On-Campus Delivery System

AEROSPACE1

Sponsored by The Aerospace Corporation

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Meet Our Team:

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Background

- The Aerospace Corporation is committed to delivering mission success in the space enterprise through technical expertise
- Aerospace is our “customer”
  - We want to deliver a product to Aerospace based on their requirements

Goals

- Design goal: Develop a solar powered remote control car built from the ground up and demonstrate the real time telemetry results and wifi control

Needs/Demands

- Charge Controller for charging NiMH batteries from solar panels
- Energy efficient remote controlled vehicle
- Data logging telemetry
  - Keeping track of system health and efficiency (solar array outputs, estimated battery charge etc)

Problem Statement

“The need of hungry students on campus who are too busy to get food on their own, would need a way to have it delivered to them autonomously.

Design Requirements

Charging Station

- Solar Panels
- Charge Controller
  - Solar Panels -> Battery
  - Analog Controller
- Interface/Connector -> Vehicle
- Charging Platform
  - Enclosure for Vehicle
- State of Health Monitoring
  - Solar Efficiency, Charge Controller Converter Efficiency

Vehicle

- Wifi MCU
  - Arduino Uno Rev2
- Motor Driver Circuit
- Basket
  - Optional Heated, Insulated
- State of Health Monitoring
  - Battery State of Charge
- Battery
  - NiMH
- Chassis, Wheels, Axles
  - Mechanical Assembly

Standards and Regulations

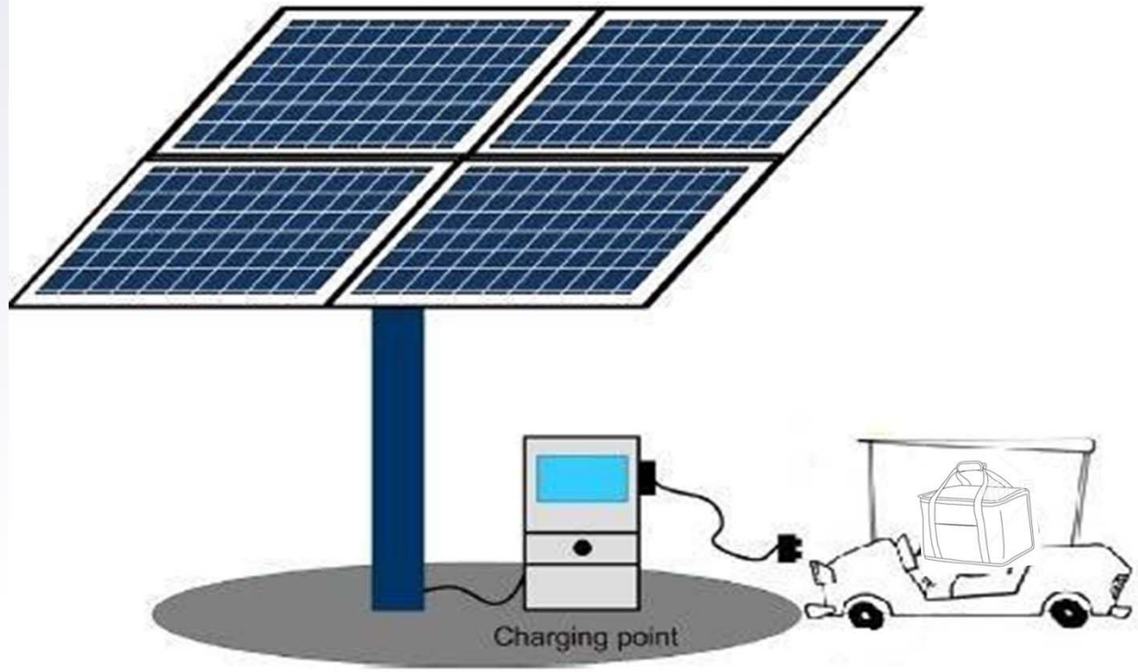
- FCC(Federal Communications Commission)
  - Electromagnetic interference, broadband, and radio
- OSHA(Occupational Safety and Health Administration)
  - Safe assembly
- Cyber Security (NAS9933)
  - Protection of unclassified information

Constraints

- Cost: Budget of $1,000
- Time: Limited to two semesters
  - One for designing, one for implementation
  - Received parts two weeks before final presentation
- Environmental:
  - Must be able to navigate a college campus
  - limited energy consumption

Solution design

- The vehicle is loaded with a food order and is transported to the customer
- The vehicle would navigate via a WiFi/bluetooth connection
- Charged in a charging station
  - Charging station uses solar panels
  - Energy converted using charge controller
  - Vehicle's batteries start to charge

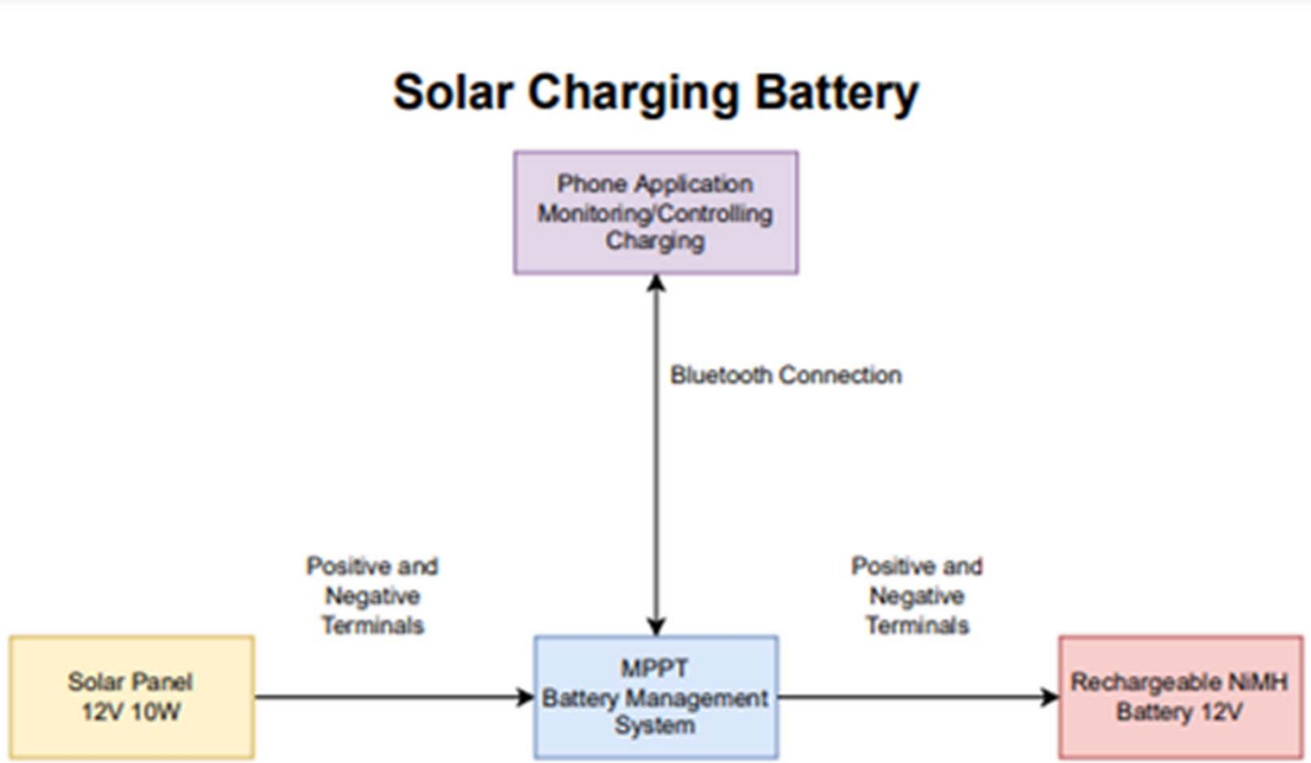


Implementation process

- Charging station design (Essien, Dymier)
- Vehicle design (Tyler, DeAndra, Yaman)
- Telemetry design (All)
- Charging station implementation (Dymier, DeAndra, Yaman)
- Vehicle implementation (Essien, Tyler)

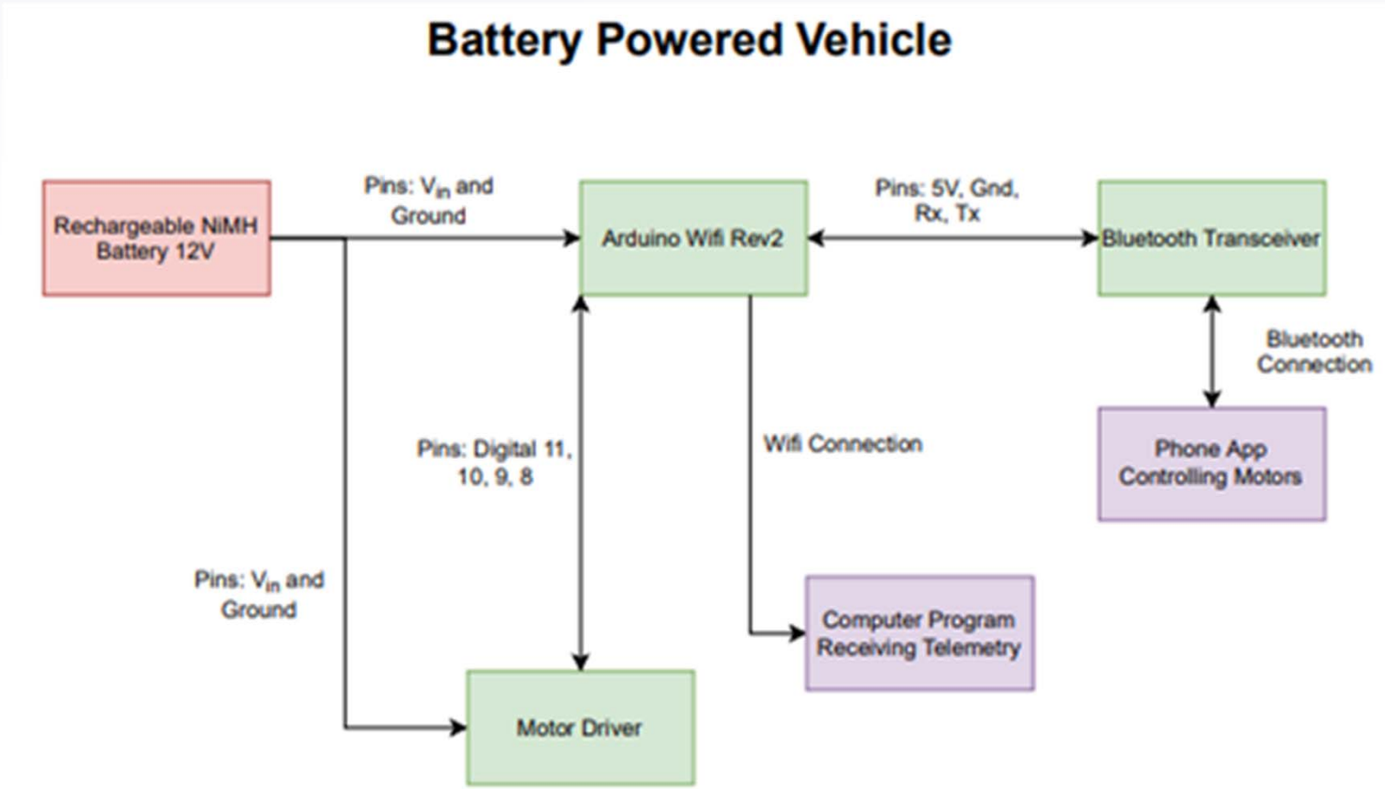
Charging Station Design

- Determined optimal angle to receive sunlight
- Chose charge controller to ensure that the battery can be charged
- Connected to phone application for charge control/telemetry



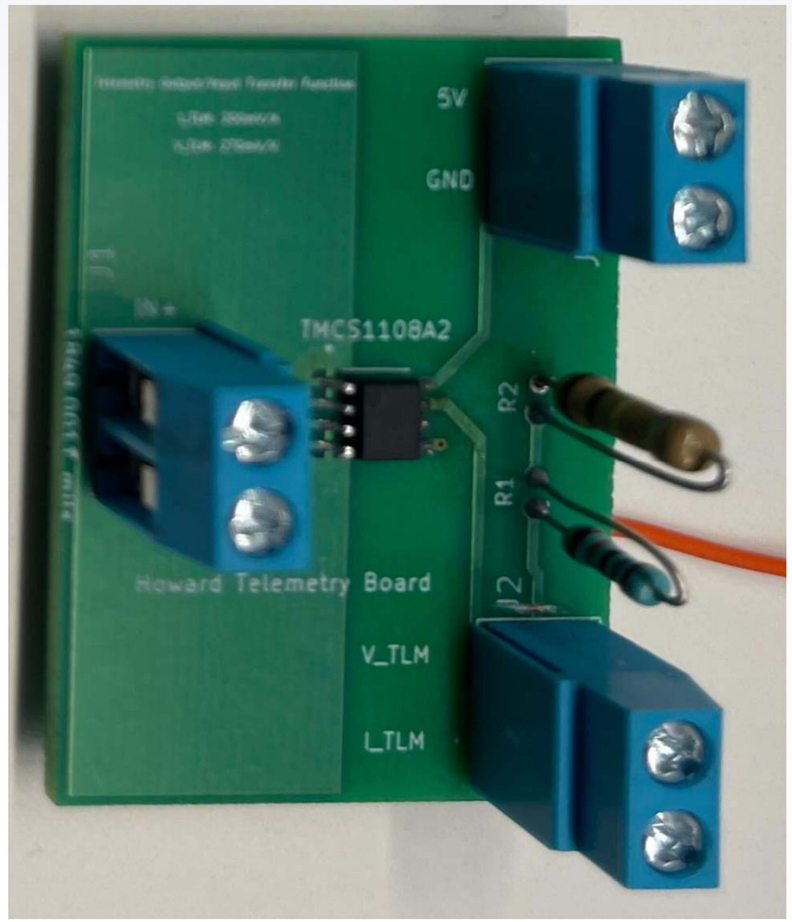
Vehicle Design

- Arduino Uno Rev2 Wifi
  - Built-in Wifi Capability
  - HC-05 transceiver for bluetooth
- Two motor drivers
  - Control four motors
- Phone app used to transmit bluetooth signals to arduino



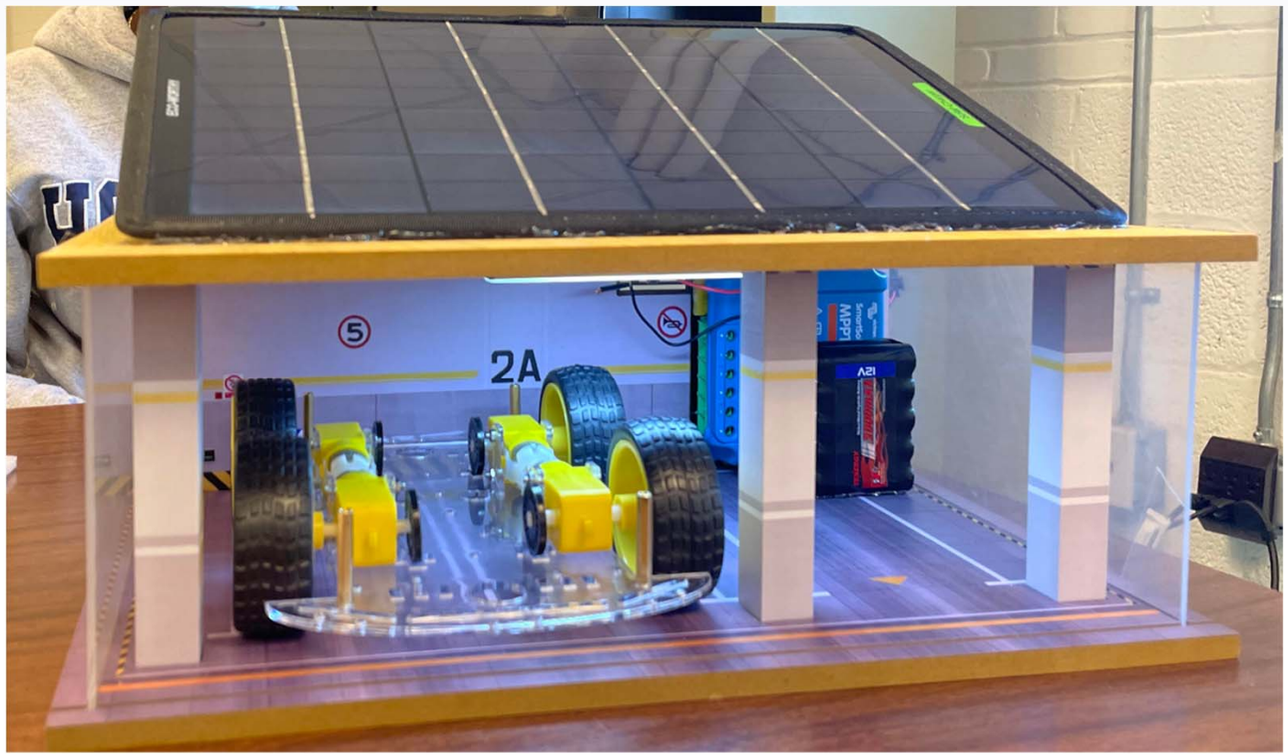
Telemetry Design

- Worked with Aerospace advisors to create a PCB for telemetry
- Records current or voltage / keeps track of system health
- Voltage and current will be output to arduino



Charging Station Implementation

- Added lights
- Enclosed sides
- Separate space for car and charge controller
- Optimized angle for solar panel (23°)



Vehicle Implementation

- Used HC-05 bluetooth transceiver instead of wifi to control car
- Four motors with two motor drivers between them
- Phone app to sends bluetooth signals

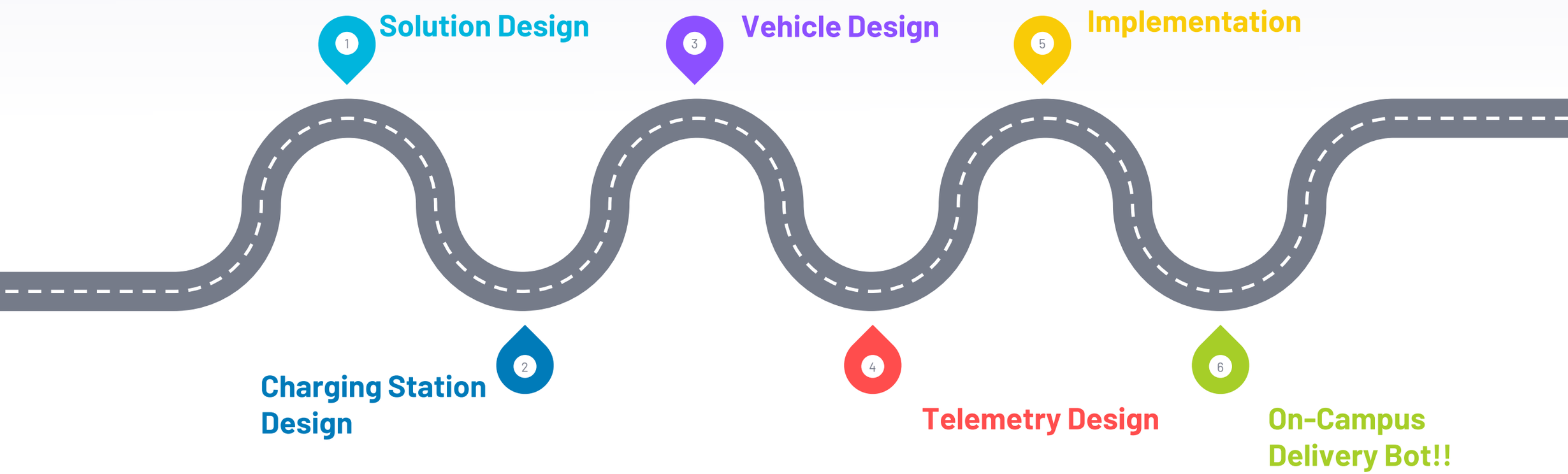
Testing of the integrated system

- Sending bluetooth signals to control direction of the motors
- Created program to test vehicle movement (left/right turns and forward/backward driving)

Conclusion

- Basic “Brains” of vehicle completed
- Vehicle functions as expected
- Future work can add telemetry and food delivery compartment

Conclusion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Solution Design
2
Charging Station Design
3
Vehicle Design
4
Telemetry Design
5
Implementation
6
On-Campus Delivery Bot!!

Thank You!

Questions?