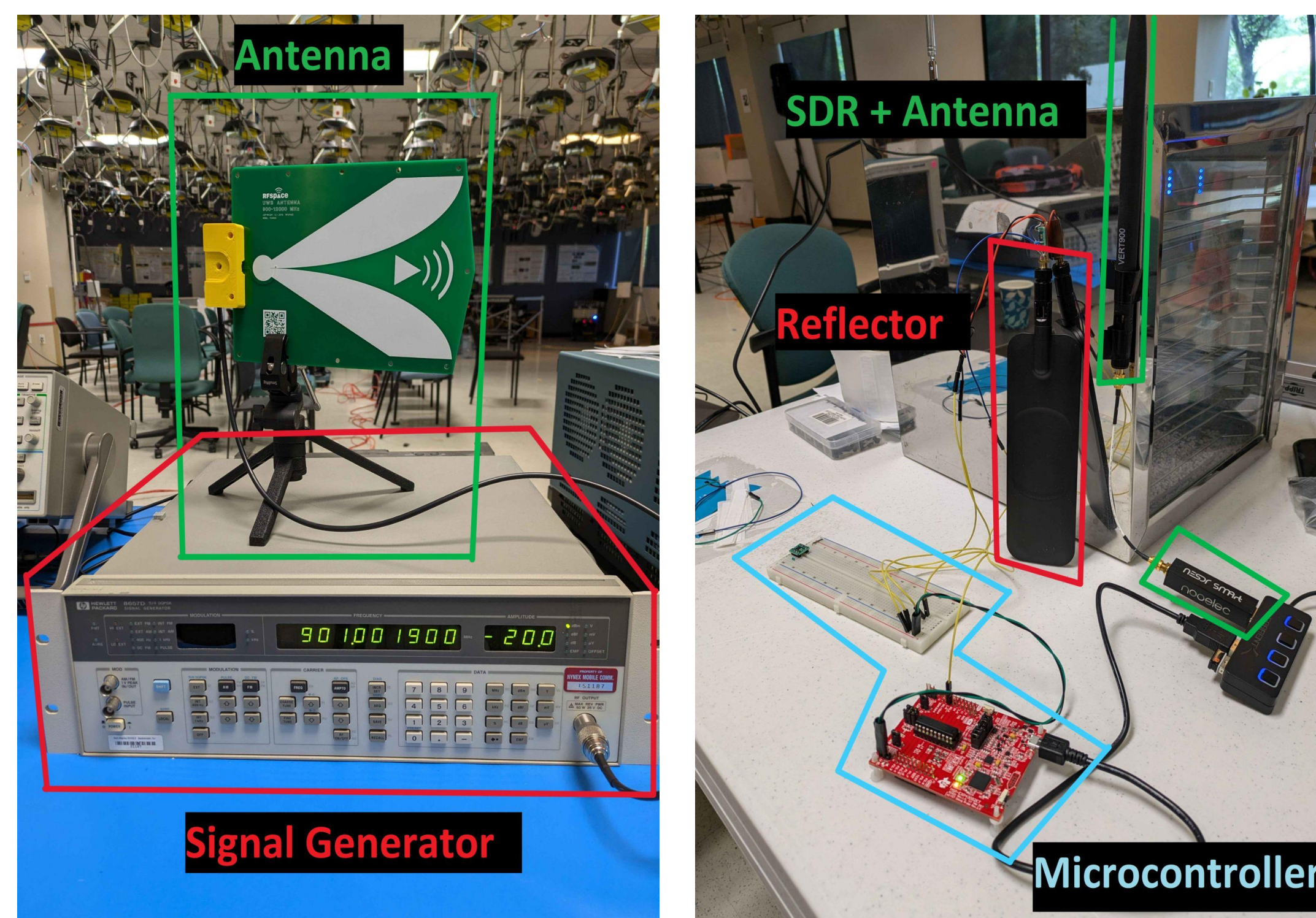
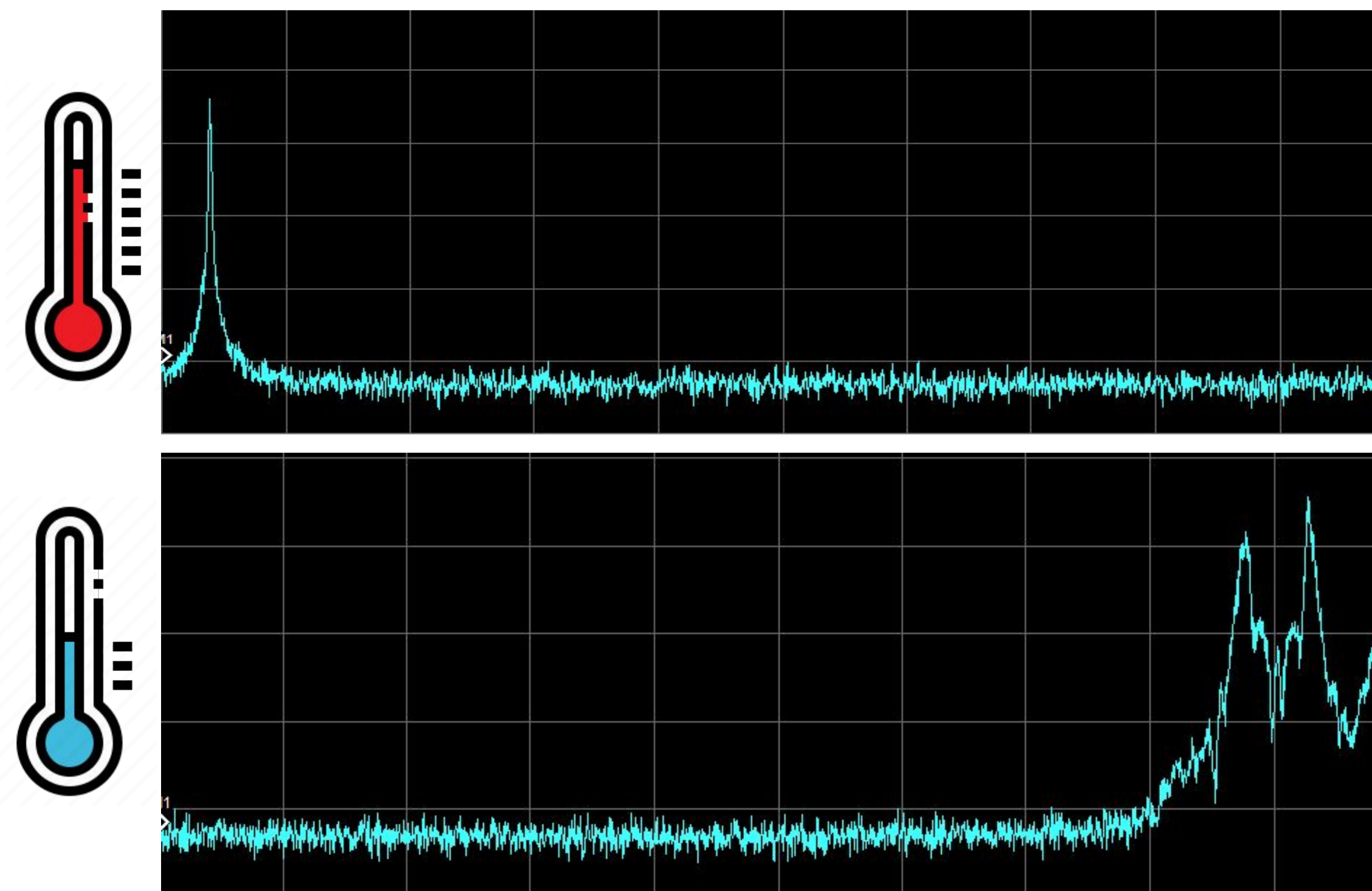
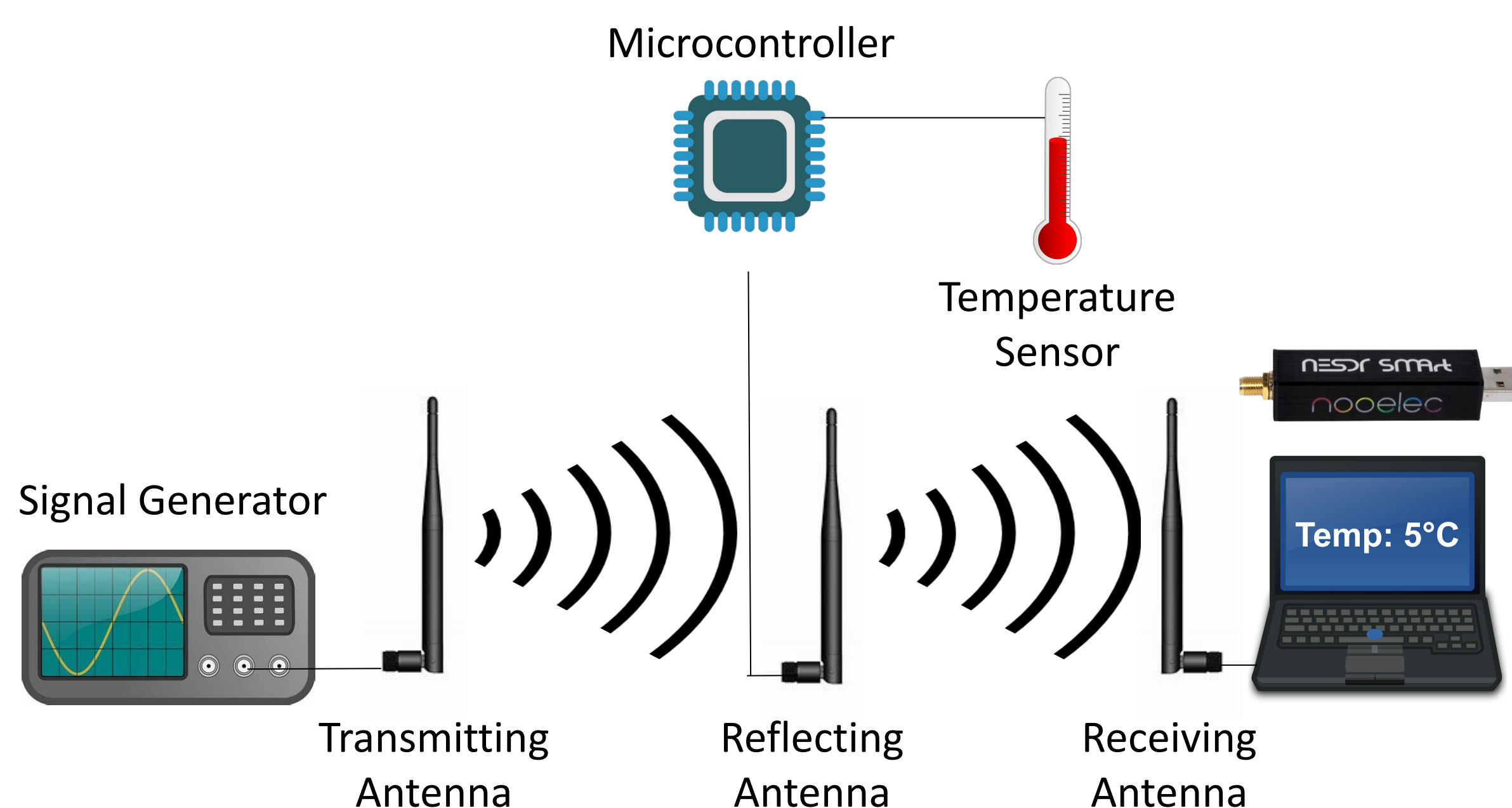


Background

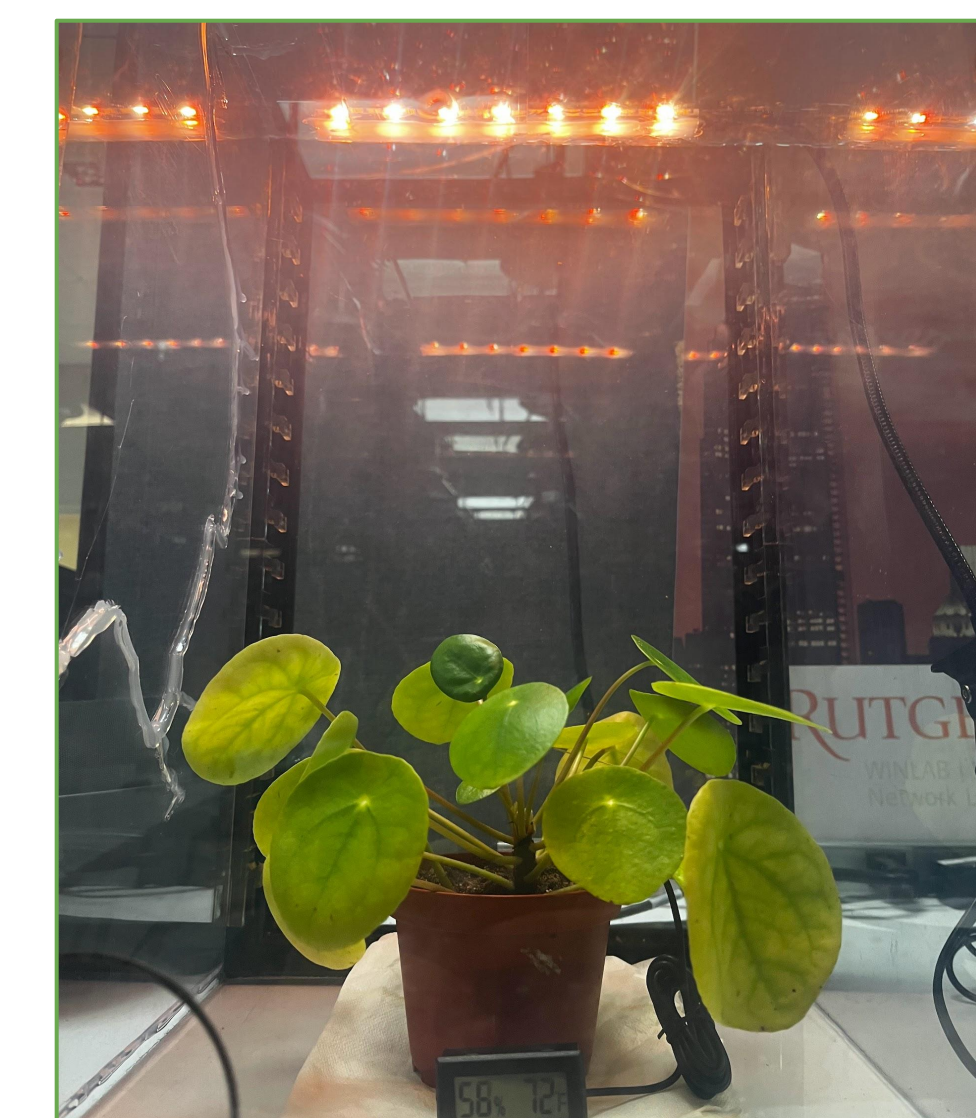
- Backscatter radio, or reflection radio, offers a low-cost and low-power alternative to conventional sensor networks. [1]
- Prior research using capacitance sensors to measure soil moisture showed promising results for agricultural use [2]
- Our group expanded this work to transmit analog plant data using backscatter radio with different sensors

System Overview



Conclusion & Future Work

- Increase detection range by implementing matched filtering which maximizes the signal-to-noise ratio (SNR).
- Create a digital modulation scheme for digital sensors
- Make the low energy sensors batteryless
- Create a larger plant chamber with controls
- Use computer vision to efficiently log data from inexpensive sensors
- Expand scope to measure plant's ultrasonic communications and magnetic fields



Methodology

- Microcontroller collects data from connected temperature sensors
- Microcontroller uses sensor data to change the frequency of an antenna
- 900MHz signals reflect off of the antenna and change frequency (backscattering)
- Estimates backscatter frequency with periodogram
- Interpolates temperature based on backscatter frequency
- Created a plexiglass chamber with grow lights, humidity sensors, and a temperature controller

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References

- [1] A. Bletsas, P. N. Alevizos and G. Vougioukas, "The Art of Signal Processing in Backscatter Radio for μ W (or Less) Internet of Things: Intelligent Signal Processing and Backscatter Radio Enabling Batteryless Connectivity," in IEEE Signal Processing Magazine, vol. 35, no. 5, pp. 28-40, Sept. 2018
- [2] S. -N. Daskalakis, S. D. Assimonis, E. Kampianakis and A. Bletsas, "Soil Moisture Scatter Radio Networking With Low Power," in IEEE Transactions on Microwave Theory and Techniques, vol. 64, no. 7, pp. 2338-2346, July 2016

