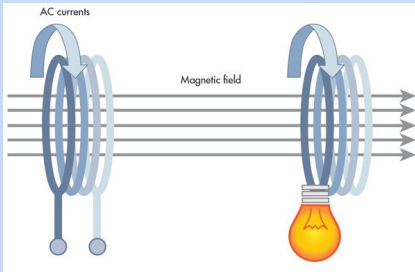
Sdmay19-14
Wireless Recharging System

Group Members : Miguel, Kyle, Doruk, Benjamin

Advisor: Craig Rupp

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.

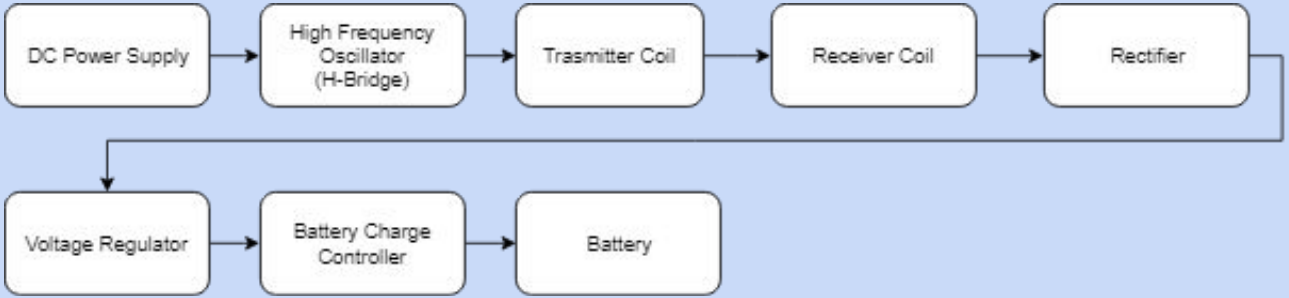
Functional Requirements

- The sensor must be powered during the work hours without interruption.
- Additional charging capacity should be used for charging the LEDs and the adjacent circuits.
- The wireless charging unit must fit the allowed space on the arm.
- This wireless powering solution must not affect the functioning of the arm.

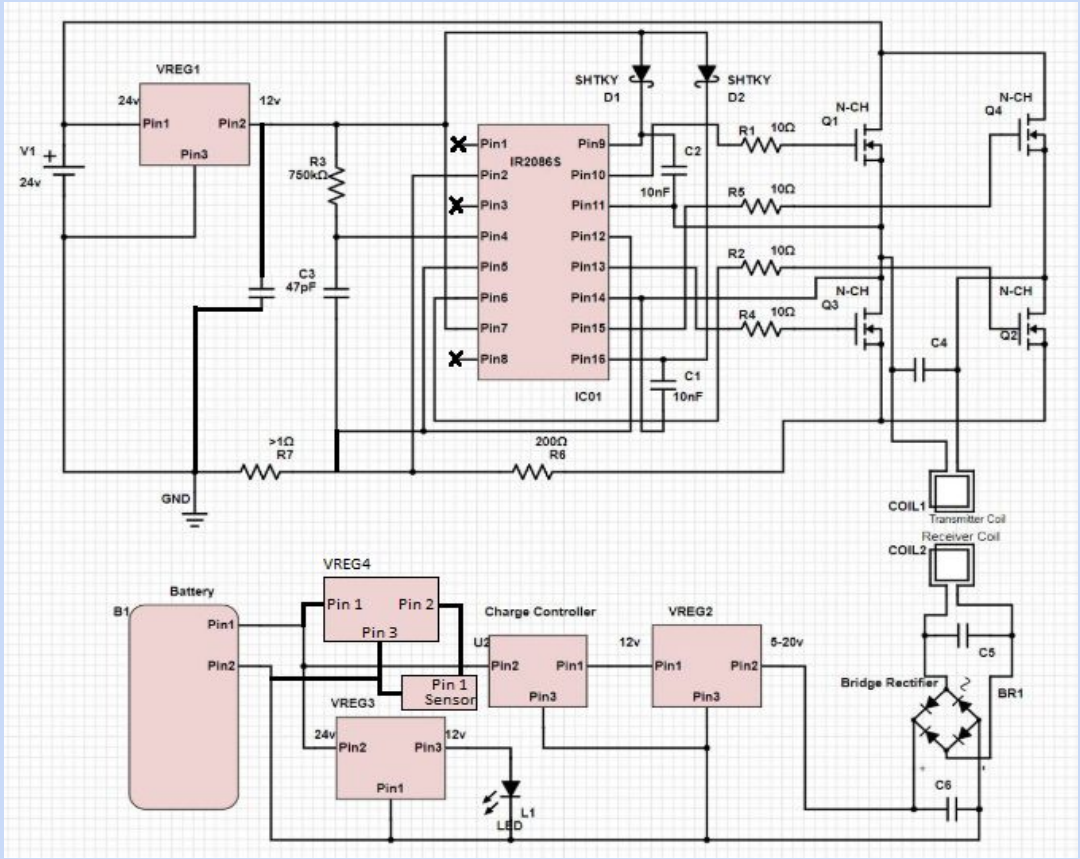
Non-Functional Requirements

- The cost of our wireless solution should be feasible when compared to the regular renewal of the non-rechargeable battery of the sensor over a reasonable period of time.
- The necessary load value for the sensor that needs to be provided is 3 VDC and 0.1A, and for the LEDs and the adjacent circuits is 24VDC and 1A.

Conceptual Diagram



Proposed Design

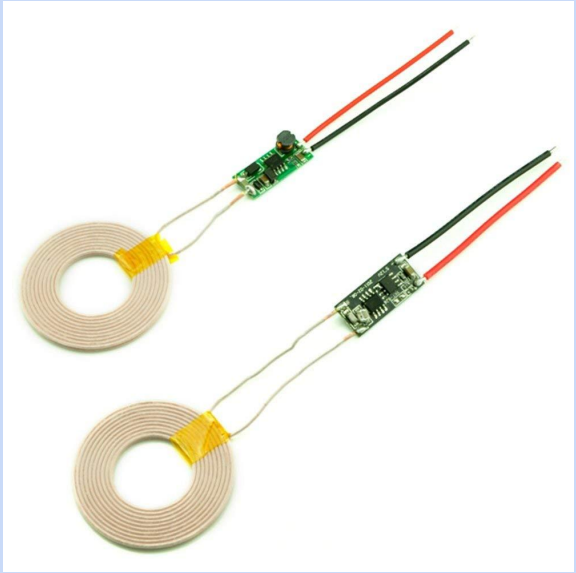


Market Survey

-Other products on the market (5v 1.5A)

-Possible Long Term Impact on Reputation of the Company

-Very Innovative Product

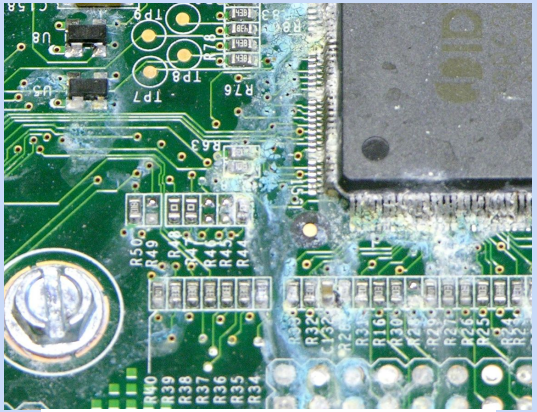


Potential Risks & Mitigation

-Environmental effects on circuits

-Environment varying from location to location (winter, summer….)

-Large power demand and large batteries



Resource/Cost Estimate

MOSFETs(10): **$7.68**

Gate Driver ICs(3): **$13.78**

Rectifying Diodes(10):**$3.68**

Transmitter/Receiver Coils(4): reimbursed**$**

Other components (res, cap, ect) : TBD **$**

PCBs(2): TBD **$**

Unexpected Shipping Costs: **$15.98**

Batteries(5 to 8): **$49.75 / $79.60**

Voltage Regulation: TBD **$**

Project Milestones

- Acquired the components necessary to make a functional prototype for testing
- Getting our H-bridge controlling IC to oscillate
- Changing the output frequency of our H Bridge
- Created small scale testing environment for Power Management System

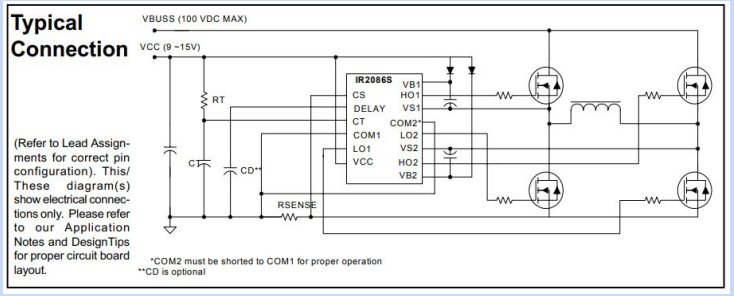
Functional Decomposition

Our decomposition of task is as follows:

- Power management / control (software implementation)
- Circuit designing and testing
- Circuit building and debugging

Technical/Other Constraints/Considerations

- Keeping/testing the design feasibility
- Navigating through datasheets of the IC for the H-Bridge and researching values non present
- Power consumption and management
- Lower cost and overall high efficiency



Test Plan : Hypothesis and Defining tests

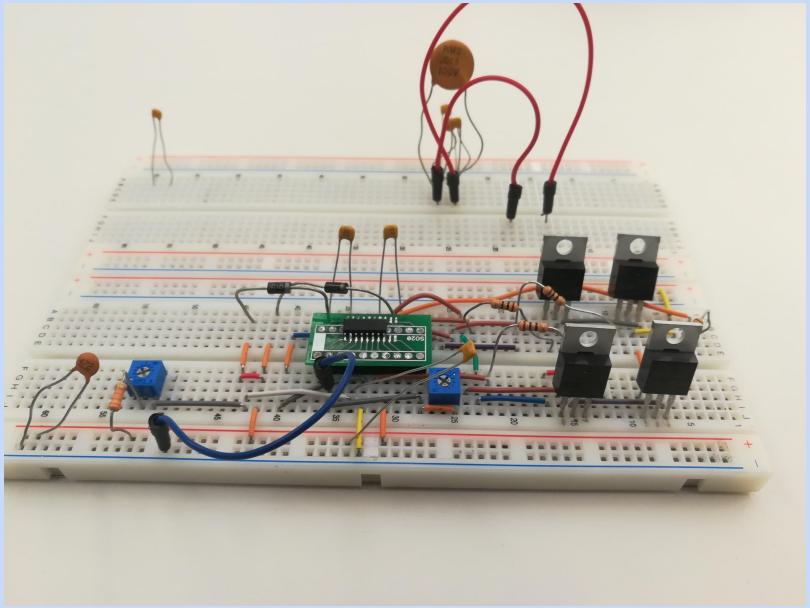
- Expect to see a square wave output of IC
- Observe Resonance in our coils
- Confirm voltage and frequency values
- Test operation of both integrated circuit and H-bridge
- Determine whether or not the design can perform as desired

Test Plan : Simulations

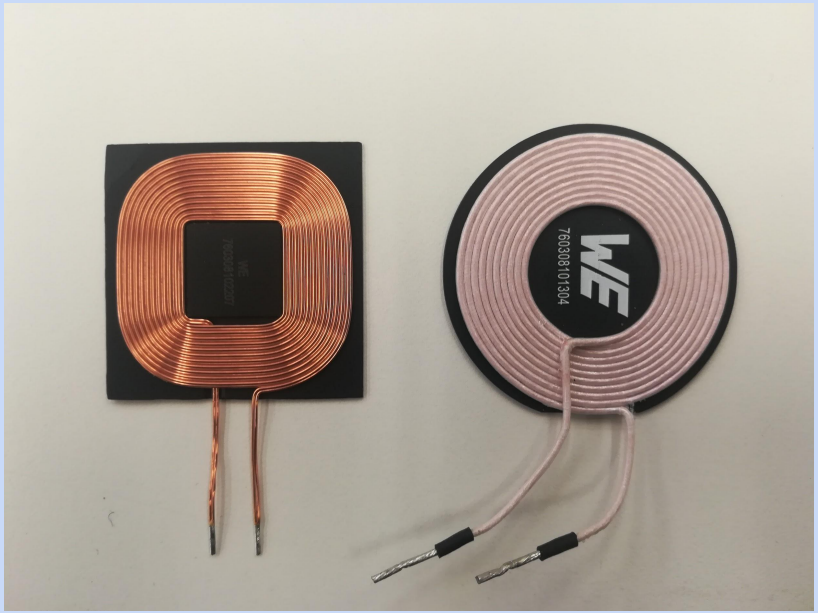
- Using function generator and sized capacitors to observe resonance
- H-bridge (MOSFETS) driven with function generator
- Simulation were helpful but were limited in their usefulness

Prototype / Block Implementations

H-Bridge Circuit Prototype



Transmitter and Receiver Coils

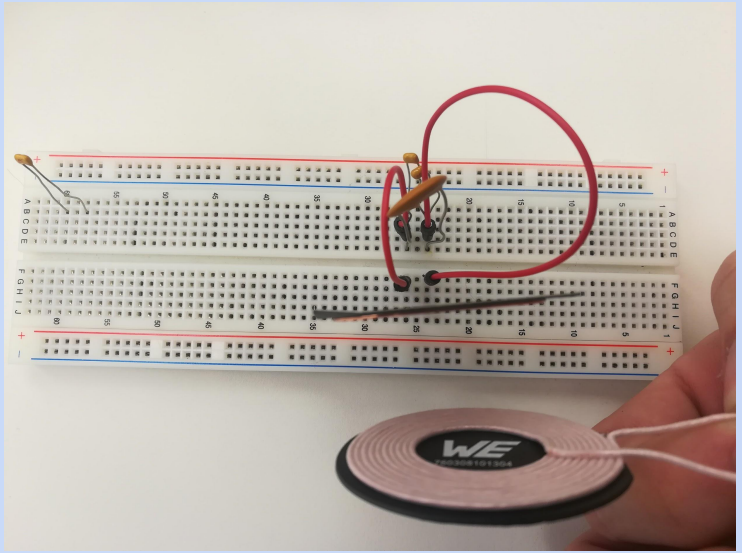


Implementation Results

- Capable of varying oscillating frequency
- H-bridge operated correctly
- Voltage levels at expected values
- Overcurrent sensing working

Current Project Status

- Prototype of the H-bridge circuit is complete, coils transfer and receive power.
- Preliminary tests with the power management prototype is complete .



Task Responsibilities & Individual Contributions

Miguel Hennemann	Benjamin Gisler	Doruk Er	Kyle Henricksen
- Communicated with client	- Set/determined goals for team and kept group on track	- Calculated values for the battery pack and coils' size	- Operated team website
- Ordered necessary parts	- Formed basis of documents and google drive	- Provided options for parts	- Designed a prototype Pow. Management Sys.
- Tested prototype circuit	- Soldered components and refined design	- Assisted to the design and test processes	- Provided alternative perspective for solutions

Plan for Next Semester

- Finish testing prototype(s)
- Design a PCB for the transmitter circuit and for the receiver circuit
- Incorporate control/power management software to interface with circuit
- Implement a battery protection unit for charging