Dwight Look College of ENGINEERING
TEXAS A&M UNIVERSITY

Team 0: Growable Space Habitat

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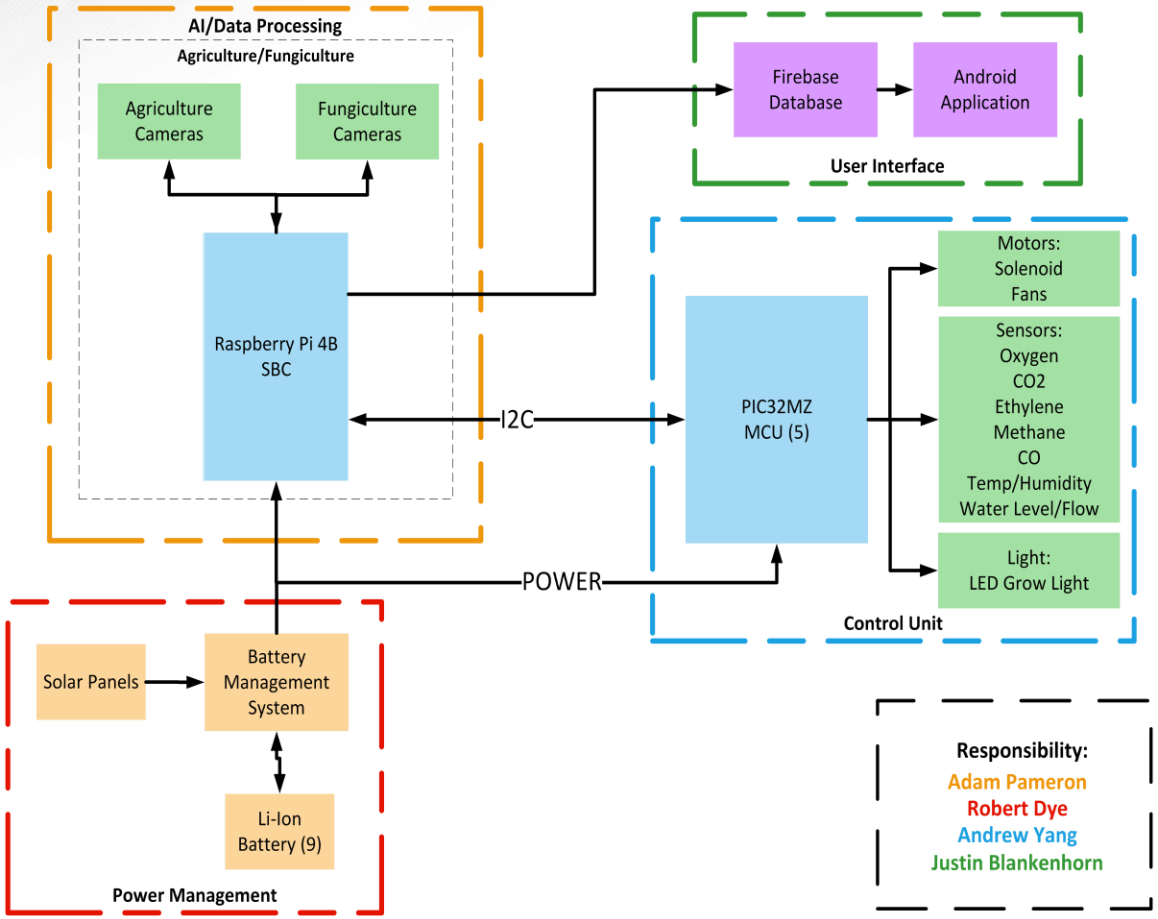
Andrew Yang
Adam Pameron

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:

- Will display data on health of system

AI/Data Processing:

- None

Microcontroller:

- None

AI/Data Processing Subsystem

Adam Pameron

- Create binary classifier using Convolutional Neural Network (CNN) Model
  - Baby Spinach [Proxy: Tomato Leaves]
- Collect sensor data from microcontrollers
- Send sensor data to database

AI/Data Processing Subsystem

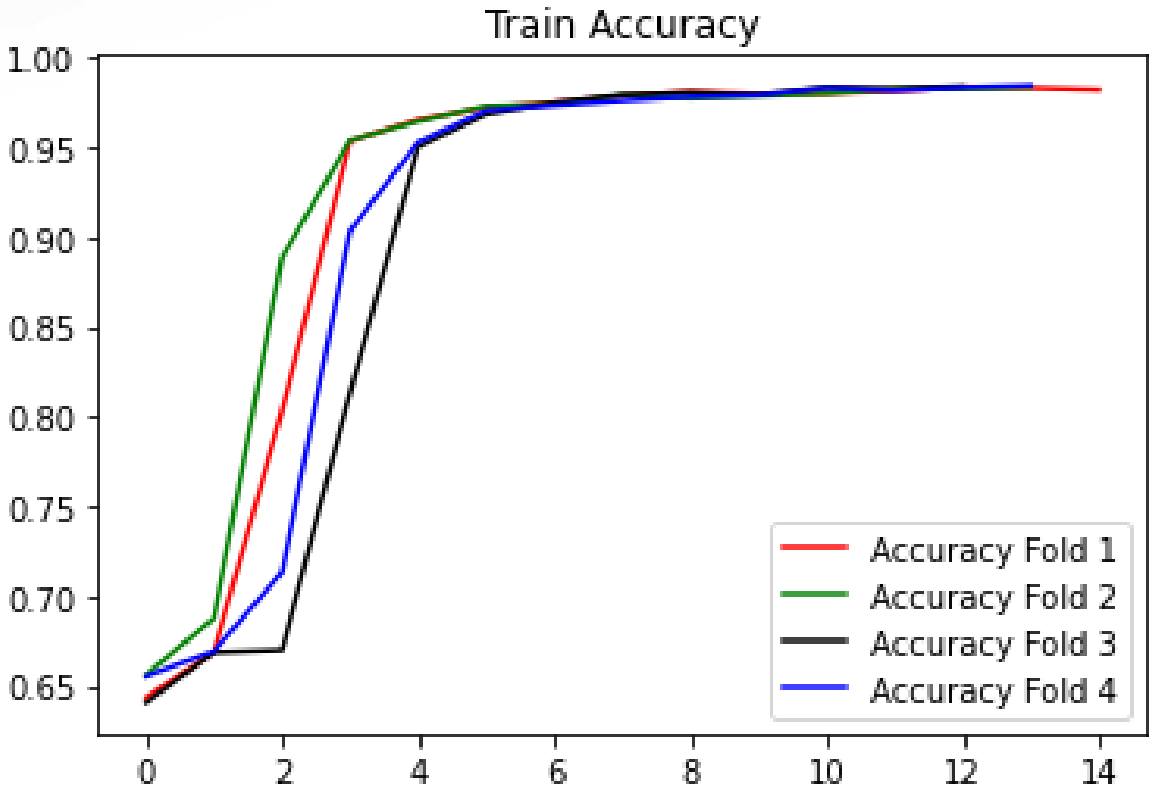
Adam Pameron

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

• Perform Stratified Cross Validation with augmented RGB Dataset
  • Used SGD Optimizer
• Configured UART serial communication
  • Validated sensor data with trusted Pi data
• Configured I2C serial communication
  • Controller and Peripheral Mode
  • Validated Sensor Data with trusted Arduino data
• Deployed model to Pi to validate classification
• Built application code to repeat routines (classify, send image and state)
  • Created specialized functions to abstract routine
	• Further validation of sensor data
	• Build application code for PIC32
	  • Create specialized functions to abstract routine

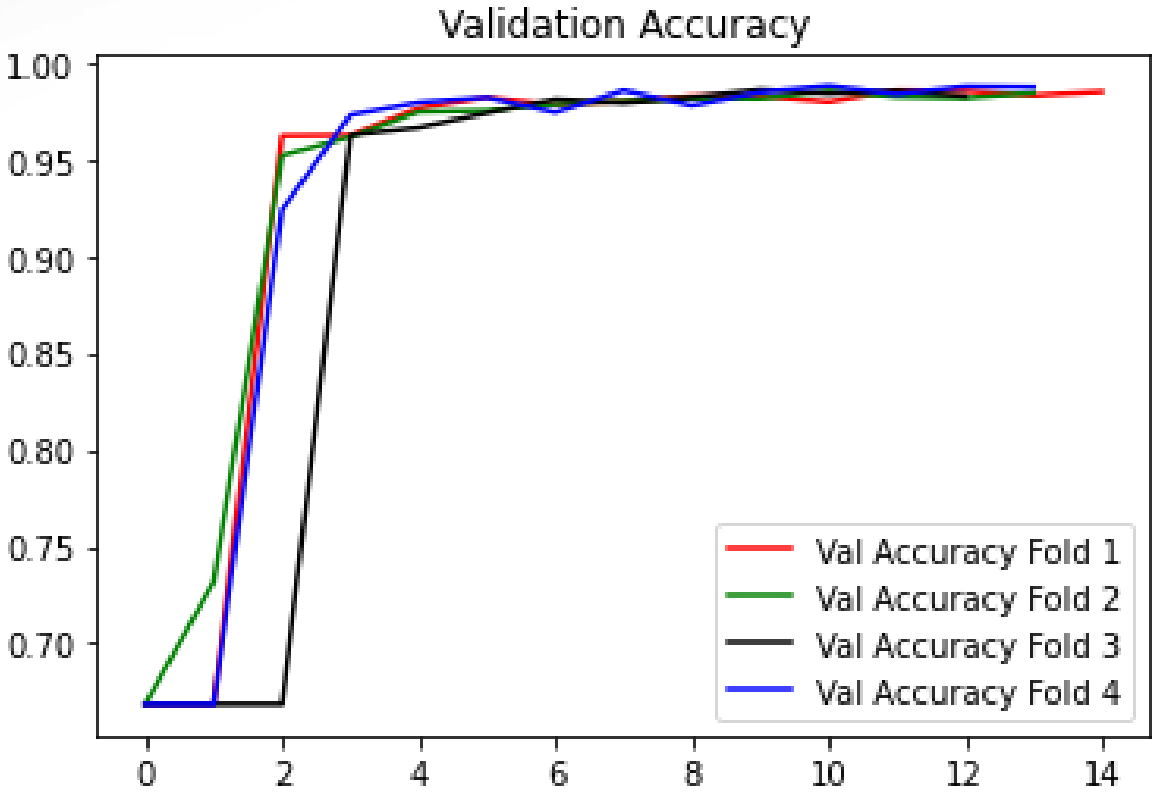
AI/Data Processing Subsystem – Train Accuracy 4 Folds

Adam Pameron



AI/Data Processing Subsystem – Validation Accuracy 4 Folds

Adam Pameron



AI/Data Processing Subsystem – Validation Accuracy 4 Folds

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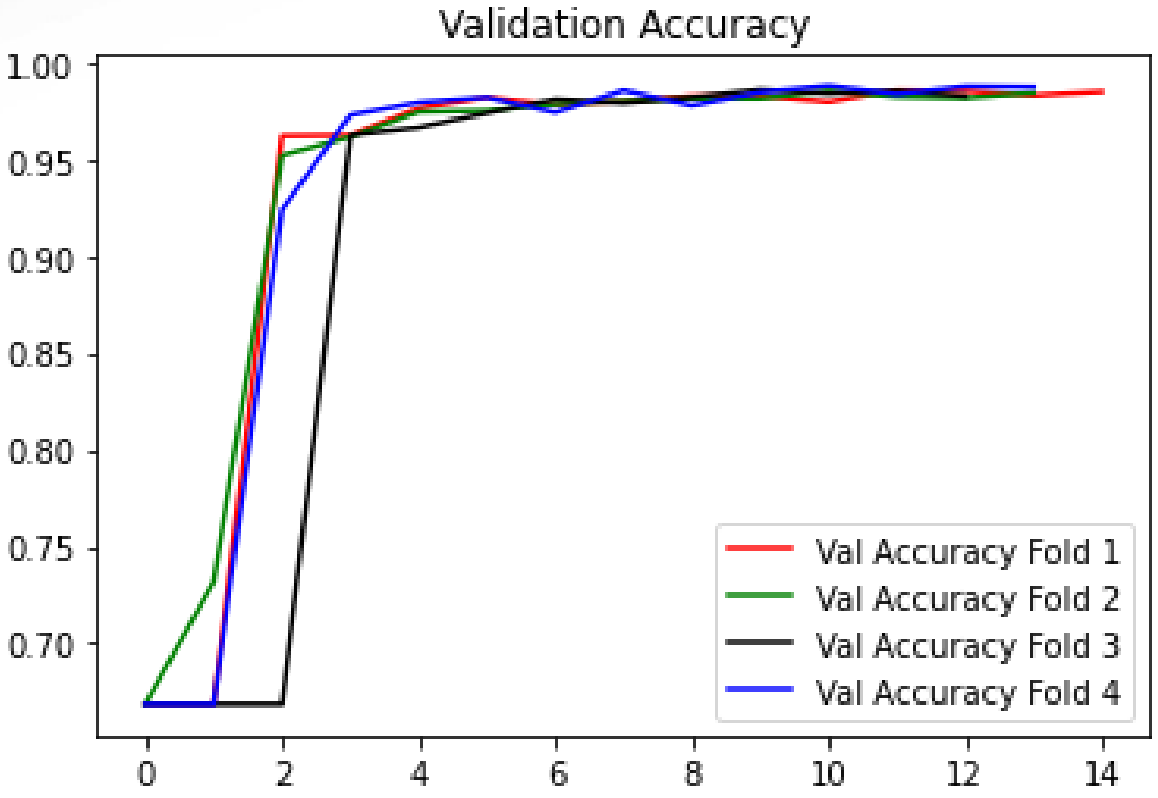
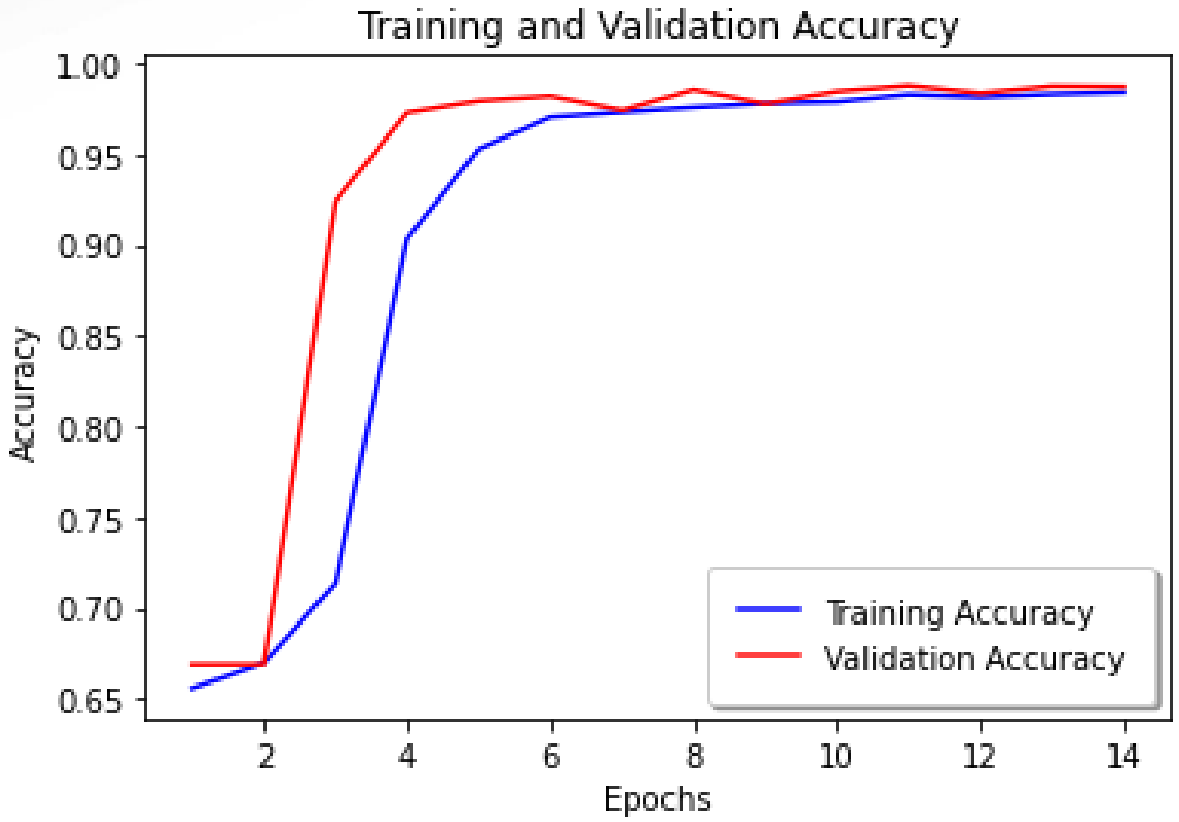


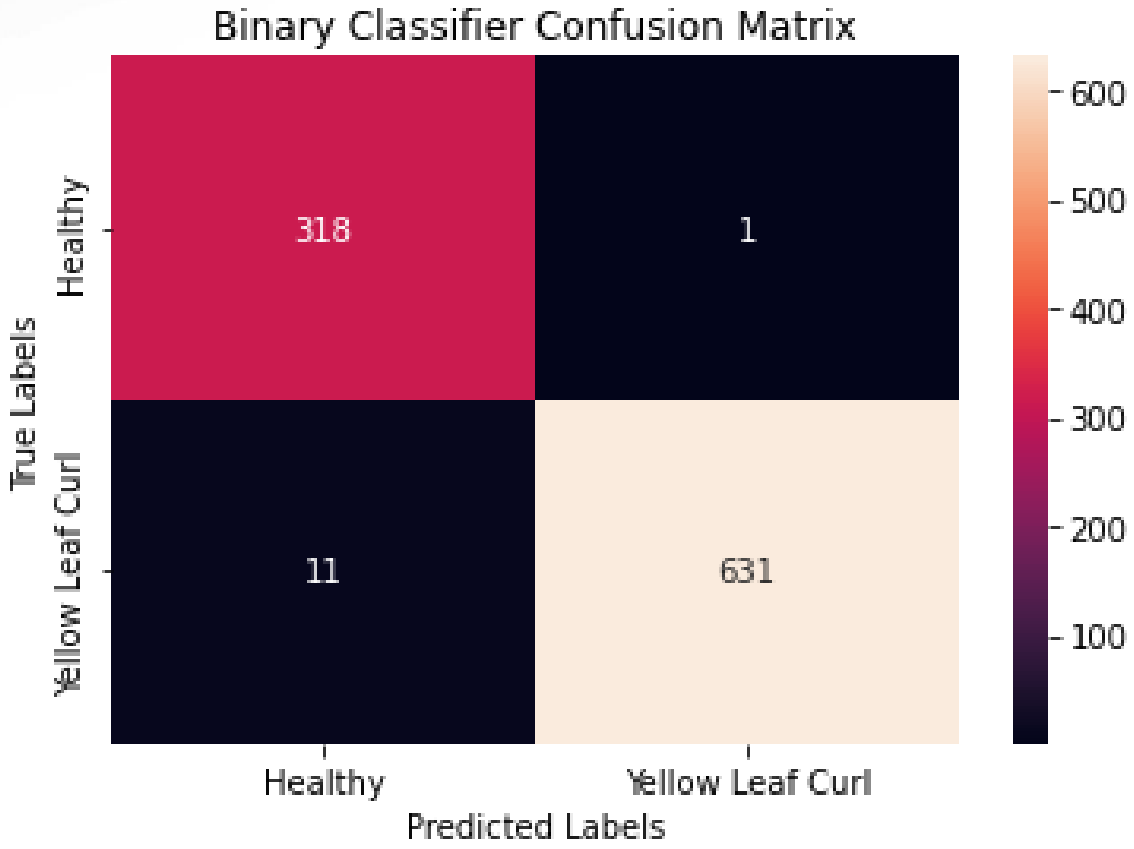
AI/Data Processing Subsystem – Training and Validation Accuracy Fold 4

Adam Pameron



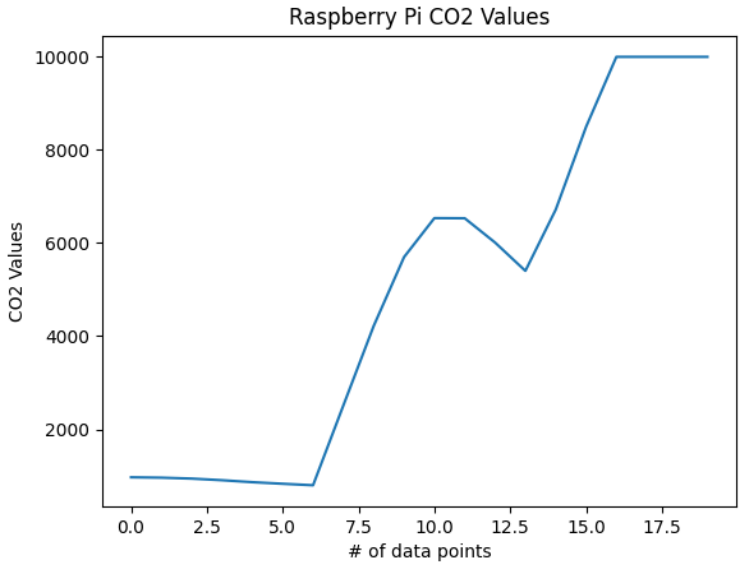
AI/Data Processing Subsystem – Confusion Matrix Fold 4

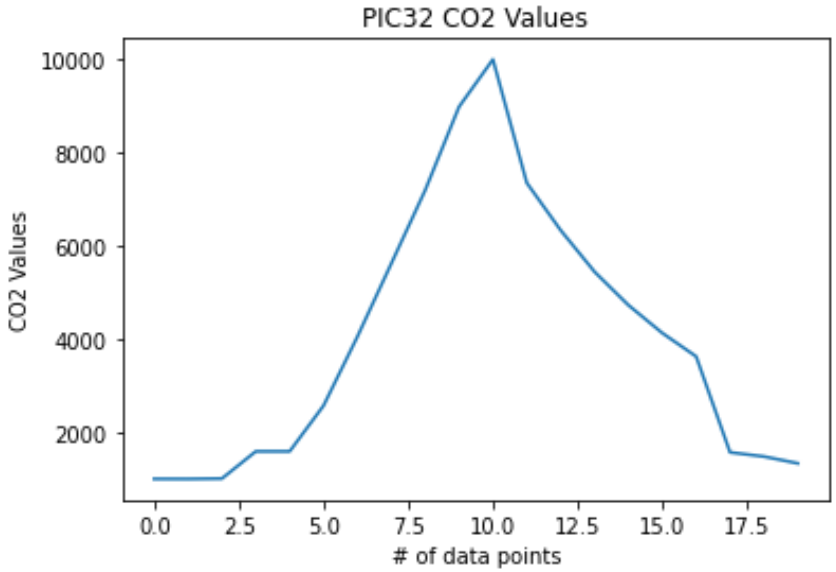
Adam Pameron



AI/Data Processing Subsystem – Pi and PIC32 CO2 Values

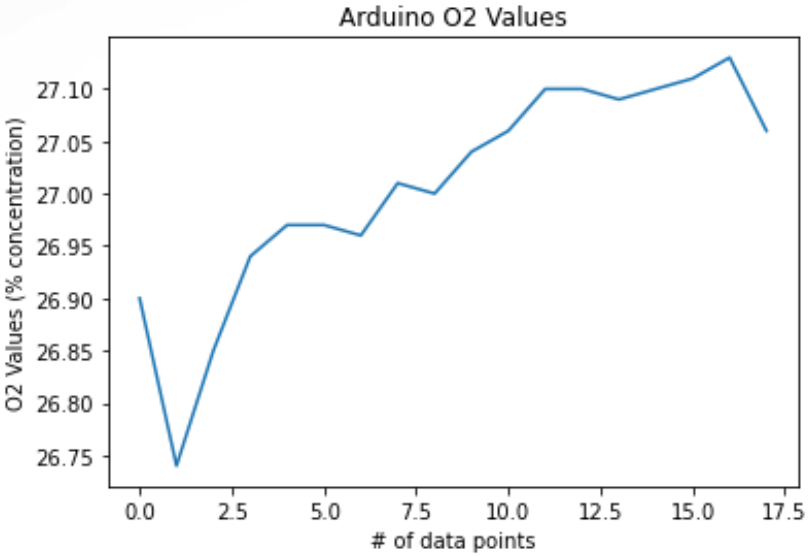
Adam Pameron

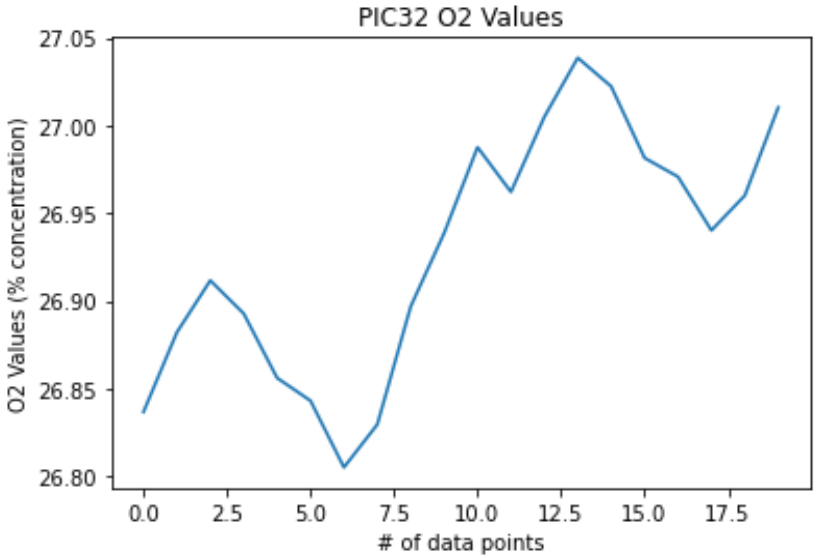




AI/Data Processing Subsystem – Arduino and PIC32 O2 Values

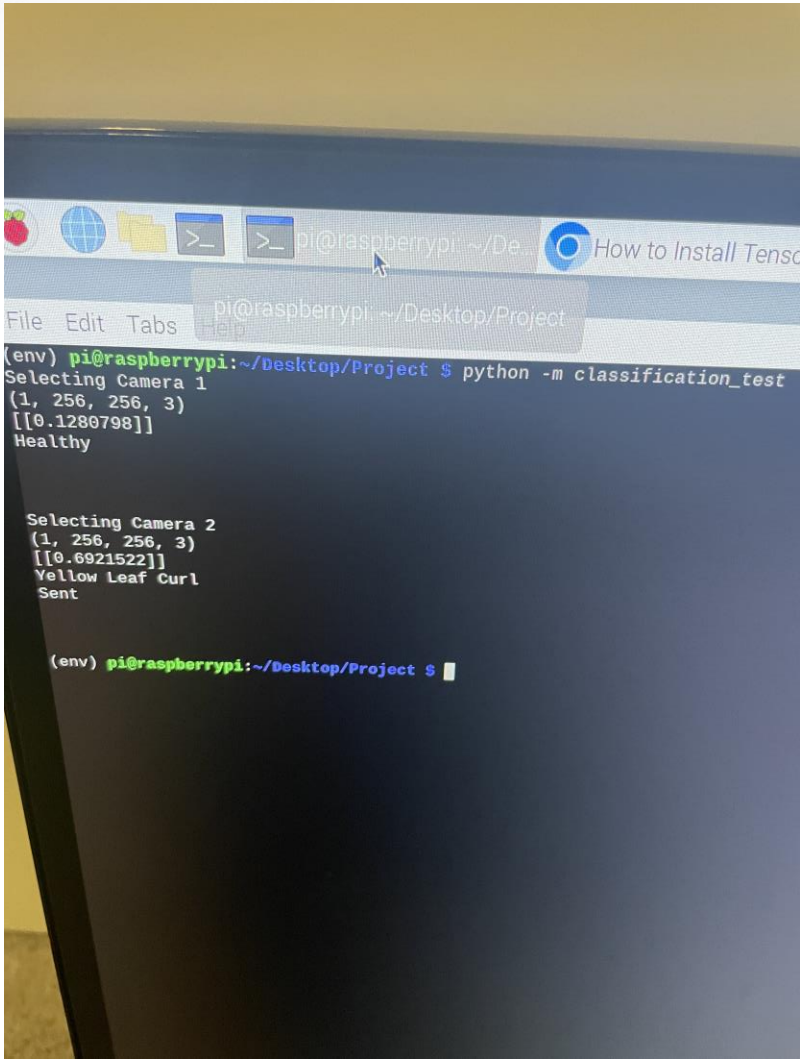
Adam Pameron





AI/Data Processing Subsystem

Adam Pameron



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

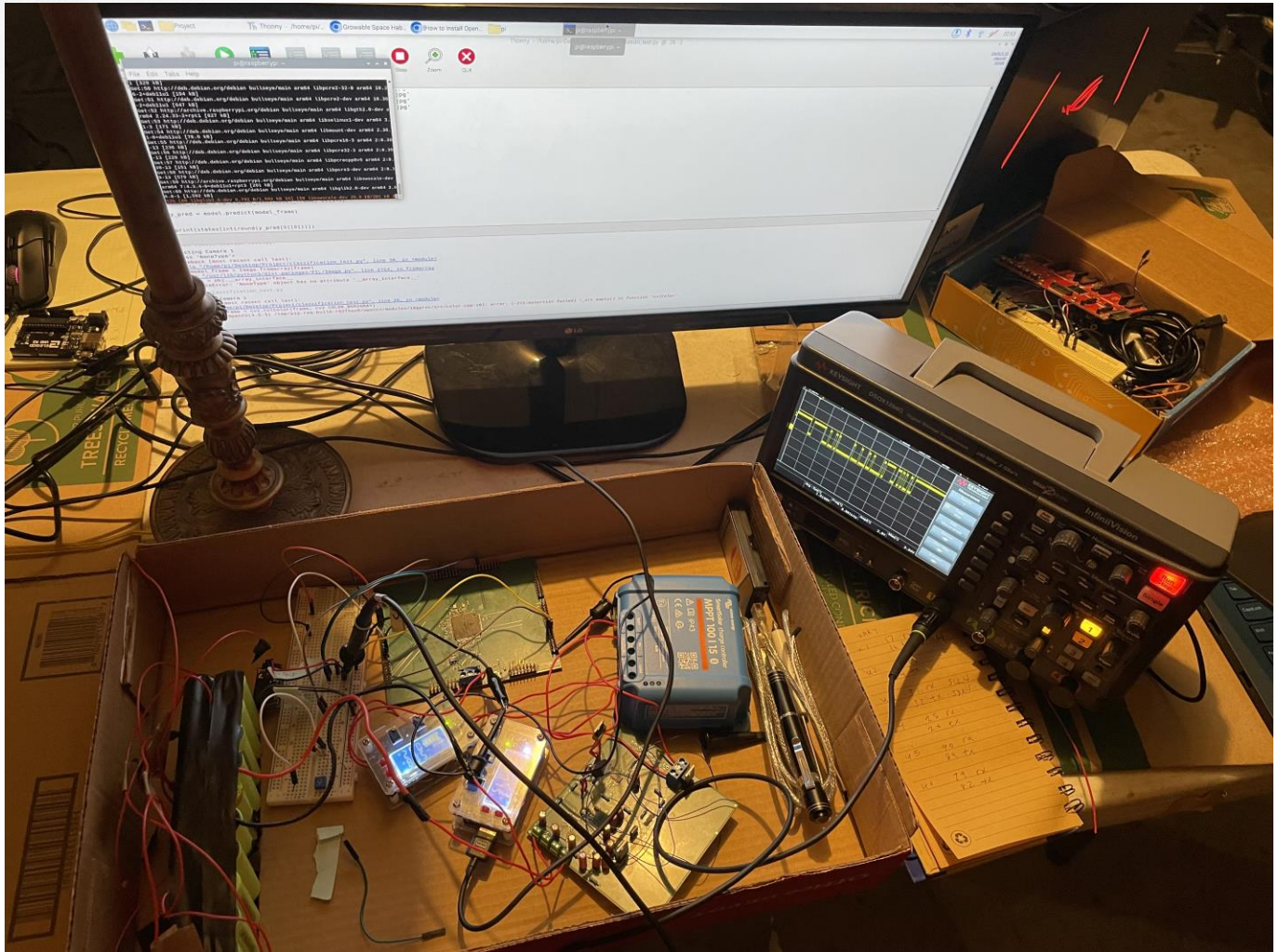
Power Management

Robert Dye

Accomplishments since last presentation	Ongoing progress/problems and plans until the next presentation
• Powered all subsystems at the same time • Soldered analog Sensor PCBs	• Keep performing testing on the BMS • Code monitoring chips with BQ Studio

Power Management

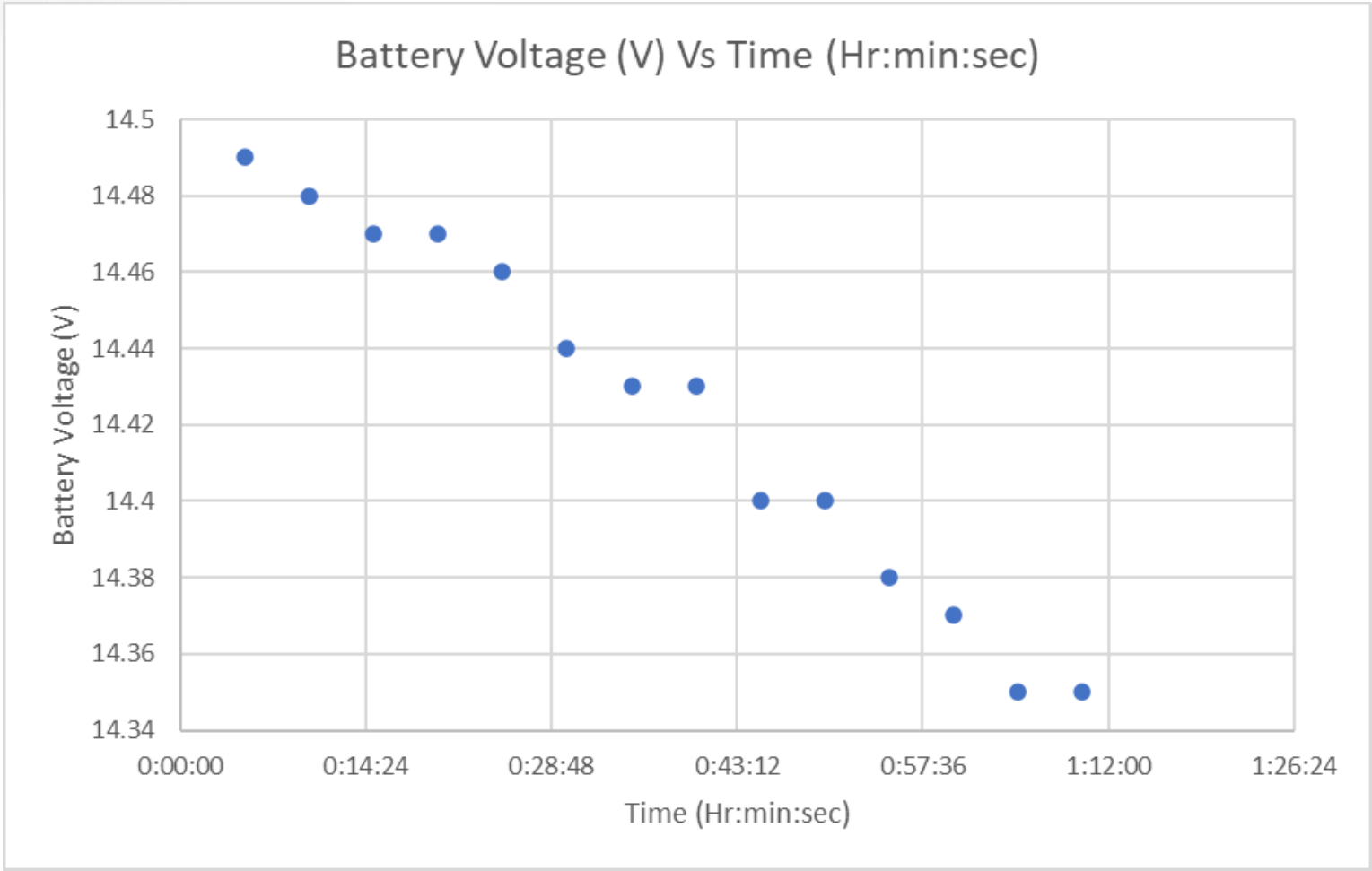
Robert Dye



Power Management

- Voltage/Time graph current 1.06/1.25

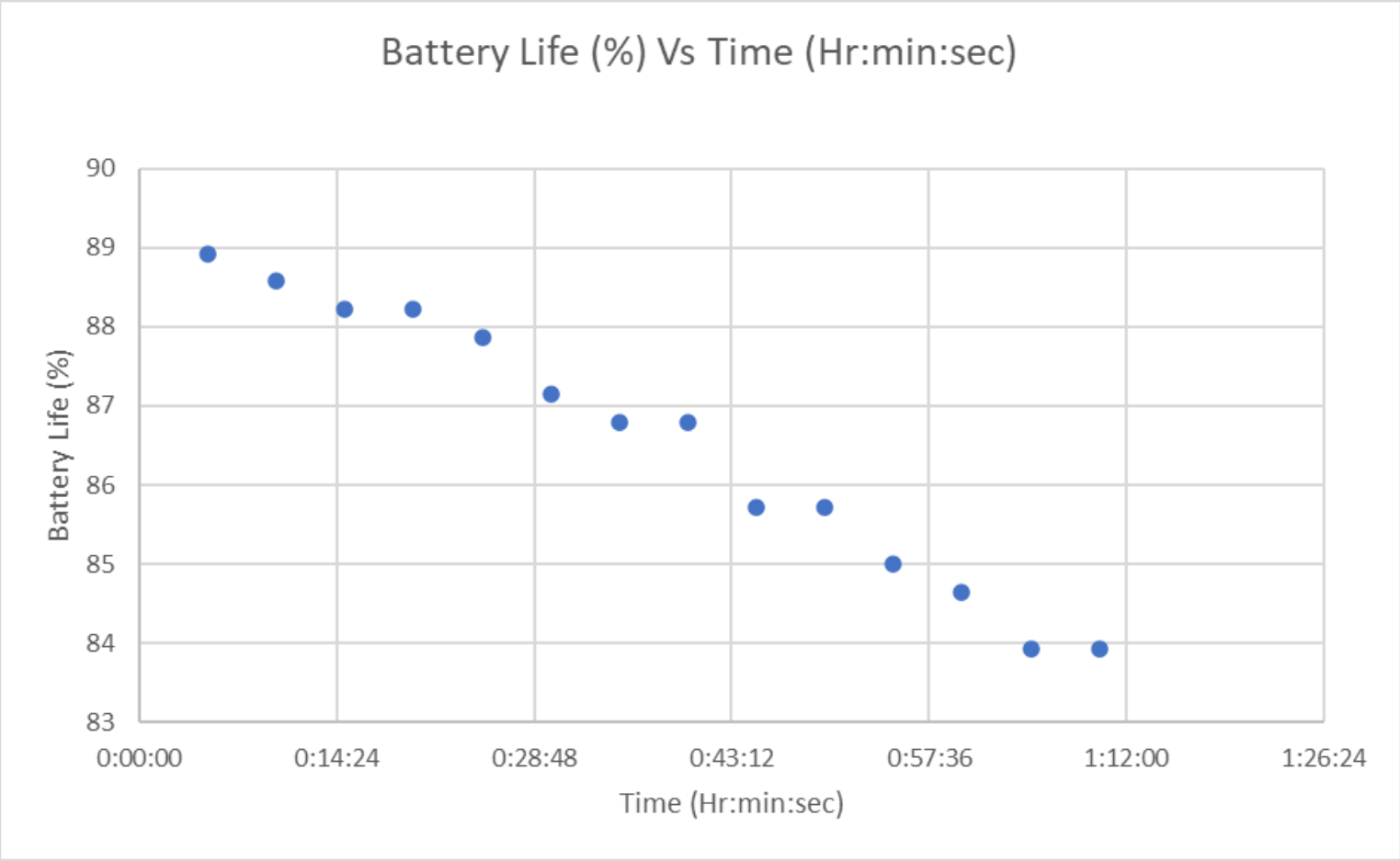
Robert Dye



Power Management

- % Health/Time graph current 1.06/1.25

Robert Dye



Microcontroller

Andrew Yang

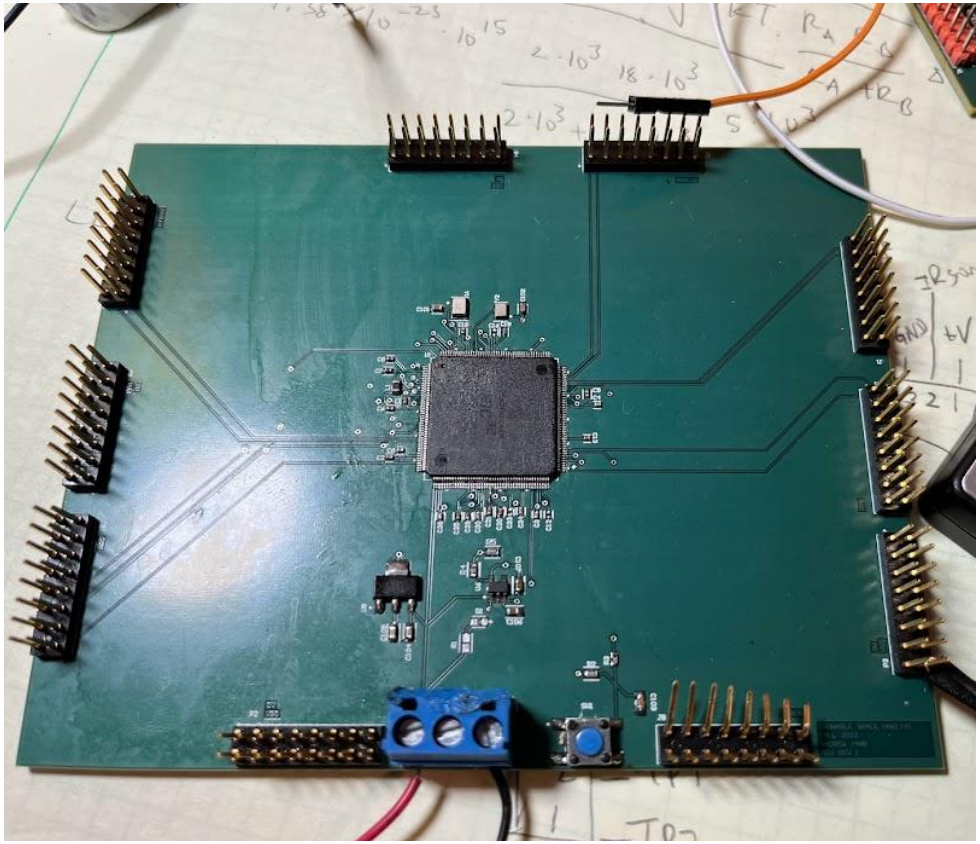
- 200 Peripherals modularized between 5 microcontrollers
- UART, I2C, Analog, Digital, Digital Counter, GPIO switch

Microcontroller

Andrew Yang

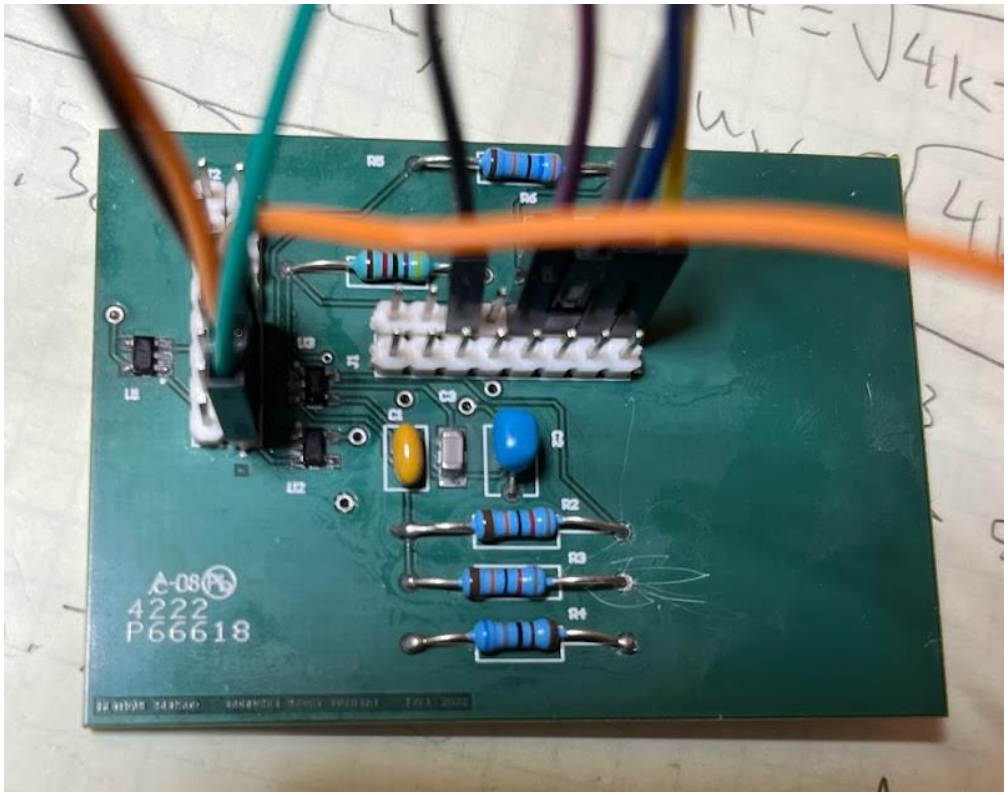
Accomplishments since last presentation	Ongoing progress/problems and plans until the next presentation
• Validated MCU operation • Ordered Analog Sensor PCBs Rev. 2	• Implement counter logic for water flow sensor • Solder and validate analog sensor boards • Flash MCU with dev board code

Microcontroller
Andrew Yang



Microcontroller

Andrew Yang



User Interface

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

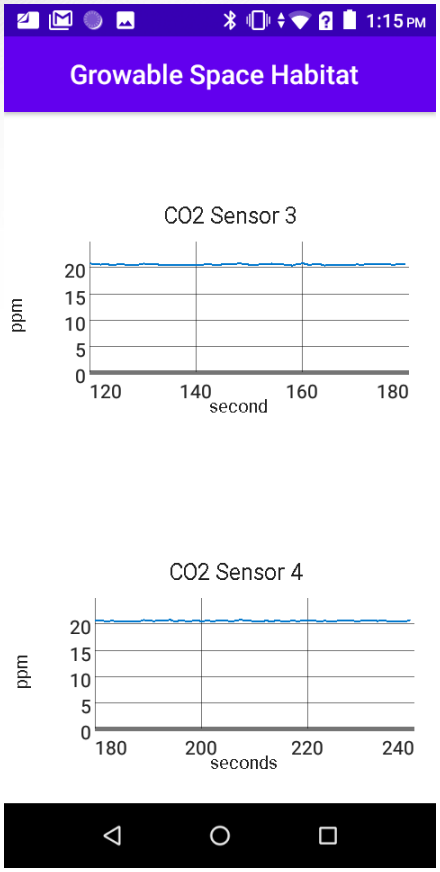
User Interface

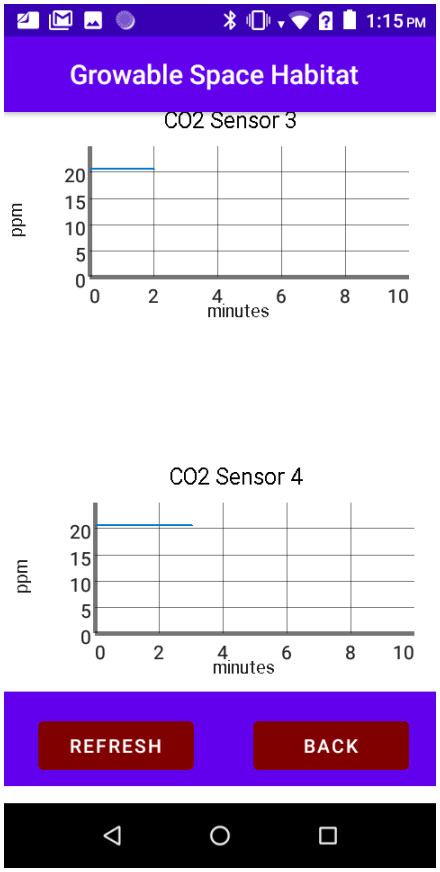
Justin Blankenhorn

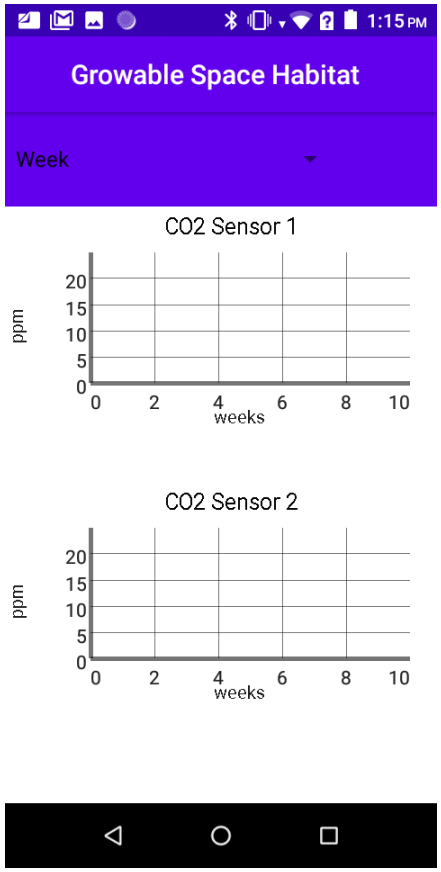
Accomplishments since last presentation	Ongoing progress/problems and plans until the next presentation
• Configured Graphs in terms of hours, days, weeks, years • Use dropdown button instead of buttons • Included data + graphs on plant health with pictures • Reconfigured graphs to lower noise • Put Camera pictures on separate pages	• Reformat graphs to align with Pi internal clock • Work on formatting

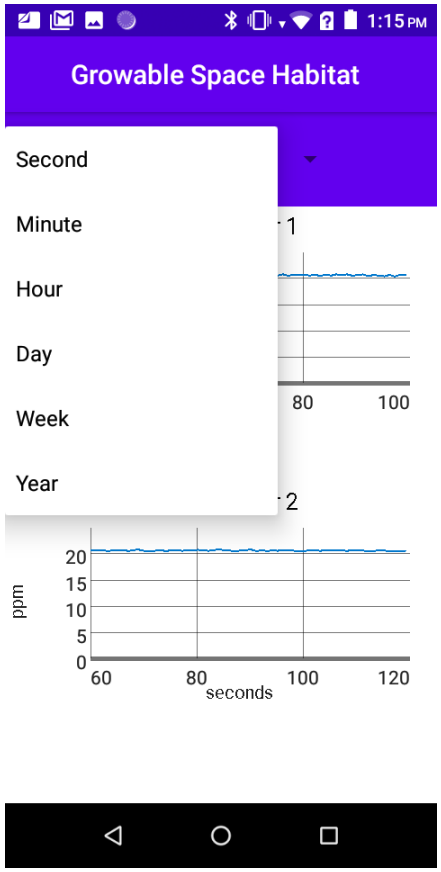
User Interface - Graphs

Justin Blankenhorn

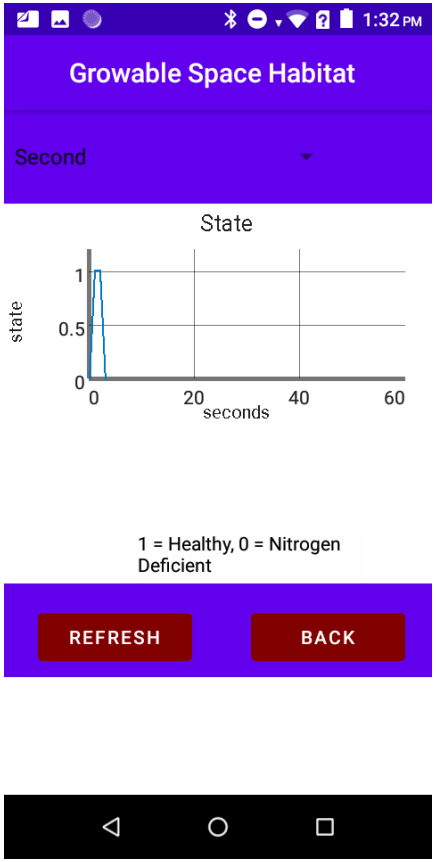


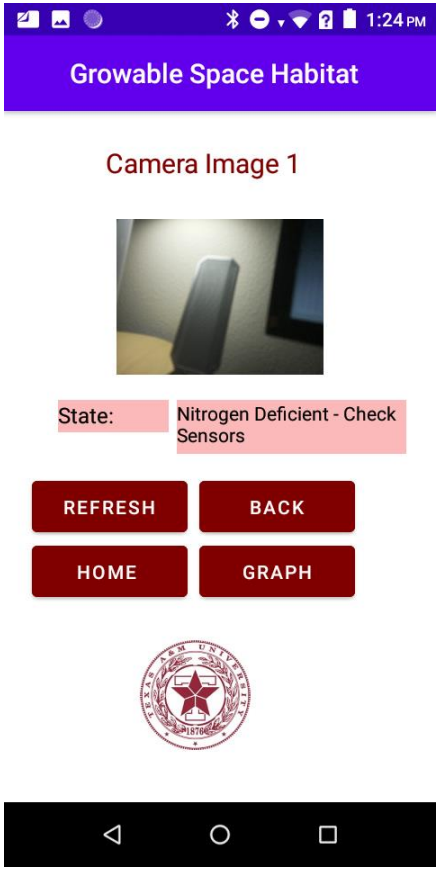






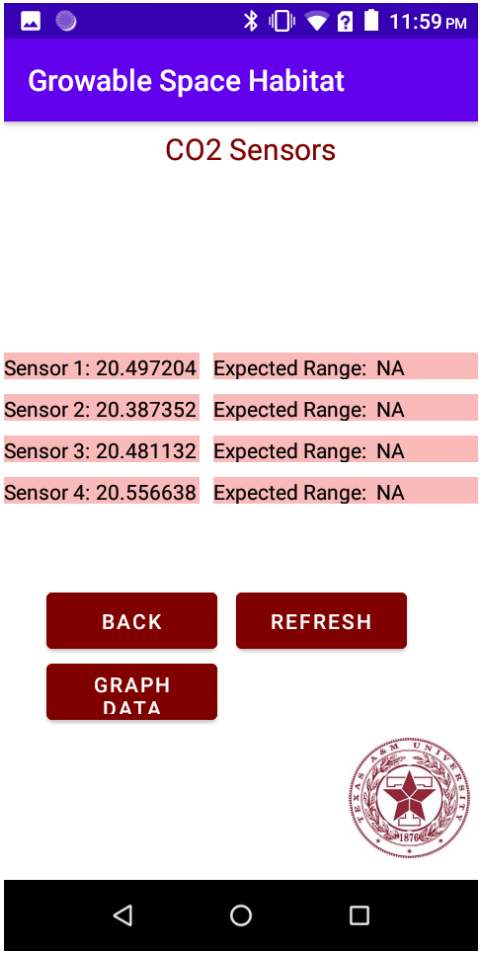
User Interface – System Health





Data Integration

Data Integration



Execution & Plan

Robert Dye	Completed
Adam Pameron	In progress
Justin Blankenh	Not Started
Andrew Yang	Behind Schedule

Tasks	Target Date
Completed pcb design for power management	9/2
Testing of charging controller with battery	9/2
Completed MCU PCB design	9/5
Update Presentation #1	**9/5**
Testing the abiltiy to power other subsytem	9/8
Collect Significant data of how long battery takes to charge under various conditions	9/8
Order PCB for power management	9/8
Order MCU PCB	9/8
Implement fan control	9/9
Implement I2C Sensors	9/16
Integrate I2C Connection between Pi and 5 MCUs	9/17
Update Presentation #2	**9/19**
Restructure Android Studio code to use Firebase database	9/20
Implement UART Sensors	9/23
Implement solenoid control	9/23
Implement Analog Sensors	9/30
Solder wires to the 4 series cells to be able to connect to the bms	9/30
Receive BMS PCB and begin soldering all components	9/30
Receive MCU PCB and begin soldering all components	9/30
Integrate PI with database to send sensor data	10/3
Measure current draw per hour of all used peripherals	10/3
Update Presentation #3	**10/3**
Finishing soldering components to BMS PCB	10/12
Finish soldering components to MCU PCB	10/15
Display Sensor Data into graphs on app	10/16
Integrate PI to send pictures to app	10/16
Update presentation #4	**10/19**
Complete MCU PCB testing	10/21
Verify data collected from the MCU is accurate	10/25
Verify data and picture received from pi is accurate	10/30
Validate sensor data with controlled test	**10/30**
Update presentation #5	**10/31**
Perform all testing of subsystems connected to BMS	11/4
Final Presentation	**11/14**
Final Demo	**12/2**
Final Report	**12/3**

THANK YOU!