Dwight Look College of ENGINEERING
TEXAS A&M UNIVERSITY

Team 0: Growable Space Habitat

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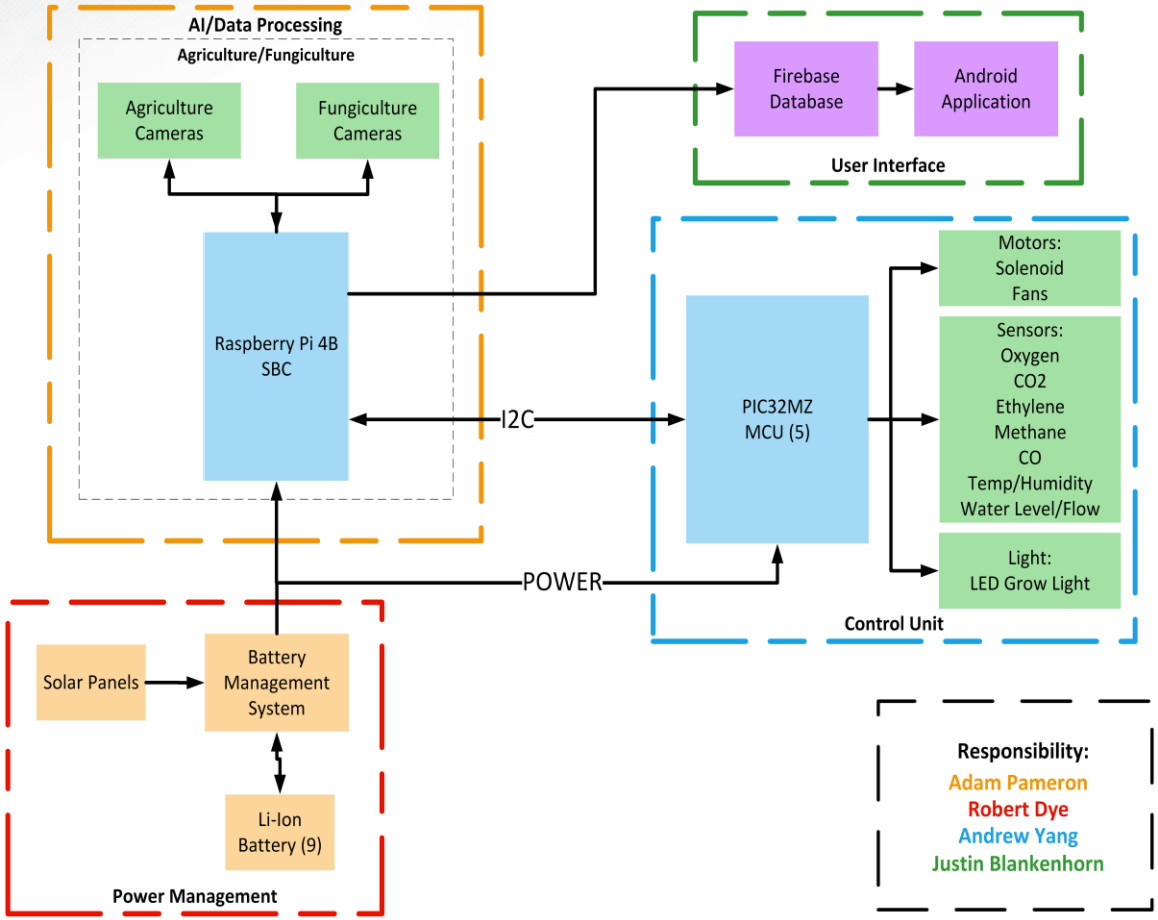
Adam Pameron

Sponsor: Dr. John Lusher II, Dr. Hope Rising
TA: Rohith Kumar

Project Summary

- Current space operations require constant resupply
  - Costly ($20,000 per kg)
  - Inefficient and wasteful
- Long term space missions need a sustainable food source
- Project provides electrical infrastructure for a self-sustaining system capable of recycling agricultural products

Project/Subsystem Overview



Major Project Changes Since Last Time

Power Management:

- None

User Interface:

- None

AI/Data Processing:

- None

Microcontroller:

- None

AI/Data Processing Subsystem

Adam Pameron

- Create binary classifier using Convolutional Neural Network (CNN) Model
  - Baby Spinach
- Collect sensor data from 5 microcontrollers
- Send sensor data to database

AI/Data Processing Subsystem

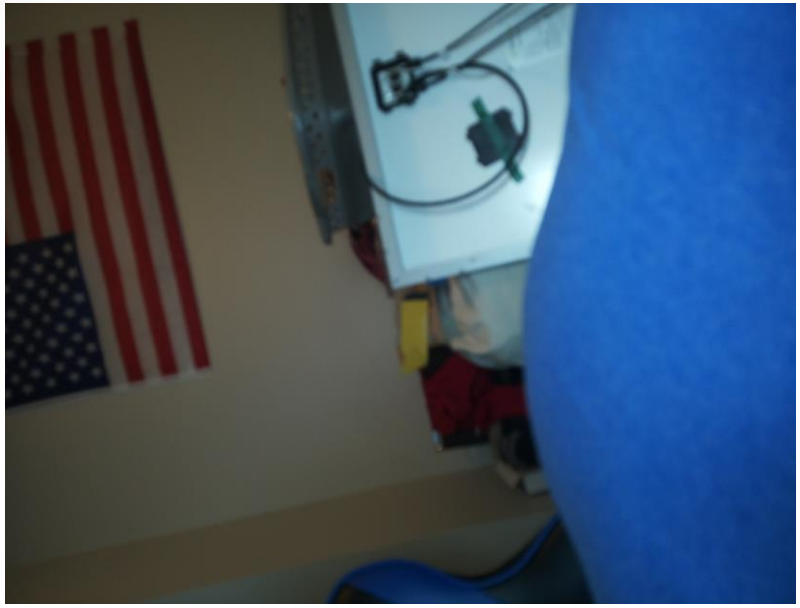
Adam Pameron

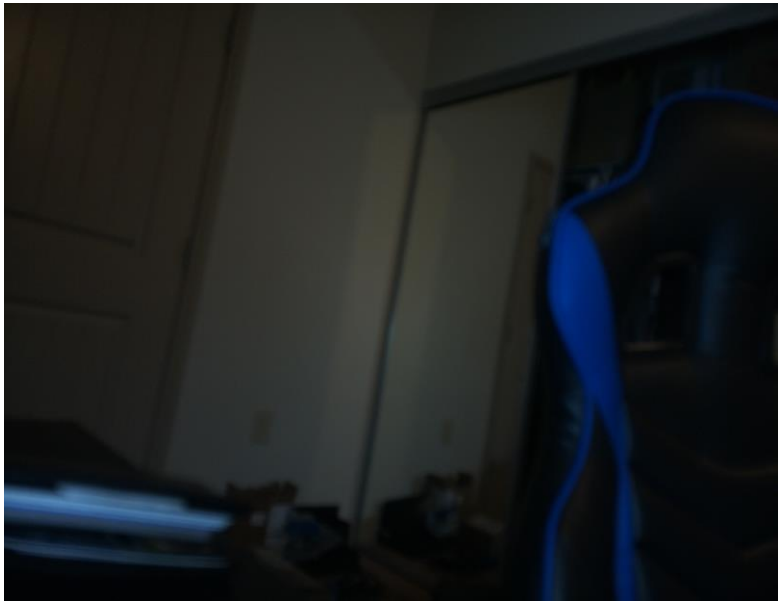
Accomplishments since last presentation	Ongoing progress/problems and plans until the next presentation

• Perform Stratified Cross Validation with augmented RGB Dataset
  • Vertical Flip
  • Gaussian Noise
  • Blur
  • Shearing
• Isolated each cameras to take photos at an interval period
• Built application code to repeat routines (classify, send image and state)
	• Interfacing with microcontrollers using serial communication to request data, and validate all sensors data is collected and accurate

AI/Data Processing Subsystem – Camera 1 and Camera 2 Photos

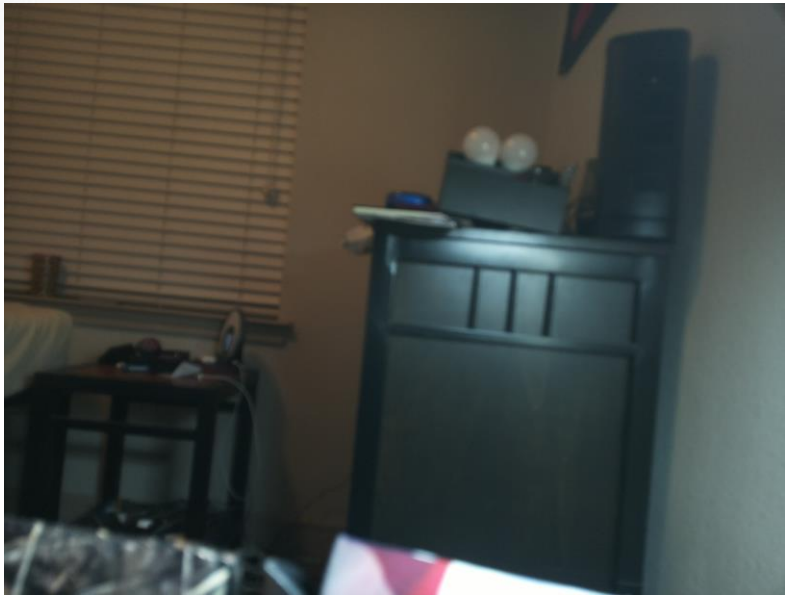
Adam Pameron

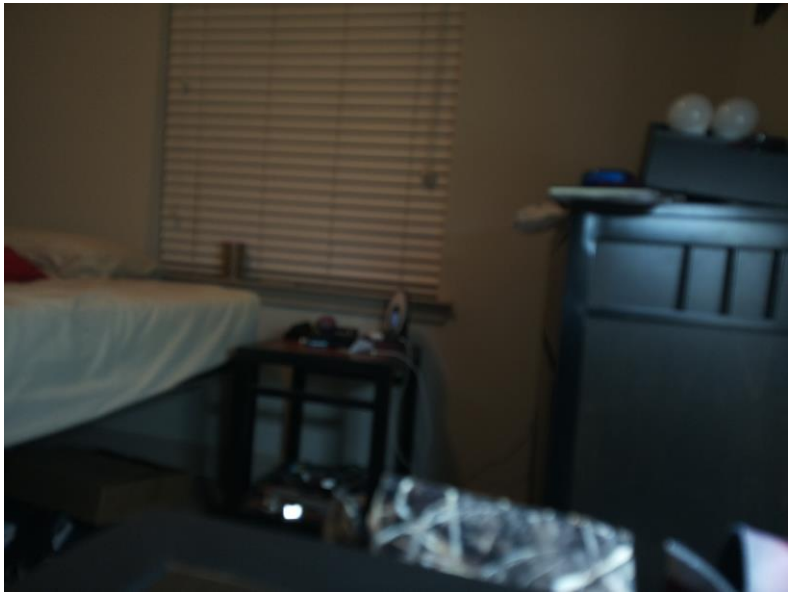




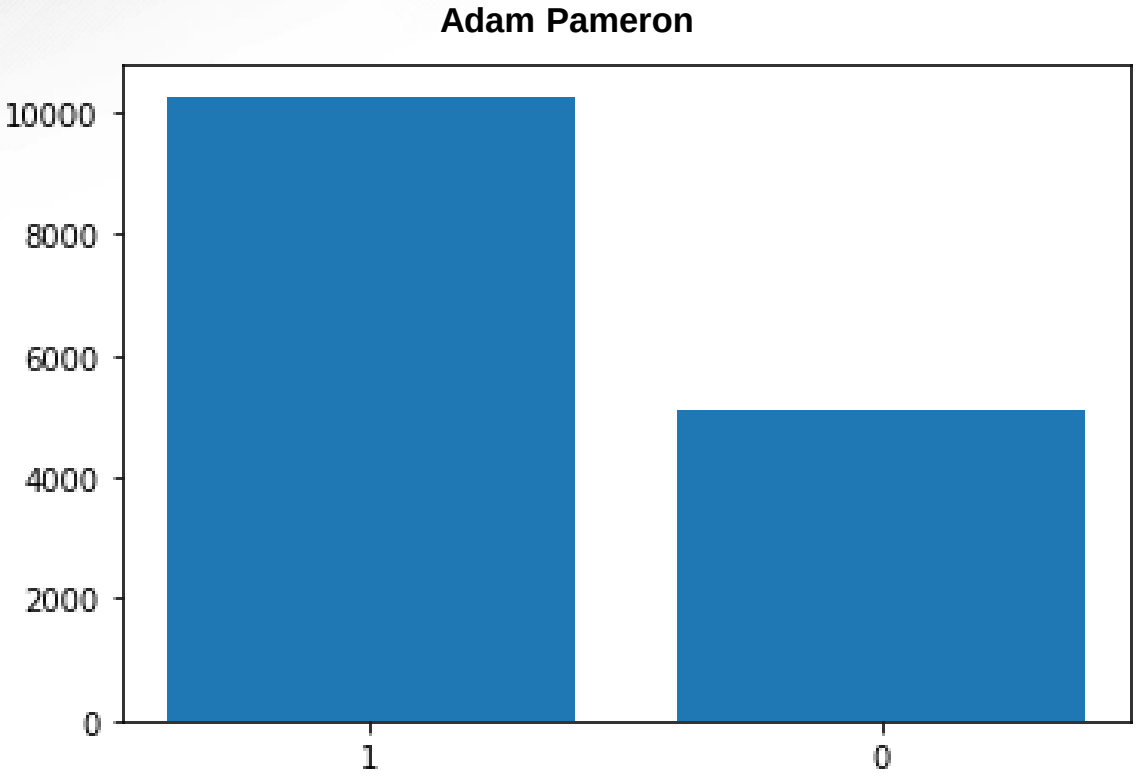
AI/Data Processing Subsystem – Camera 3 and Camera 4 Photos

Adam Pameron





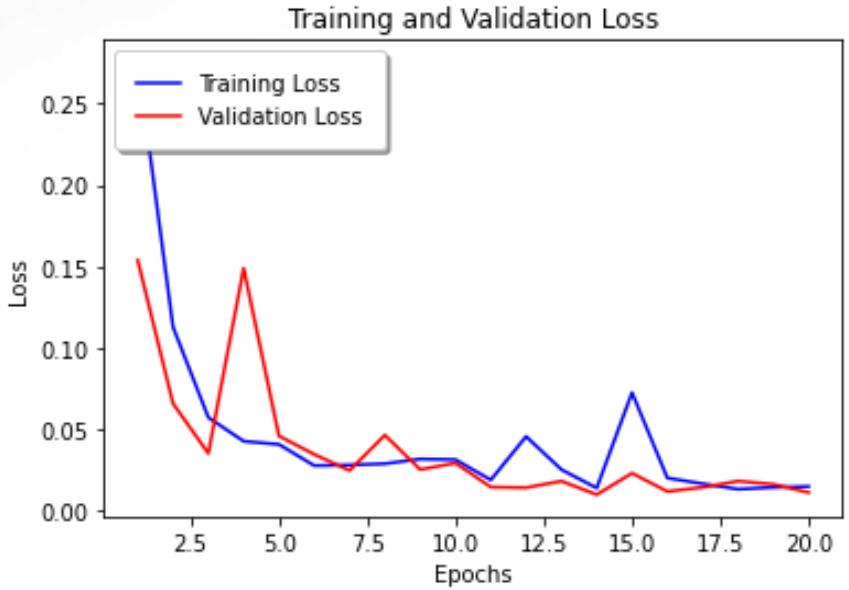
AI/Data Processing Subsystem - Total Size of Dataset

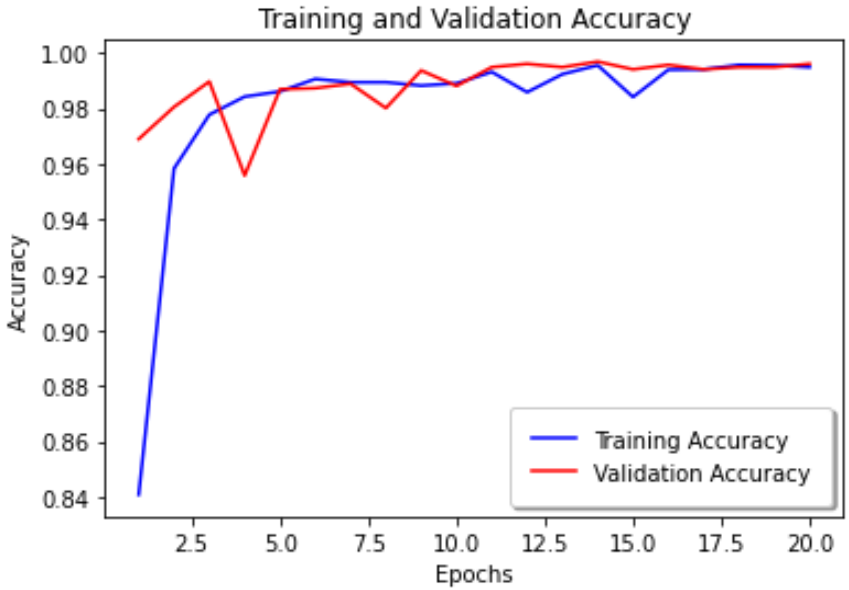


Healthy Set [0]: 5,084
Yellow Leaf Curl Set [1]: 10,264
Total Number of Images: 15,348

AI/Data Processing Subsystem – with Gaussian Noise

Adam Pameron





AI/Data Processing Subsystem – with Gaussian Noise

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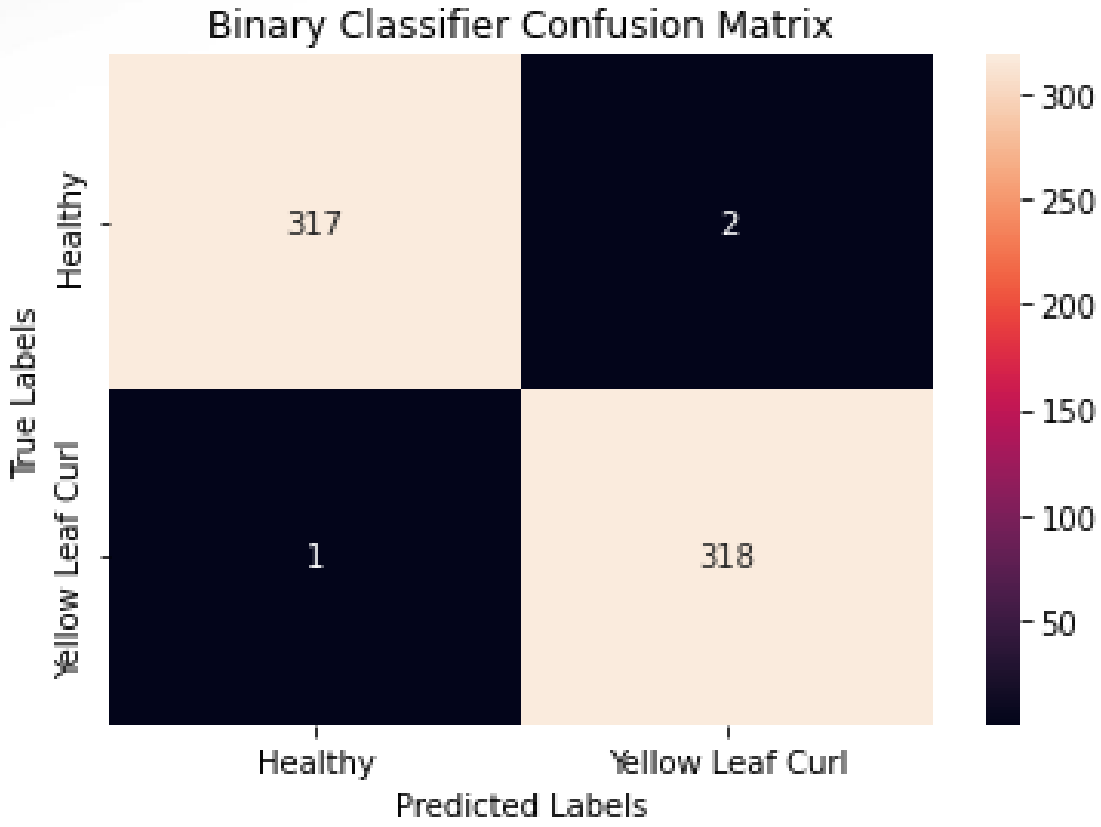


Power Management

Robert Dye

- Provide power to PCBs that house the microcontrollers as well as the pi that will be used to control AI subsystem
- BMS monitoring
- Charging

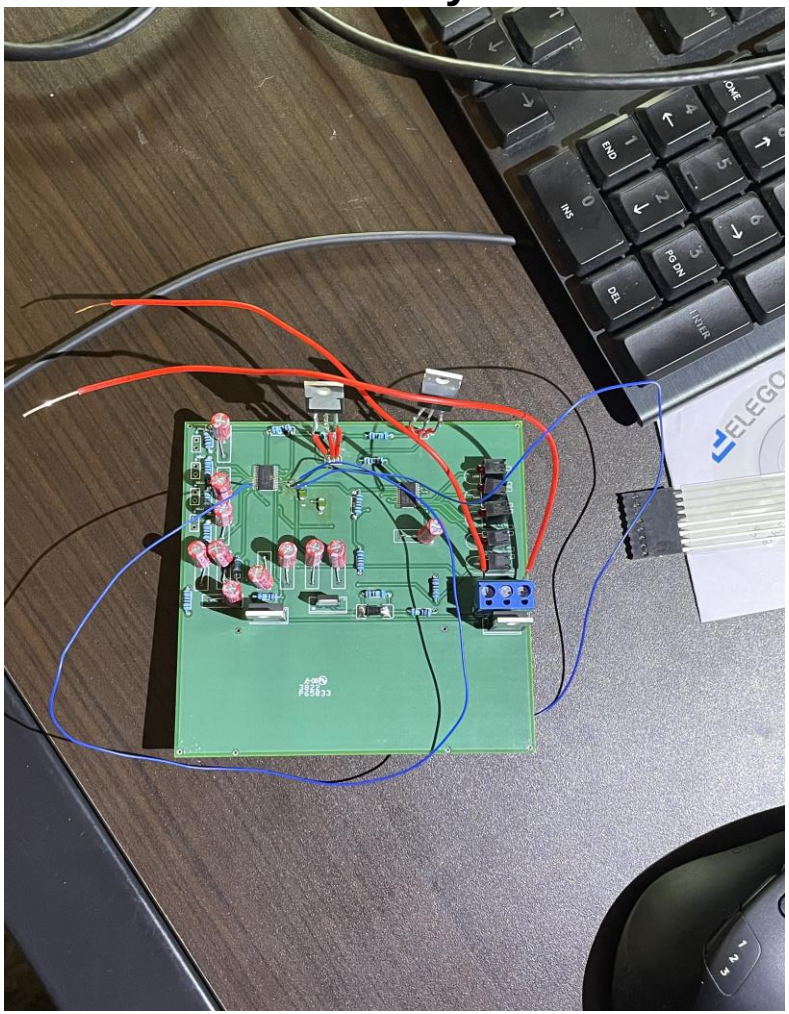
Power Management

Robert Dye

Accomplishments since last presentation	Ongoing progress/problems and plans until the next presentation
• Soldered all components • Powered MCU Subsystem • Powered AI/Data Processing Subsystem • Designed, Routed all 4 analog sensor circuits	• Keep performing testing on the BMS • Code monitoring chips with BQ Studio

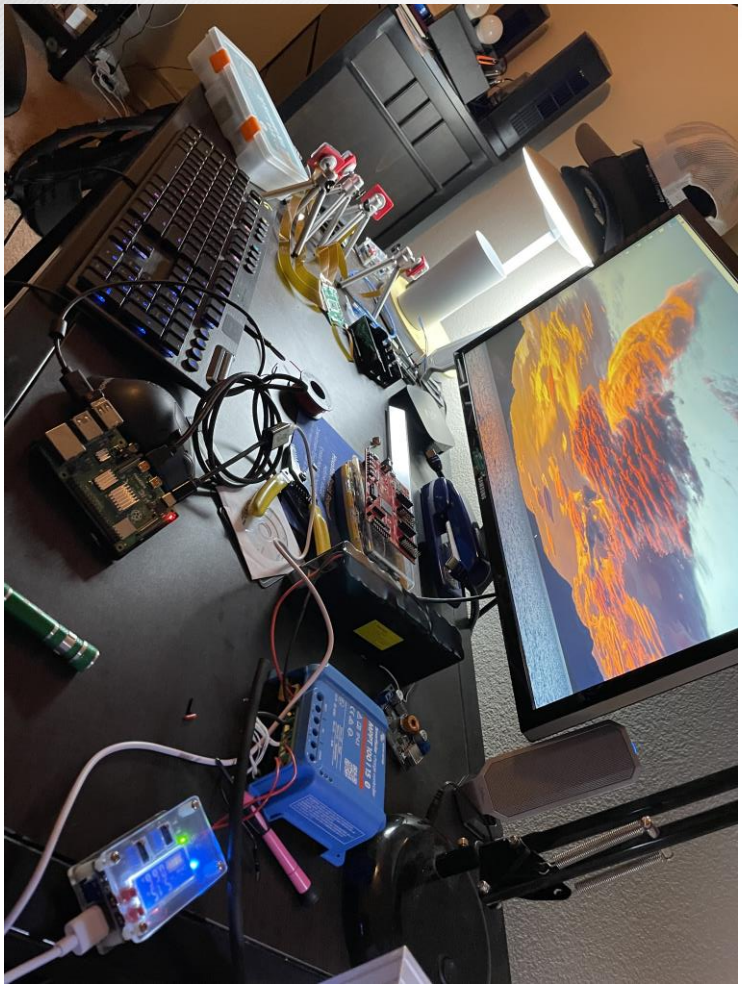
Power Management

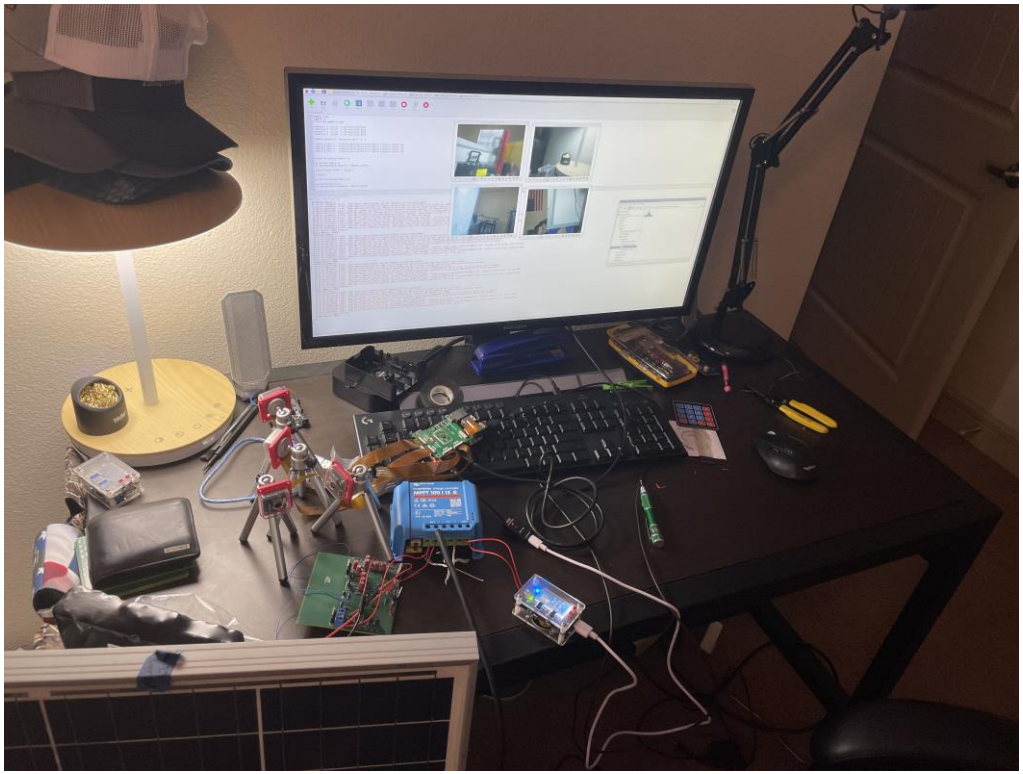
Robert Dye



Power Management

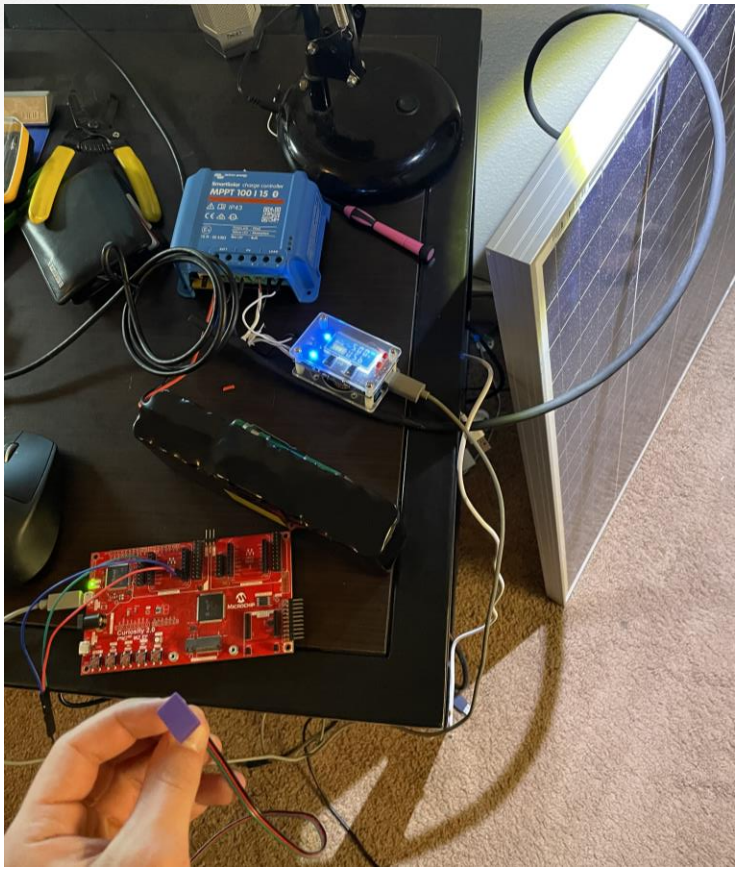
Robert Dye

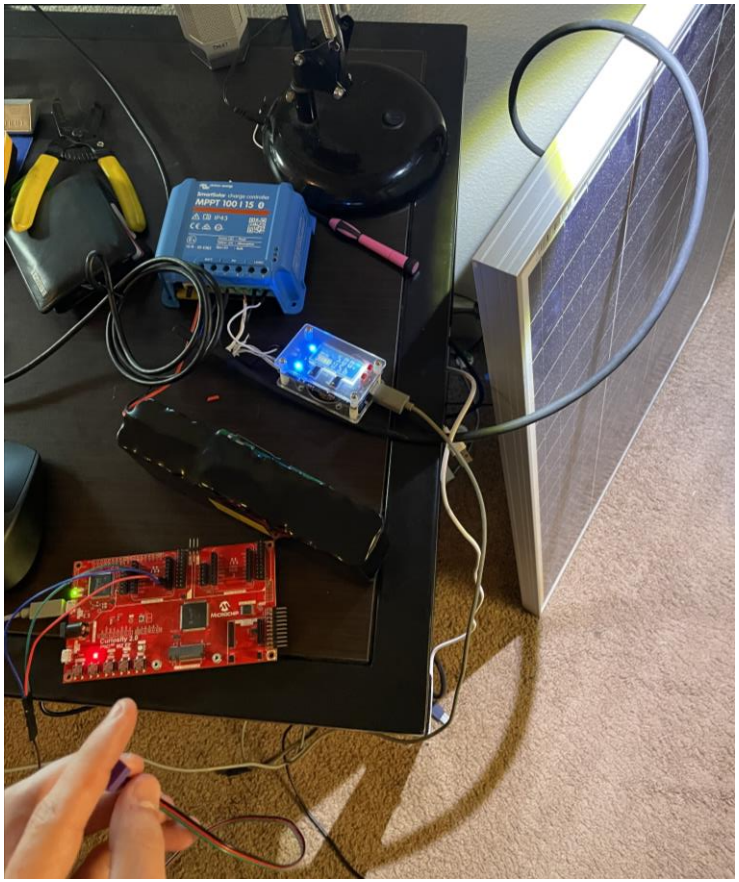




Power Management

Robert Dye





Microcontroller

Andrew Yang

- 200 Peripherals modularized between 5 microcontrollers
- 20 Oxygen, 20 CO2, 20 NO2, 20 Methane, 20 Ethylene, 20 Carbon monoxide, 12 Temp/Humidity, 4 water level, 4 water flow sensors
- 9 types of sensors using I2C, UART, Analog, or digital communication
- 38 solenoids and 26 fans controlled using GPIO + switching circuit

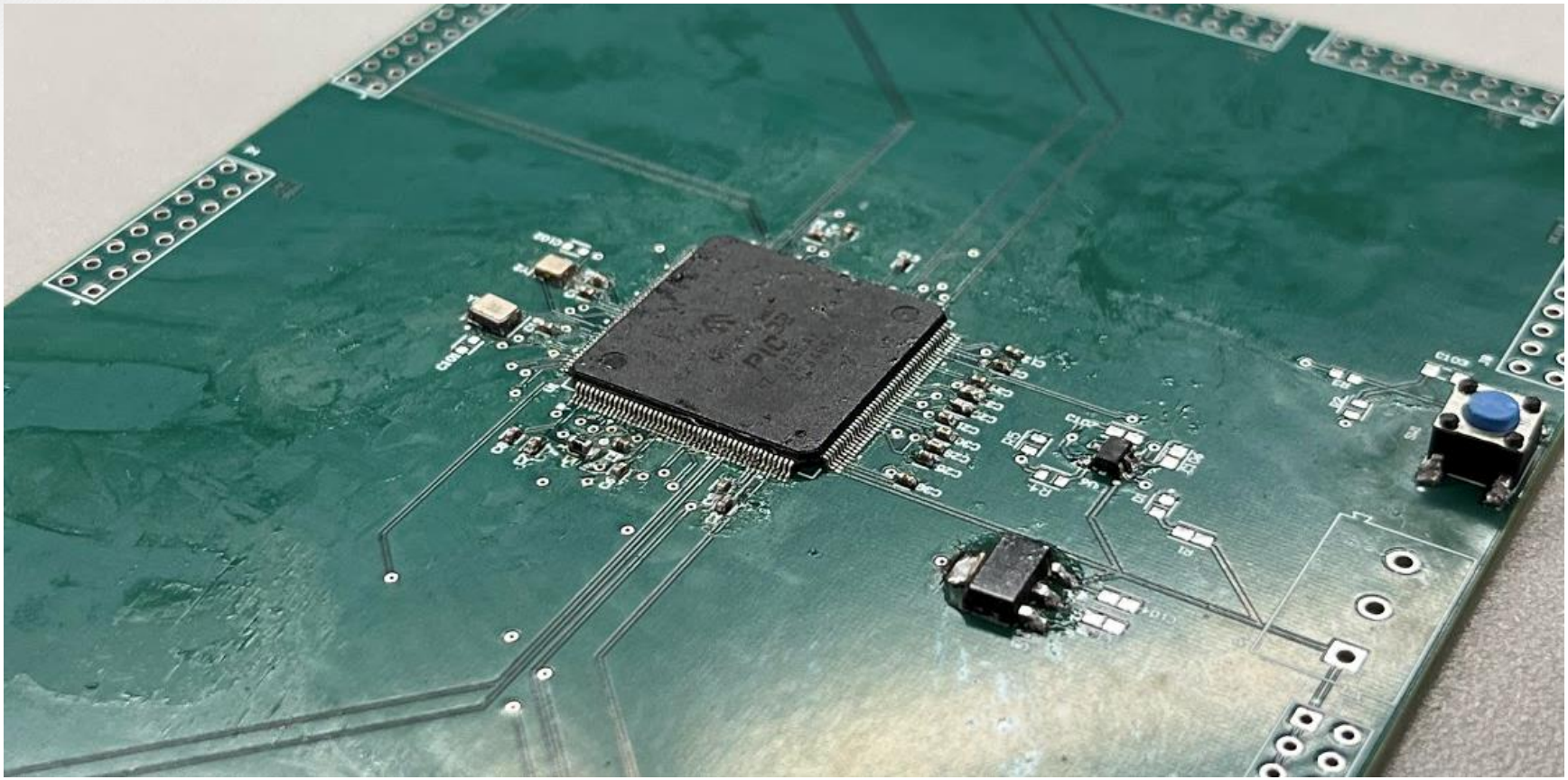
Microcontroller

Andrew Yang

Accomplishments since last presentation	Ongoing progress/problems and plans until the next presentation
• Verified Water Level Sensor operation • Designed Analog Sensor circuits • Soldered over half of all components for the MCU	• Verify Temperature/Humidity I2C sensor operation • Verify UART sensor operation • Implement PWM logic for water flow sensor • Design I2C multiplexer circuit for fan and solenoid switching

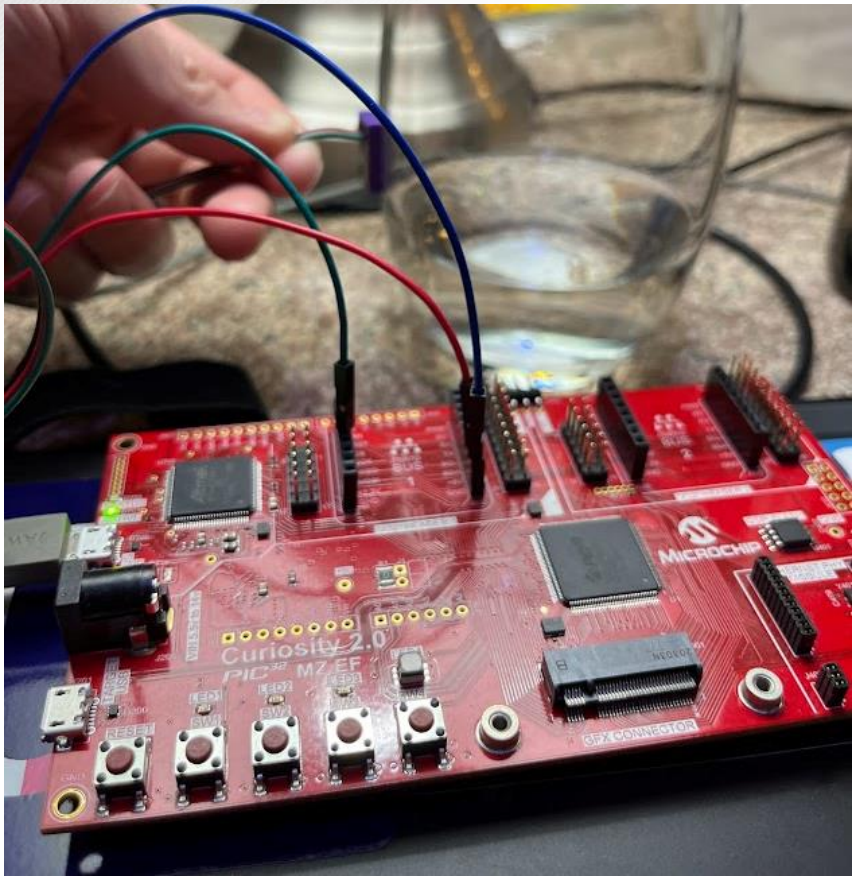
Microcontroller

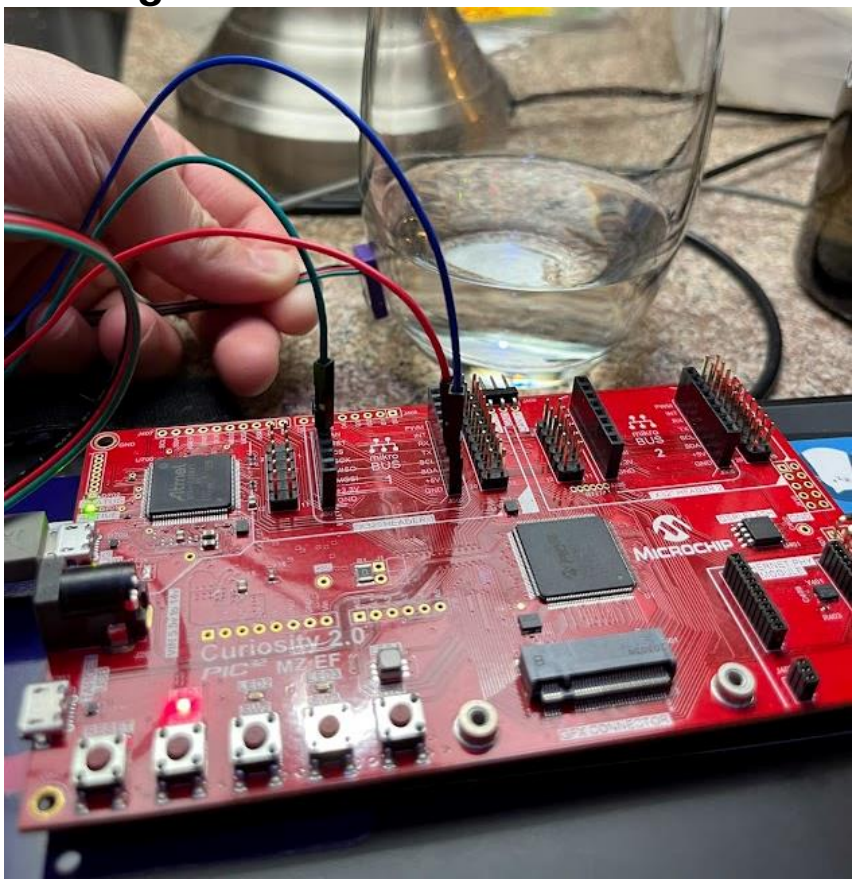
Andrew Yang



Microcontroller

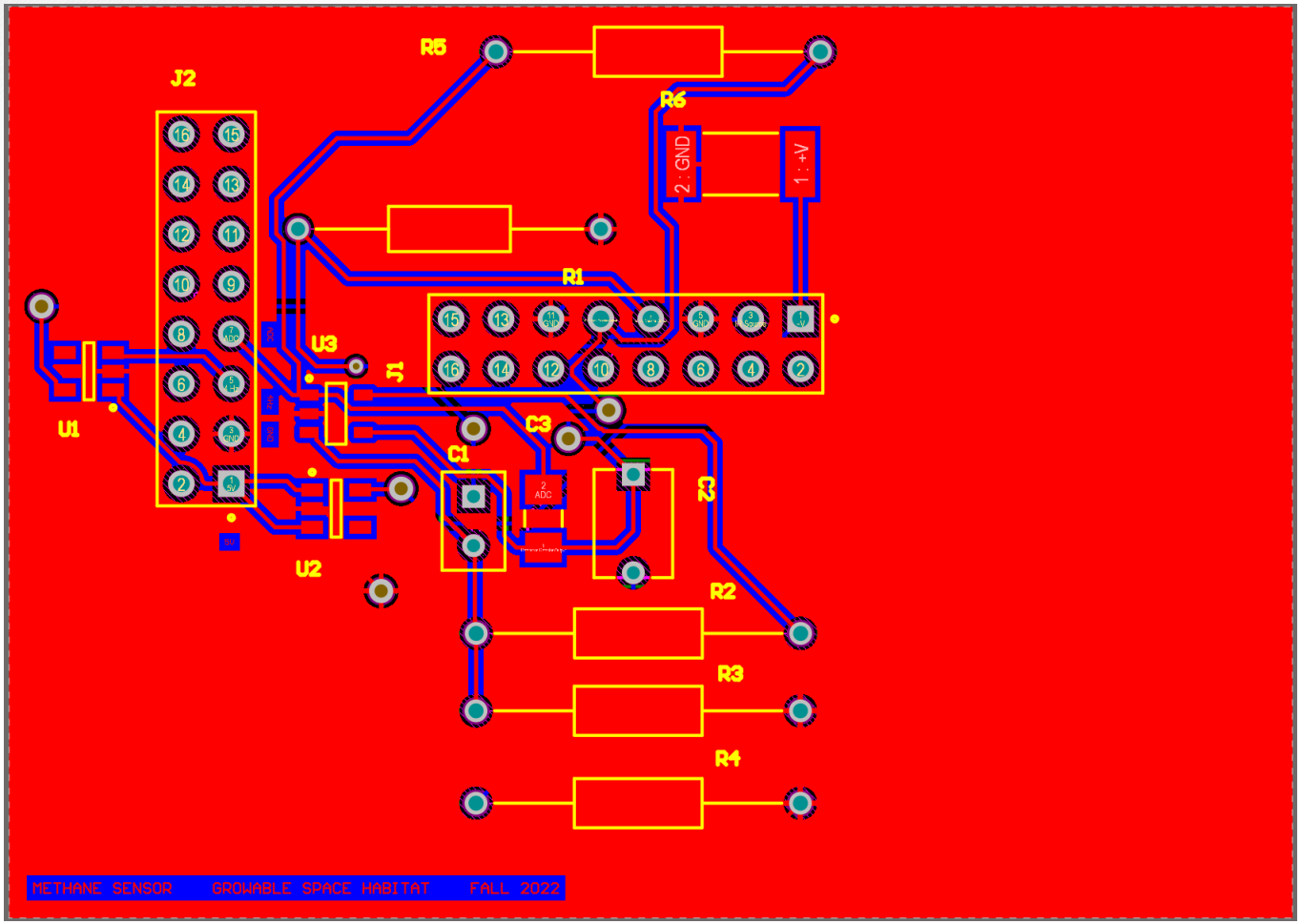
Andrew Yang





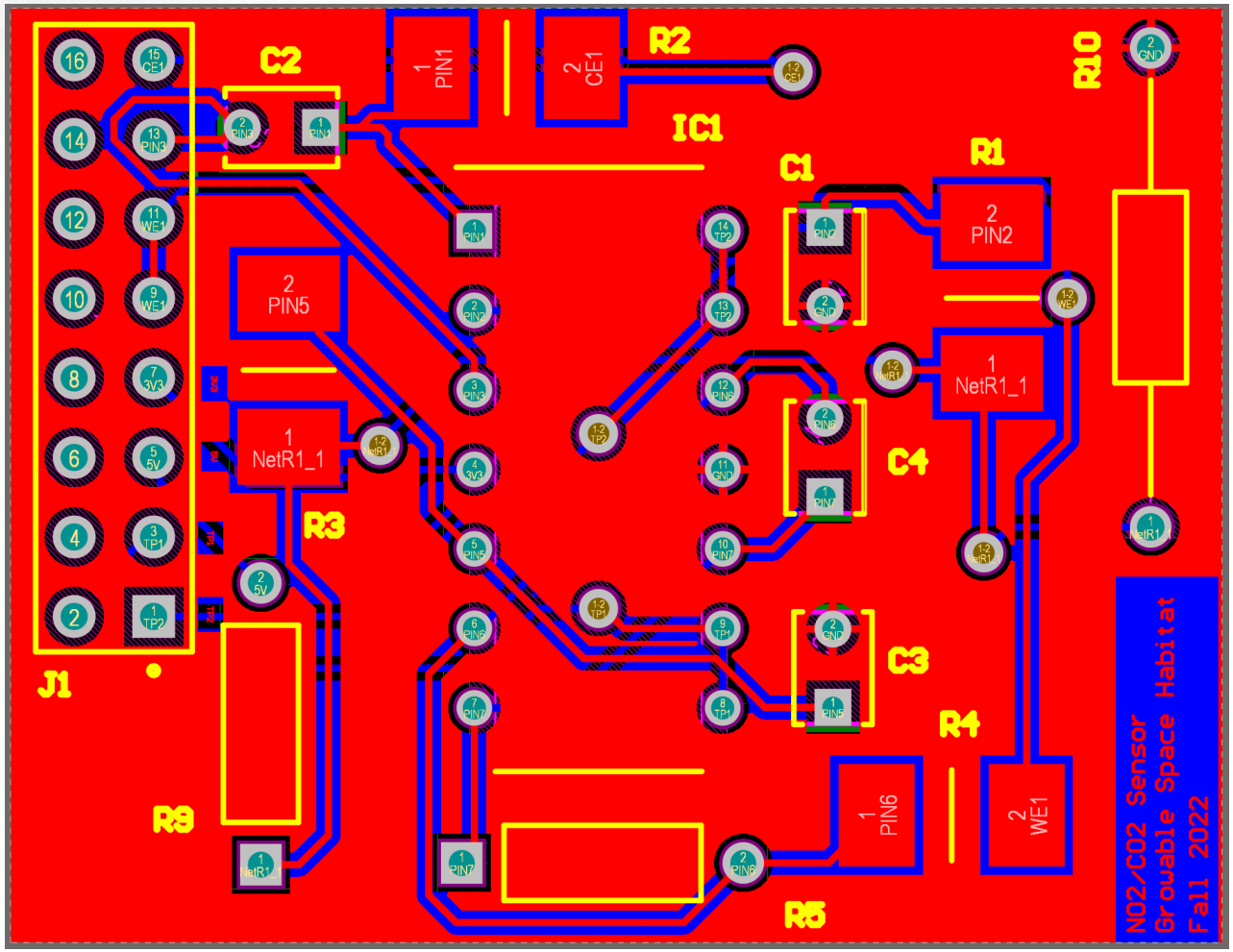
Microcontroller

Andrew Yang



Microcontroller

Andrew Yang



Microcontroller

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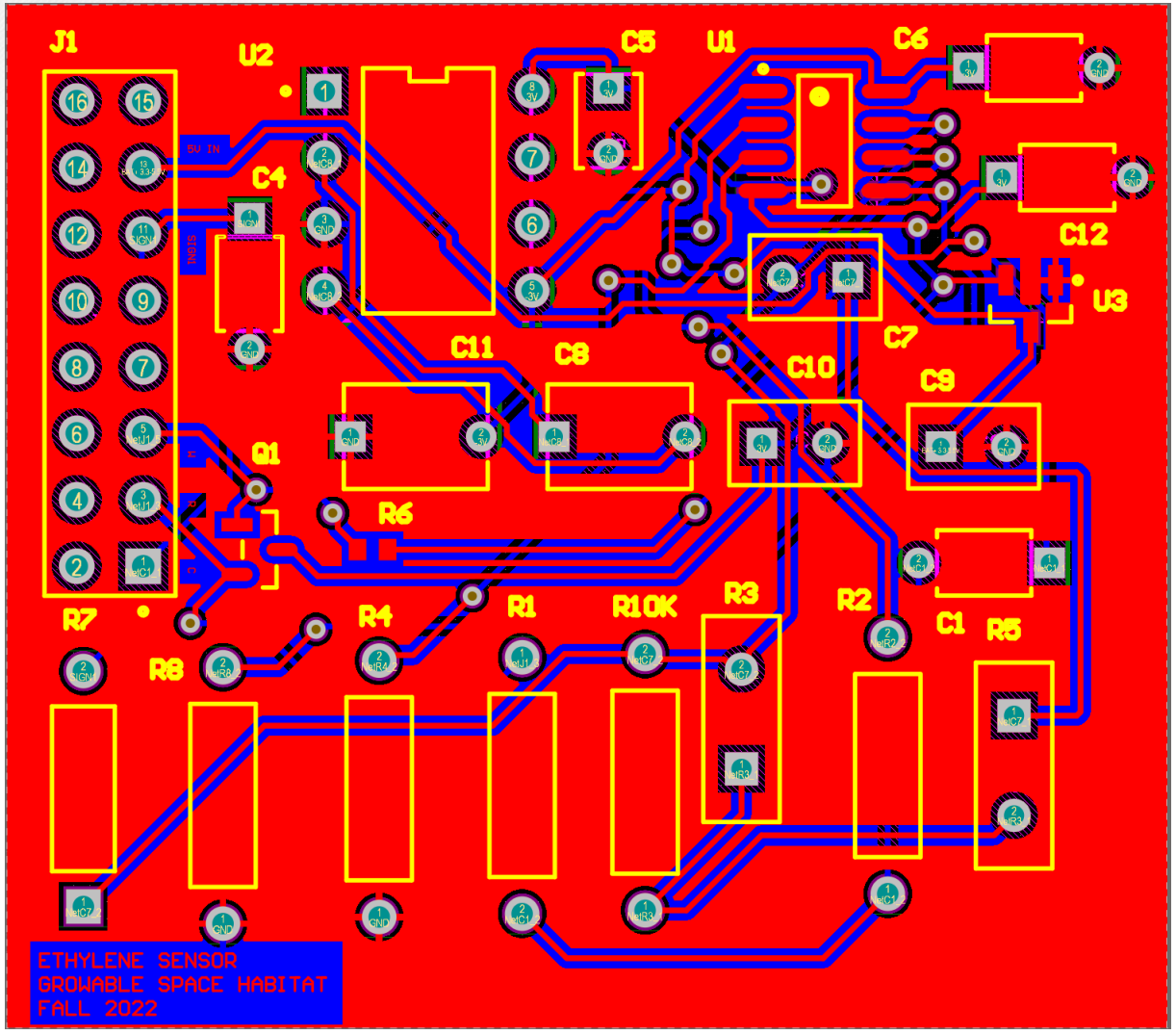


User Interface

- Display Data from MCU sensors on app
- Visualize sensor values over time
- Display camera pictures on app

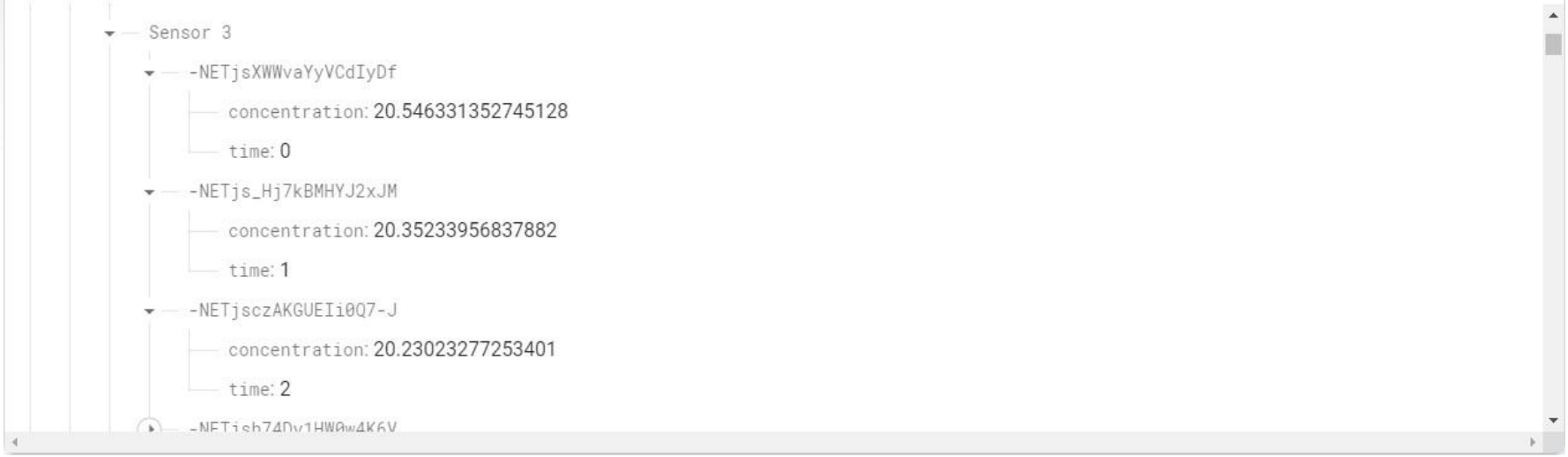
User Interface

Justin Blankenhorn

Accomplishments since last presentation	Ongoing progress/problems and plans until the next presentation
• Created Graphs for all sensors • Differentiated graphs between Second + Minutes • Included Axis's and scroll view for graph	• Improve formatting on graphs, • Help on other subsystems

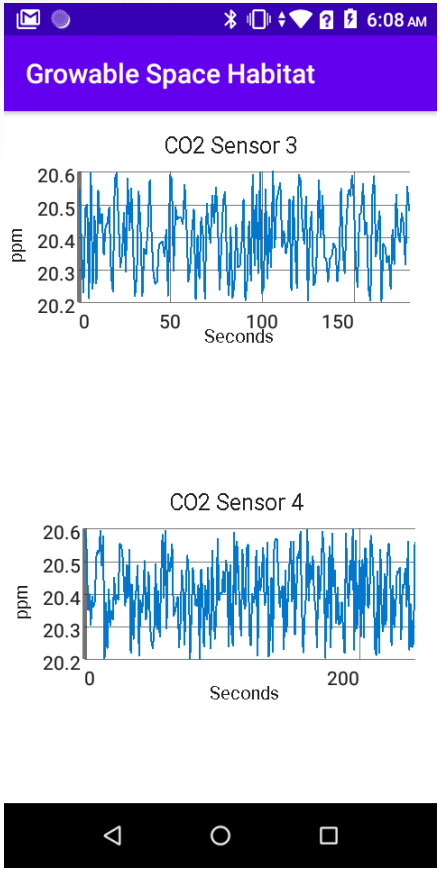
https://growable-space-habitat-default-rtdb.firebaseio.com

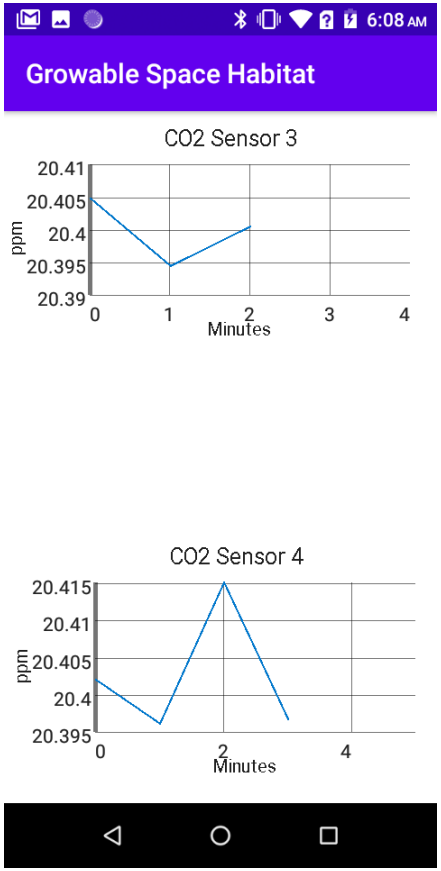
Your security rules are defined as public, so anyone can steal, modify, or delete data in your database Learn more Dismiss

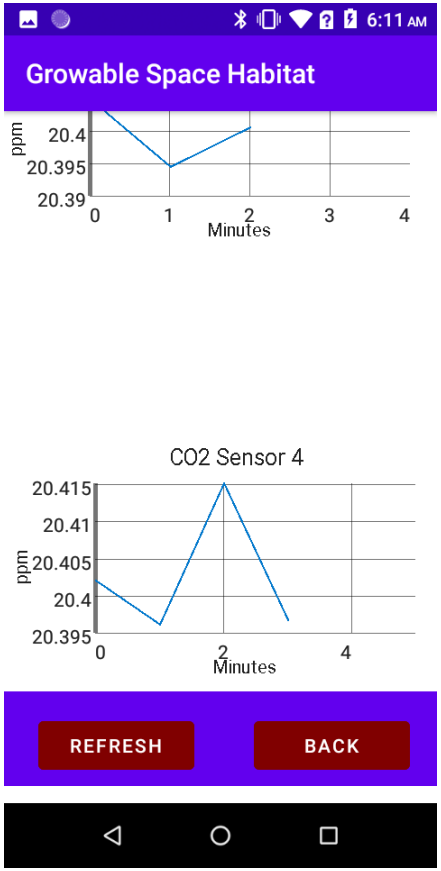


User Interface

Justin Blankenhorn







Execution & Plan

THANK YOU!