Sdmay19-14
Wireless Recharging System

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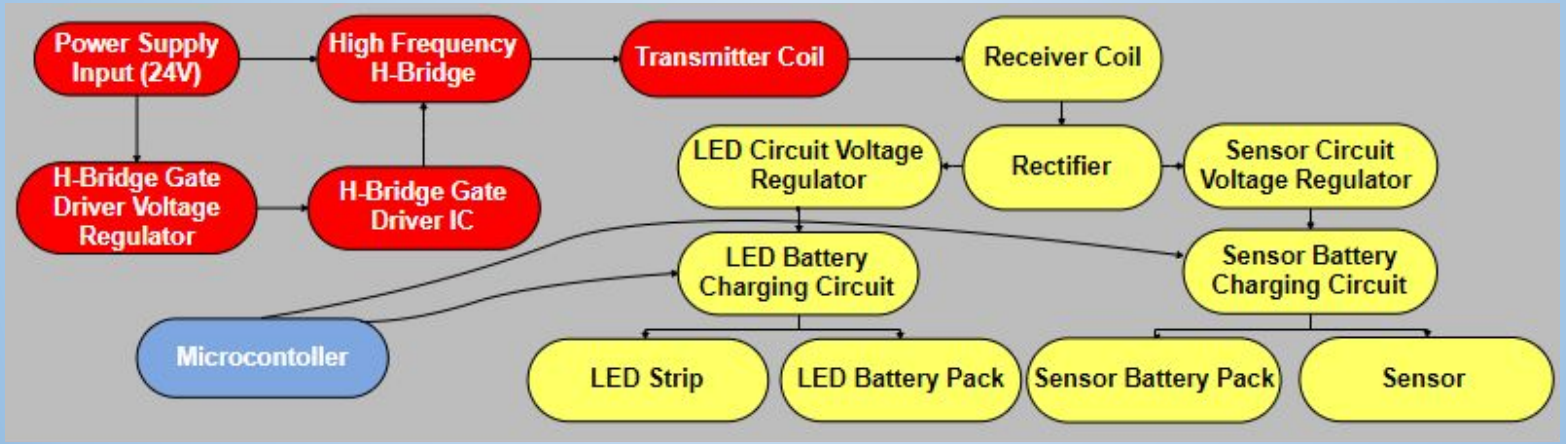
Client : National Carwash Solutions (NCS)

Website : http://sdmay19-14.sd.ece.iastate.edu

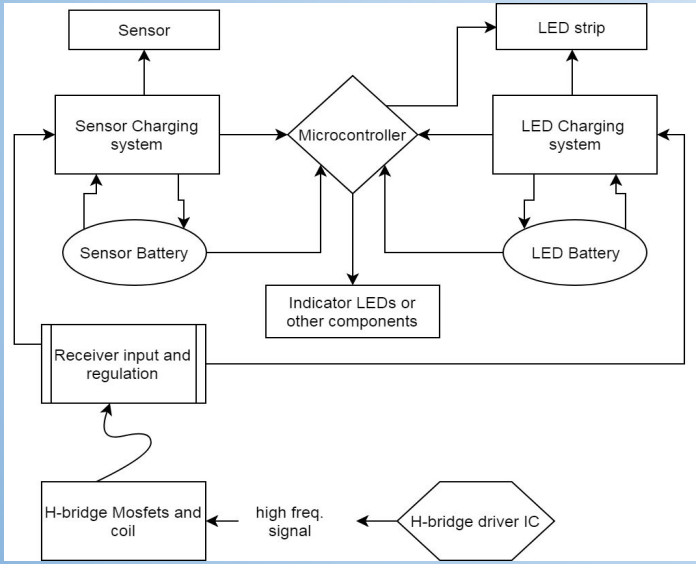
Problem Statement

National Carwash Solutions has a sensor on a car wash arm that is powered by a set of batteries . Currently, the batteries are not rechargeable and they have proposed to employ a wireless charging system. The sensor cannot be powered using a wired connection due to the car wash arm being able to rotate completely around a base point. To avoid entangling electrical power cables, a wireless charging system is the most viable option to provide constant power for the sensor.

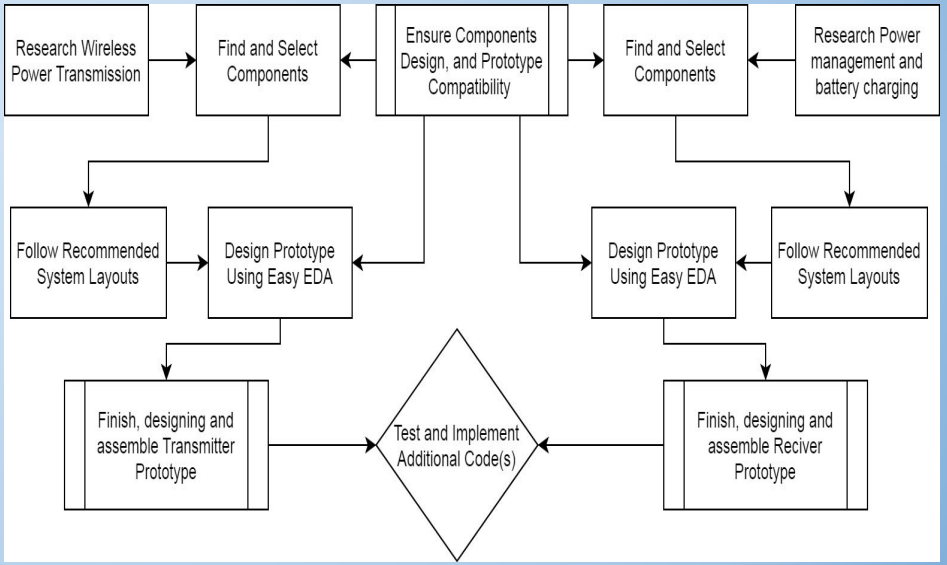
Concept Diagram



System Design Integration



System's Integration Diagram



System's Development Diagram

Functional / Non - Functional Requirements

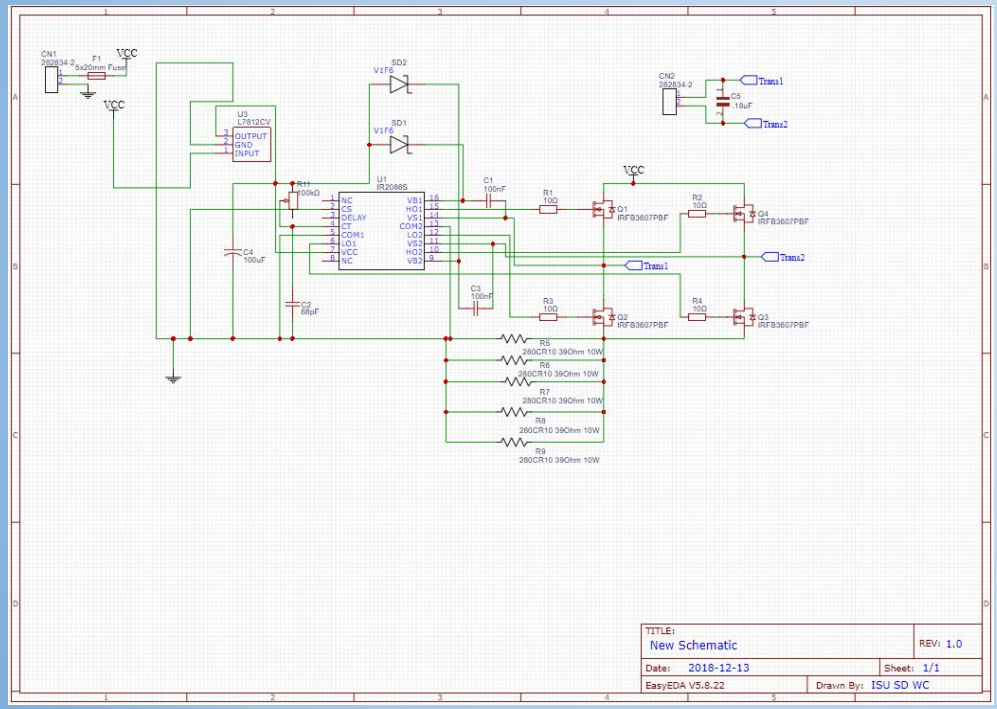
Functional requirements

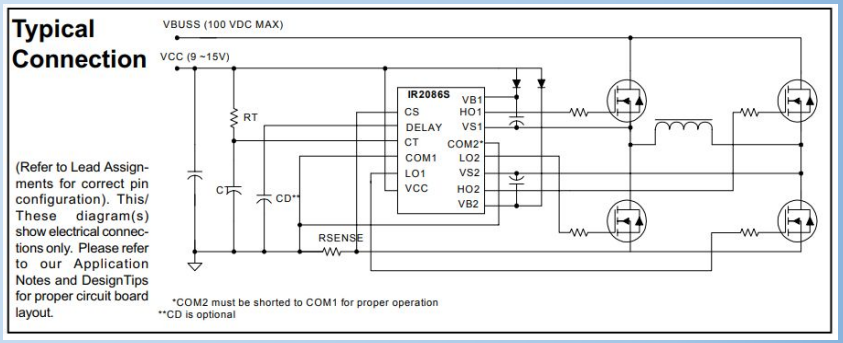
- Transmit power wirelessly through the air
- Provide a stable 3v/100mA supply for sensor load
- Provide a stable 12v/1A supply for an LED strip
- Seperate Battery Charging systems for both LED and sensor loads
- Monitor the system(s) with an onboard microcontroller

Non-functional requirements

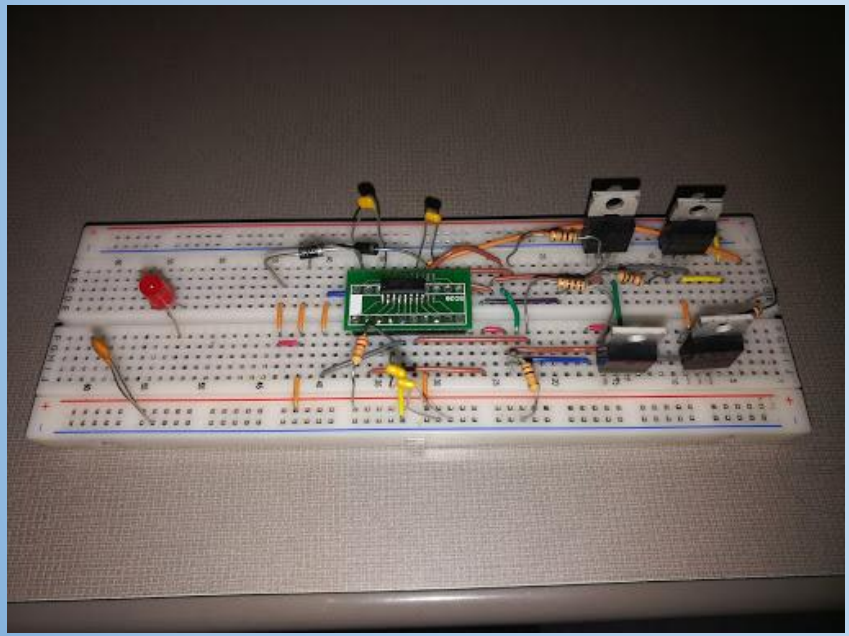
- Environmentally protecting device(s) against water and heat
- Alerting the user in case of critical battery or system state
- Having a long battery back lifespan
- Allowing options in the future for expansion and development

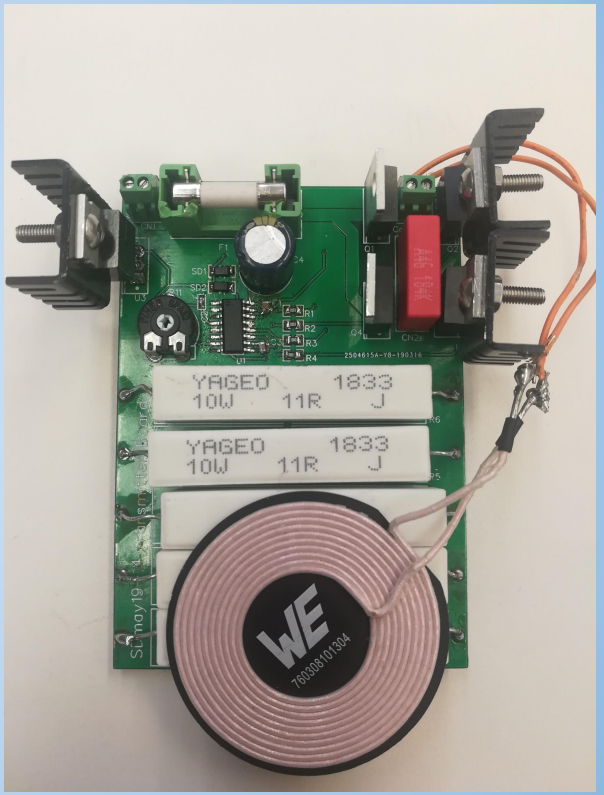
Transmitter Design



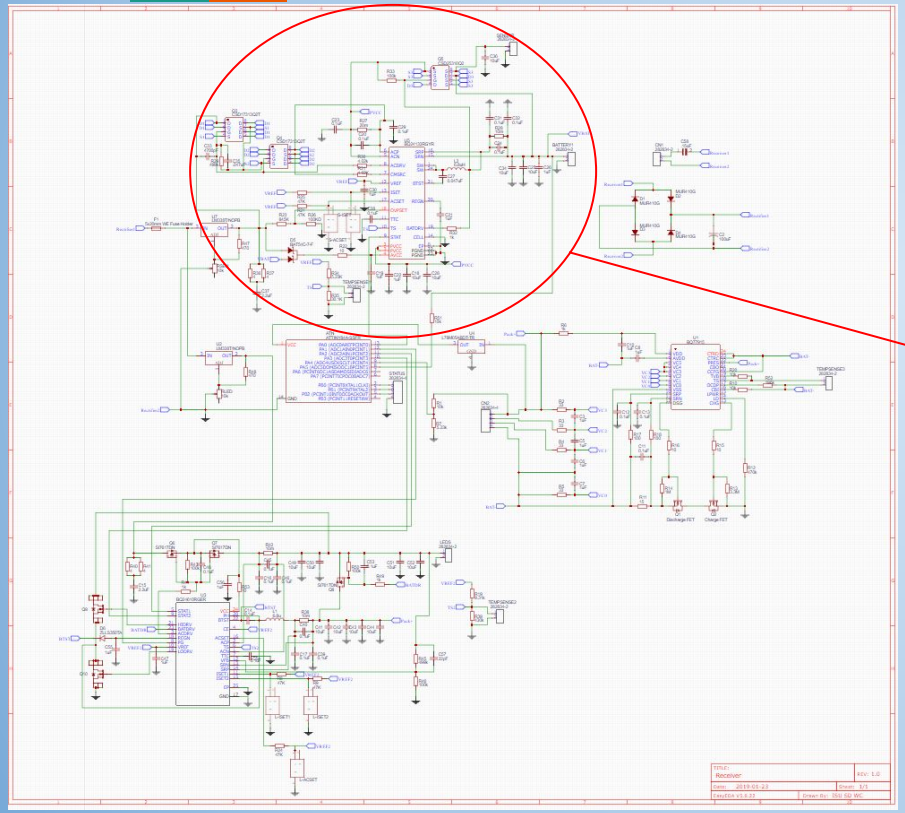


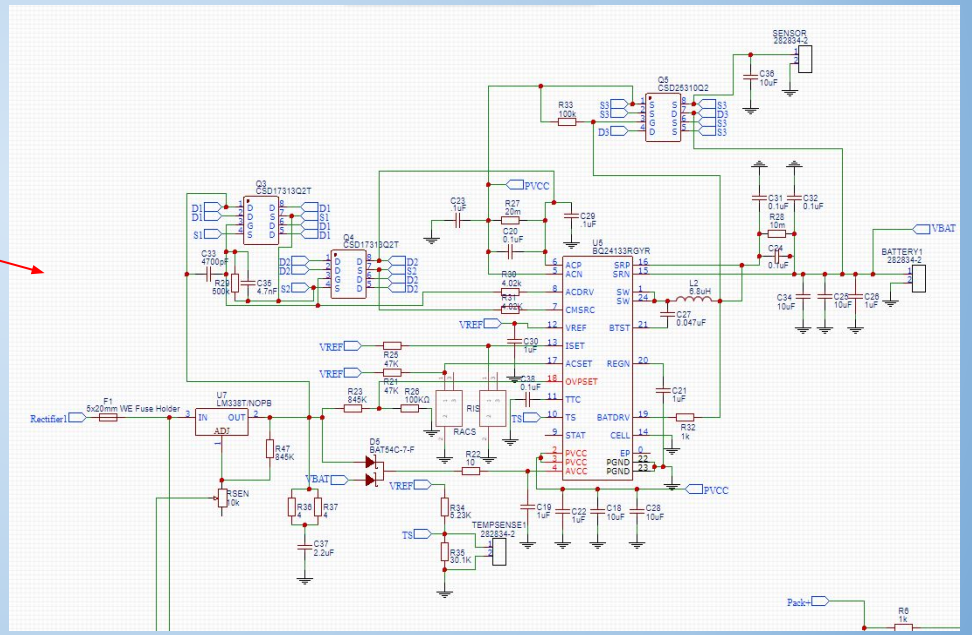
Transmitter Design





Receiver Design





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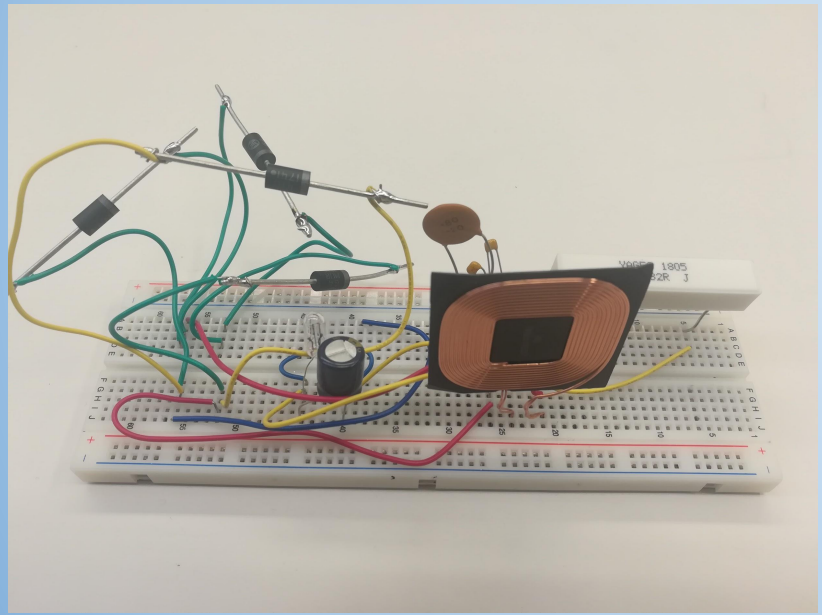
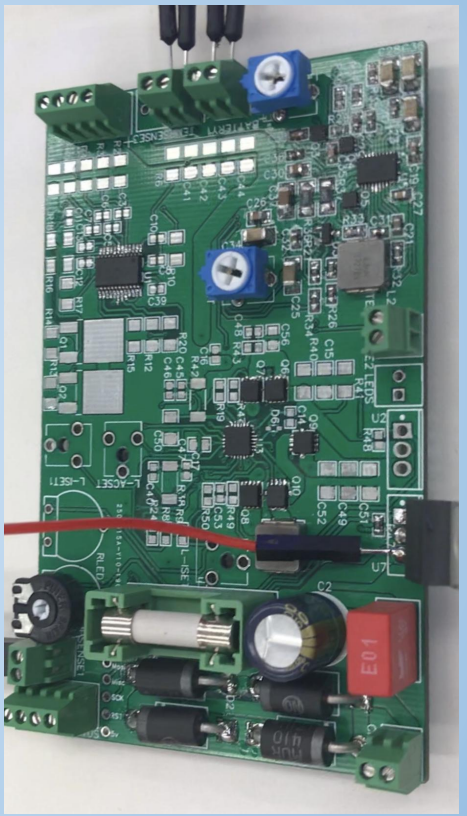
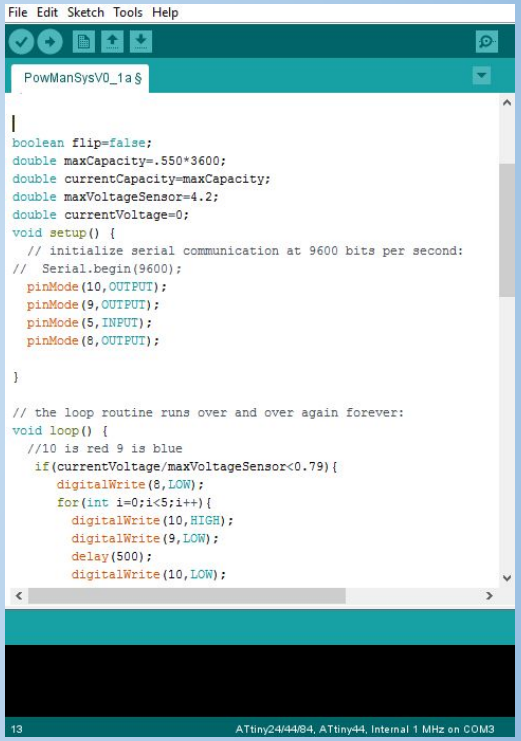




Microcontroller

Monitors the power systems of the receiver battery packs so that:

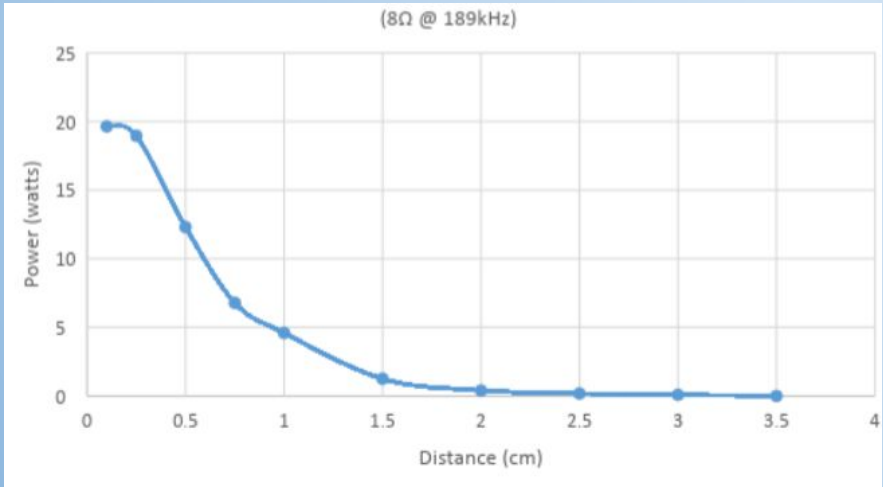
- Outputs given to operator about state of power systems
- Control of LEDs to both functional and entertainment purposes
- Be easily programmable and updateable to accommodate changes in the future



Example Code

Transmitter Test Results

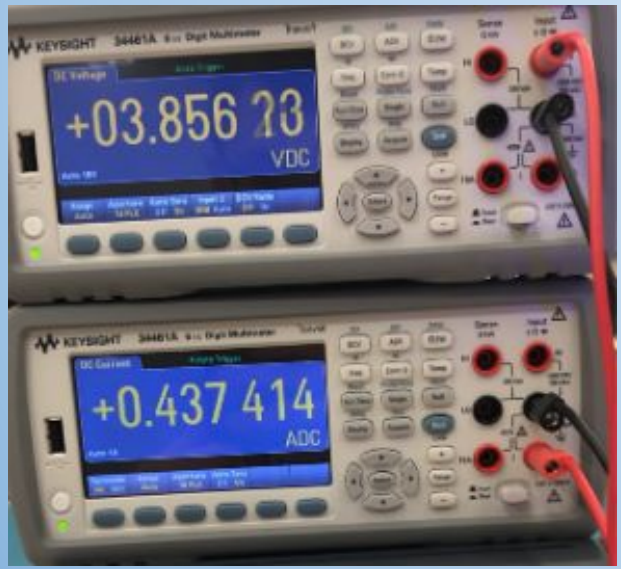
Power vs Distance



Rectified Delivered Power

Receiver Test Results

Sensor Battery Pack Charging



Power levels are what we would expect to see when charging the sensor battery

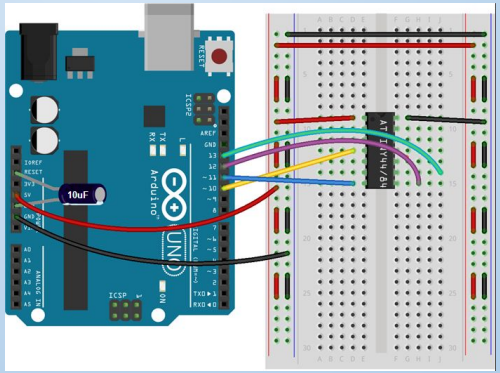
Top : Battery charging voltage

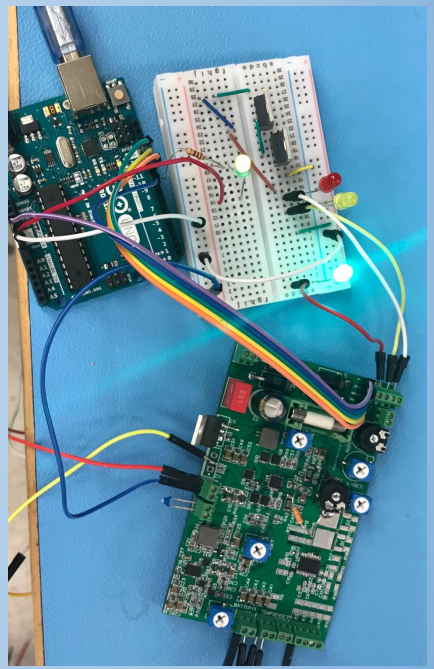
Bot: Battery charging current

Programming and Testing (attiny44)

Using an arduino and the arduino programming software, code can be uploaded to the attiny with the arduino acting as a programmer for the onboard controller

Using an arduino makes code creation, uploading, and testing, easier and simpler



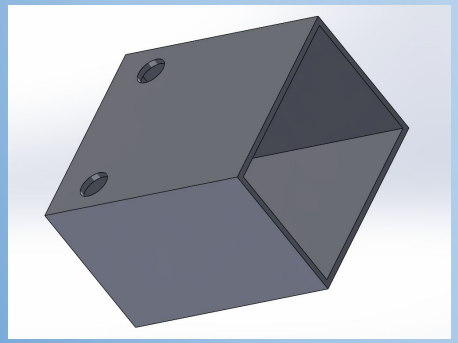


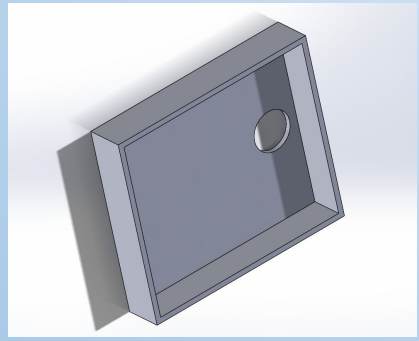
Use-Case Scenarios and Applicability

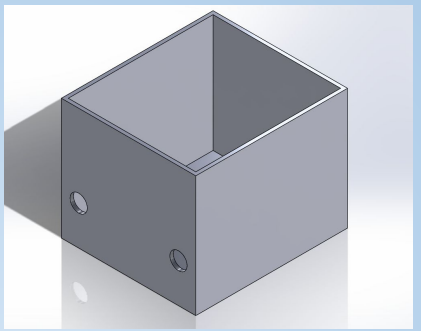
- Coding options leave room to change use of project
- Wireless charging of higher power devices such as Quadcopters, Hoverboards, or RC cars possible
- Making longer range transmitter based off design

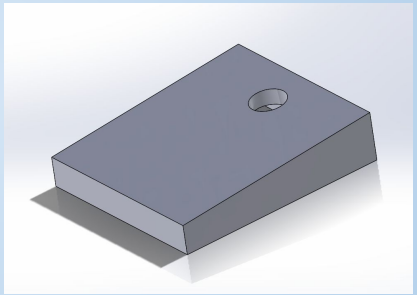
System Containment

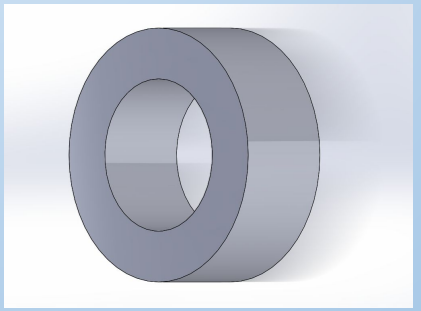
- Use of epoxy layer
- Minimal entry points
- Inclined lid for liquid direction
- Designed for specific use

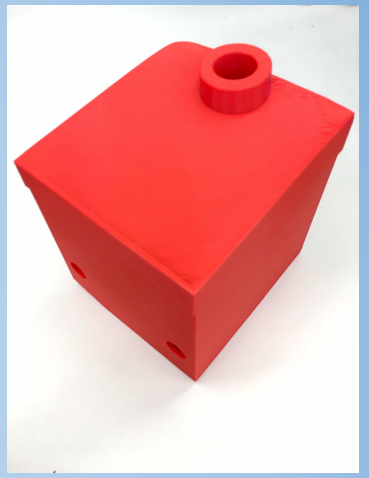


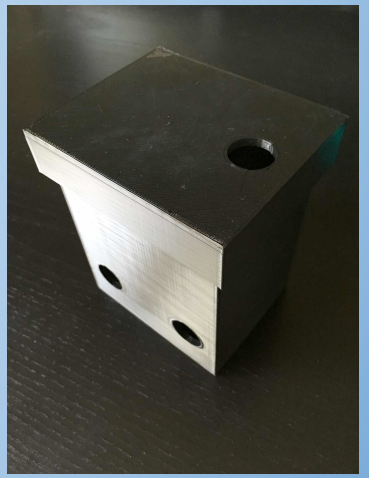










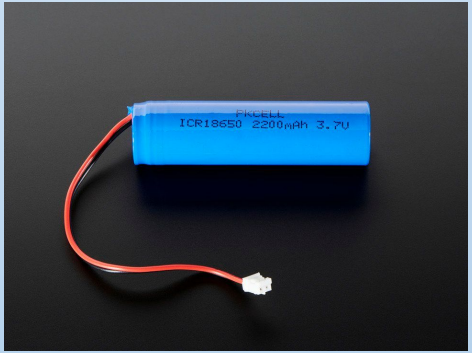


Battery Choice

- Safety Standards
- Voltage/Current rates
- Mono vs Duo Pack decision effects

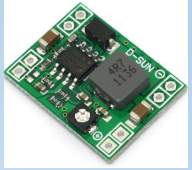
Samsung 30q

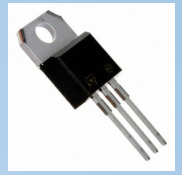
Great Power Battery Co. Ltd.



Shenzhen PKCELL Co. Ltd.

Samsung 25r





Constraints/Trade-offs

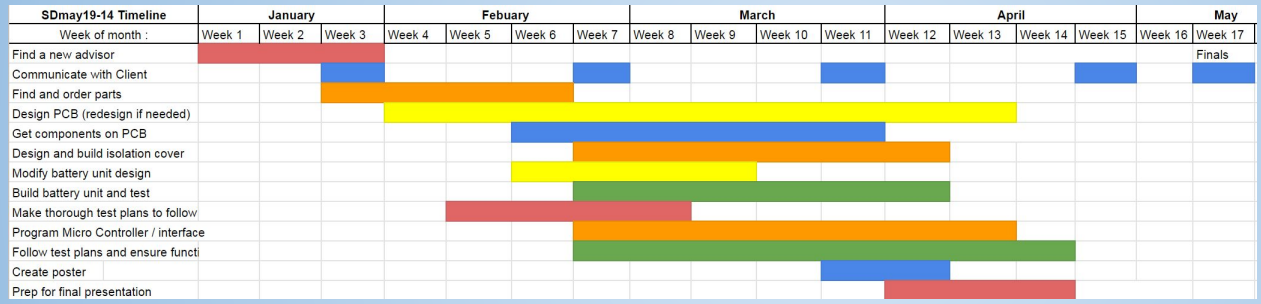
Functionality vs Efficiency

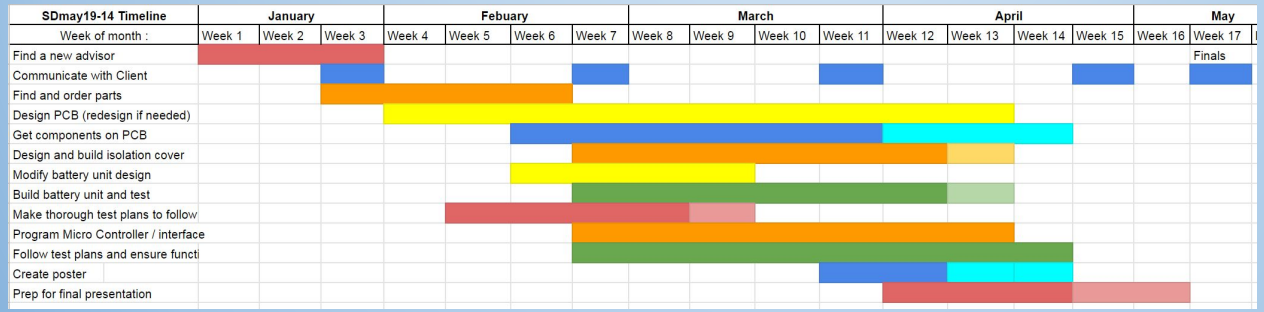
Some aspects of the project, such as power loss, were not made a main focus, as overall functionality was needed most to prove viability and do-ability of project.

Versatility vs Optimization

We aimed to design our project in a way that modifications could be more easily made, while allowing potential for more versatile device(s). Future work can expand upon and get refined as needed, instead of being limited to a unique path of development.

Project Planning and timelines



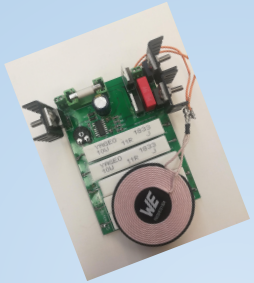


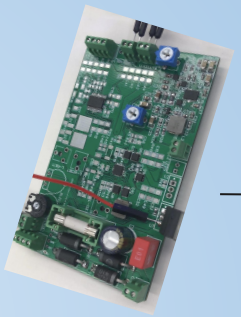
Project Status Evaluation

What is our project's state (what works what doesn't) ?

- The project functions and can transmit and receive power wirelessly, and charge sensor battery
- On board microcontroller can sense battery voltages and alert user about the state of the system
- Room for improvement and expansion of the design
- Client satisfied with our work and progress

Future Works





?

- Making design more optimized and efficient
- Adding extra features to the system (extra coding options, extra sensors….)
- Adding an additional isolating layer for the cables that goes into the boxes at the entry points
- Improving versatility and useability of components

Thank You

Questions……?