IoT Network
BioDesign Center

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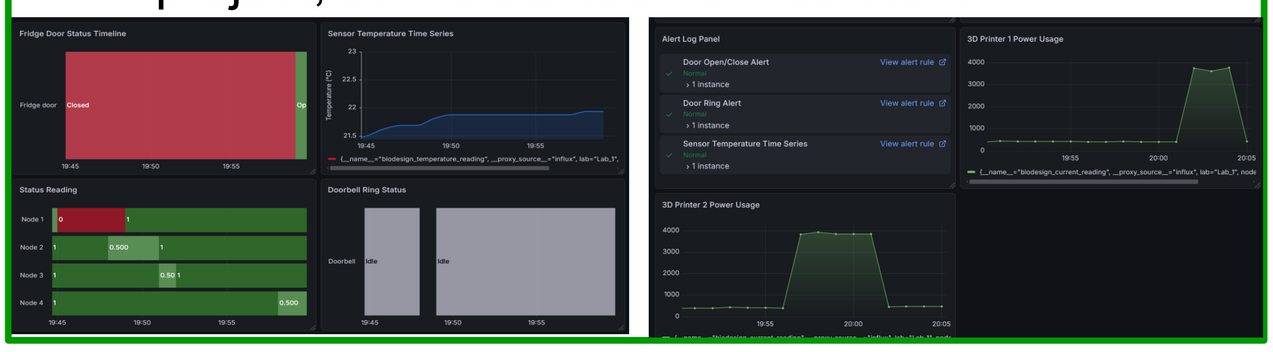
UT Southwestern Medical Center

Partner Description

- **The UT Southwestern Medical Center's BioDesign Center**, managed by our project partner Michael Kraft, aims to provide fabrication and design services to researchers and foster medical innovations to improve patient care.[1]
- It houses specialized laboratory equipment that requires monitoring to ensure operational efficiency.
- **Issue:** Currently, lab personnel must manually check the status of these devices, which is time-consuming and leaves the lab vulnerable to unnoticed equipment failures outside of working hours.

Project Description

- **Objective:** For this project we created an IoT network to monitor equipment remotely from a dashboard.
- **Goals:** The primary goal was to develop scalable sensor nodes that transmit critical lab equipment data over a LoRa network to a centralized Grafana dashboard for real time monitoring and automated alerting.
- Past Work: This is the first semester of this project, so we started from scratch.

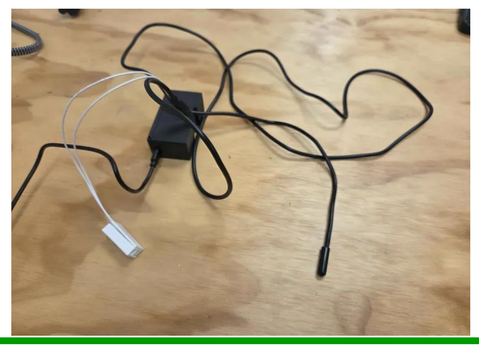


Impact

- **Easy equipment monitoring:** Automates equipment tracking by sending live sensor data directly to a centralized dashboard. Lab personnel can now quickly and securely monitor critical BioDesign Center devices from anywhere, eliminating the need for manual checks. Email notifications allow for simpler device tracking.
- **Scalability:** The flexible LoRa communication protocol and structured data payloads create a robust foundation. Future teams can easily integrate new types of sensors and expand the network to additional labs without redesigning the core system architecture.

Semester Accomplishments

- **Fridge Sensor:** Created a circuit to detect temperature changes and whether the door is open or closed. This was created using an ambient DS18B20 temperature sensor, and a Magnetic switch sensor for the door.
- **Doorbell Sensor:** Built a circuit to detect when a doorbell rings. This was done using a TSL2591 light sensor to detect the light emitted from the doorbell when rang.
- **IoT connections between sensors:** The sensors send their data to a receiver through LoRa communication. This was done using Adafruit feather RP2040 microcontrollers with a RFM95 LoRa radio.
- **Local Server:** Created a local server to gather the data from the given to the receiver and send it to the dashboard, as well as flash any new nodes.
- **Grafana Cloud Dashboard:** Created a dashboard to display the data collected from the various sensors. Set up different panels with time series graphs, alert logs, and status readings to visualize the data.





Future Work

Future work will focus on live testing the sensor network in the clinical environment and scaling the system architecture to monitor specialized equipment across multiple BioDesign labs.

References

[1] UT Southwestern Medical Center. (2024). Biomedical Engineering. https://www.utsouthwestern.edu/departments/biomedical-engineering/