UNC CHARLOTTE
The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

Senior Design Project Description

Company Name	**Rail Propulsion Systems**	**Date Submitted**	June 13, 2017
Project Title	Alignment Free Wireless Power Transfer (WPT) System for Fixed Guideway Vehicles (RAIL_WIRE)	**Planned Semester**	Fall 2017

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project. 250 hours are expected per person. Complete the following table if this information is known, otherwise the Senior Design Committee will develop based on the project scope:

Discipline	**Number**	**Discipline**	**Number**
Mechanical	2	Electrical	4
Computer		Systems	
Other ( )			

Project Overview:

Electric vehicles are gaining in popularity for a number of reasons. This fast growth is causing interest in other forms of transportation which are not as obvious as candidates for battery power or electrification. One area of interest is train locomotives. Trains are driven already by electric motors. The electricity to drive the motors is produced by a diesel engine. Since these locomotives are very large, would it be possible to replace the engine with a bank of batteries for power? Likely no for a long haul freight train, but what about a short haul passenger train? This could possibly be feasible and even more desirable to do this in corridors where air quality is a concern. This project is to develop a portion of the technology that would enable this to become feasible. This portion is to develop a wireless charging system for the battery bank. The system would be installed in the locomotive and each station to charge the battery bank.

WPT (Wireless Power Transfer) in fixed guideway applications have both a challenge and opportunity for building systems that eliminate the need for alignment between the power transmitters and receivers. This system would allow both alignment free static power transfer, and also efficient and continuous charging while the vehicle is moving. For passenger rail vehicles this would allow charging as the vehicle slowed to a stop at a station, and while in the station transferring passengers, and then when while it was accelerating out of the station.

Rail Propulsion Systems (California based) is the project lead and McDowell Engineering is a technical partner for RPS in NC.

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Initial Project Requirements:

Project team will explore the aspects of WPT system design for an axial strip of transmitters spaced under a long receiver. The long receiver will be designed and tuned to receive power from n transmitters and will be physically long enough to cover n+1 transmitters.

The system will function by activating exactly n transmitters at one time as they are under the receiver. As the receiver is in motion, the control system will deactivate the transmitter that is about to leave the space under the receivers as it turns on the transmitter that is now fully under the receiver. In this manner the system does not have a defined alignment requirement for the vehicle and can continuously transmit power as the vehicle moves along the guideway.

Team will explore ways of synchronizing and controlling transmitter activation along with methods of determining relative location of vehicle on the guideway.

Expected Deliverables/Results:

Team will define preliminary antenna designs for a 350kW power transfer system in a 15m under car length.

Team will design and build sub scale system for small gauge train car.

Disposition of Deliverables at the End of the Project:

Scale hardware developed would be used for RPS to promote rail electrification program to gain future grant opportunities in partnership with UNCC.

List here any specific skills, requirements, knowledge needed or suggested (If none please state none):

- There is an actual locomotive that is available for the project. It is located at the NC Transportation museum near Salisbury NC. Team would have to travel there as required to take data and meet with the client.

Requirements for UNCC students in this senior design team:

- Ability to work in a team.
- Electrical Engineering should be able to complete calculations and circuit simulation using Matlab/Simulink or equivalent simulation software, design, build and test power electronics converters with guidance.
- Experience with power electronics converter design in class, hands-on circuit testing ability is preferred.
    - Understanding of transformers and electromagnetic field. Ability to electromagnetic FEA tool is highly preferred.
    - Ability to create printed circuit boards (PCBs)

- Ability to assist with programming as needed

- -Mechanical Engineering Majors should have the ability to create 3-D Models through Computer-Aided Design (CAD).
- Understanding of heat dissipating elements
- Creativity in structural design for aesthetics