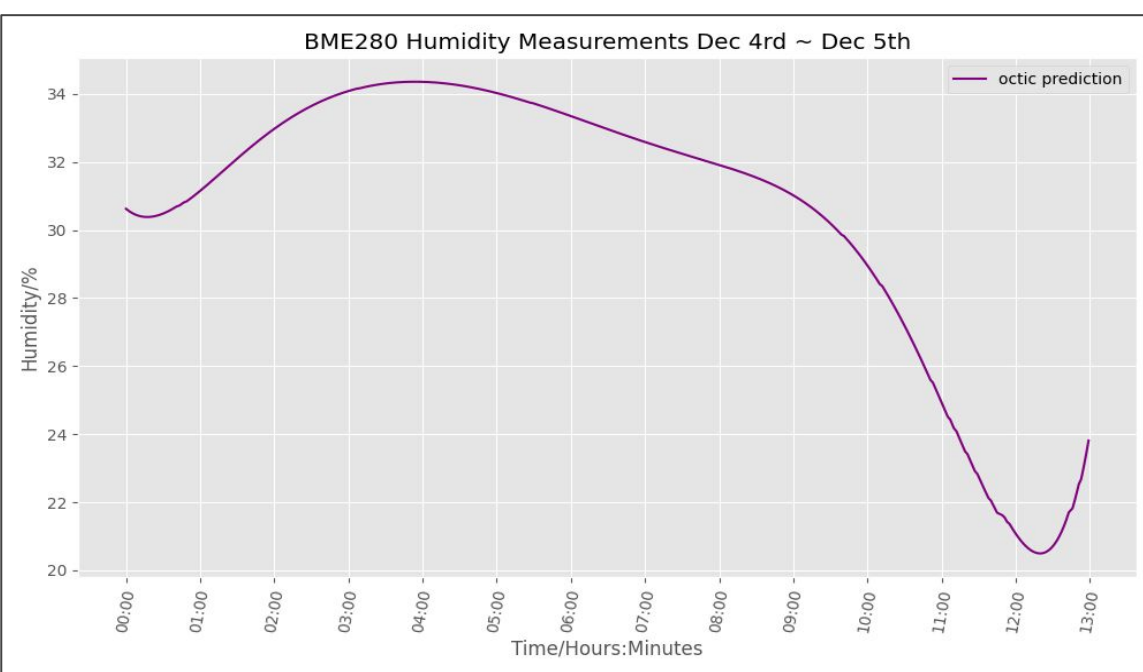


fig 5.2

Citations

1. “Role of Temperature and Humidity in Hydroponic Growth Success”. November 8, 2024. yourhydrogarden.com. [https://www.yourhydrogarden.com/temperature-and-humidity-in-hydroponic-growth/#Key\\_Takeaways](https://www.yourhydrogarden.com/temperature-and-humidity-in-hydroponic-growth/#Key_Takeaways)
2. “Why You Should Always Have Negative Air Pressure in a Hydroponics System”. September 30, 2021. Caliponics. <https://caliponics.co.uk/growing-advice/why-you-should-always-have-negative-air-pressure-in-a-hydroponics-system/>