Summary Report

Project Title: Inductive Coupling and Mobile Energy Disseminator-Based Dynamic Wireless Charging of Electric Vehicles.

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Summary: This research was conducted as an undergraduate design project, where five undergraduate students registered for the Senior Design course (EECE 4280) in the Spring 2023 semester at the University of Memphis. Also, the design was conducted as the part of the Energy Conversion class project in the Fall 2023 semester. The goal of the project is to design and create a dynamic wireless charging (DWC) system for electric vehicles (EV). This DWC is intended to display DWC on a small scale as a proof of concept where a vehicle can charge while in motion from the roadway, and from another vehicle. The device will detect the presence and charging need of a vehicle through various sensors and informative scopes. In practice of a full-scale application, public transport will be affixed with the primary DWC unit. This unit is to receive charging from the city grid, whenever needed, and transfer this energy from itself to a nearby EV in need of charge. The goal is to allow EV consumers to plan out their route that will allow them to charge their vehicle while on the move. Thus, providing a higher convenience and peace of mind to the consumer. This type of automation will allow even further development of smart transportation technology.

Design Testing and Results: For this design project, two types of DWC were considered, such as the inductive coupling type and Mobile Energy Disseminator (MED) type. For the first type, coils will be embedded into the track, each connected to a power source by a switch. The switch remains in a closed position until told to open by the Arduino Mega. To send this command, the Arduino is constantly looking out for the presence of the vehicle using Ultrasonic Sensors. The receiving coil is integrated into the car driving along the track. While the car is moving over the coils, a display will show the current battery percentage of the car. Figure 1 shows the design schematic, while figures 2 and 3 show the proof of concept on the proposed DWC technology. Our car has the receiving coil mounted onto its base, roughly one and a half inches from the track. The received voltage is converted from AC to DC using a rectifier and then moderated by a buck boost converter. This allows us to have a consistent volage into the battery pack (4.8 V rating).

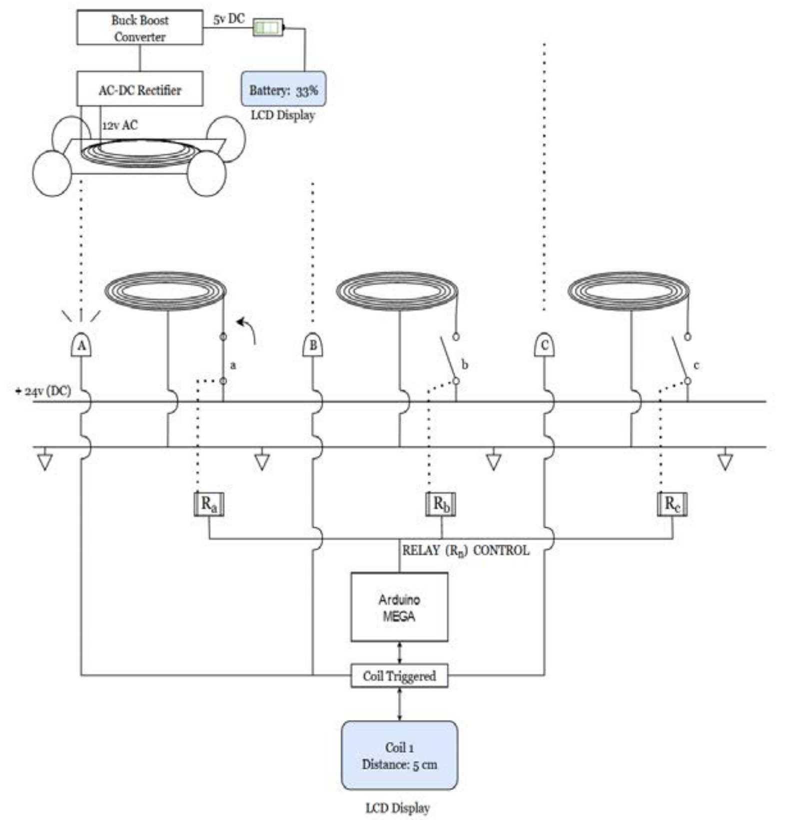

Figure 1: Design Schematic.

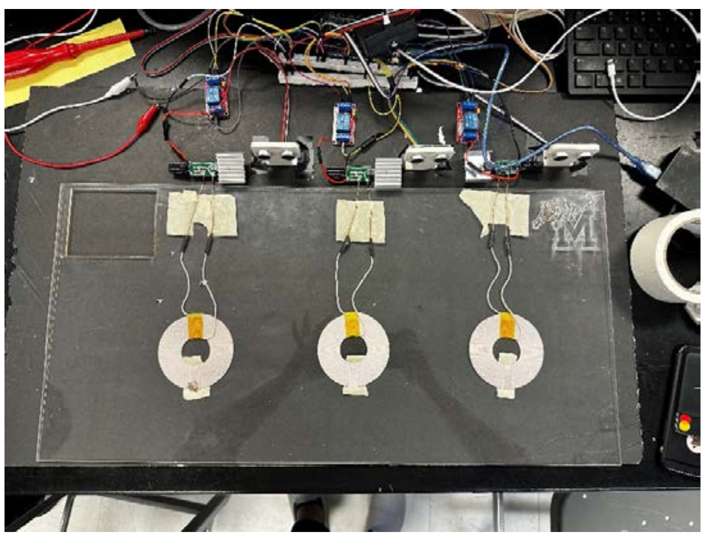

Figure 2: Alpha Model of Track.

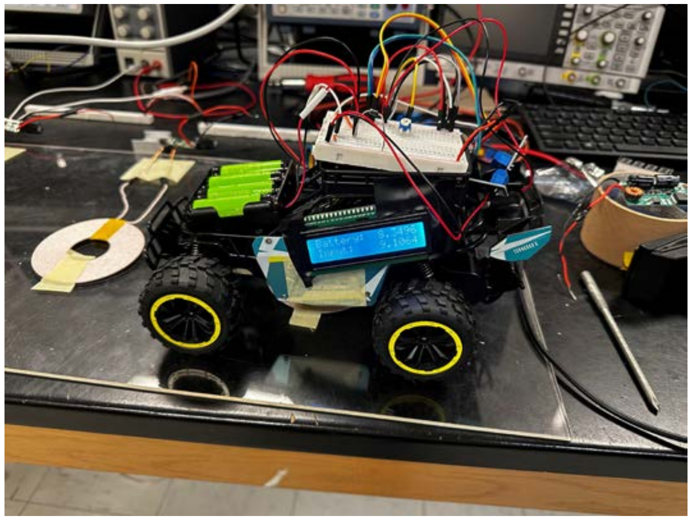

Figure 3: Alpha Model of Receiving Car.

Figure 4 shows a working alpha model of DWC and push forward with creating a mobile energy disseminator (MED). This is when a vehicle receives a charge from another vehicle and the general setup can be seen in. This requires a separate buck-boost converter to step up the voltage for transmission to take place.

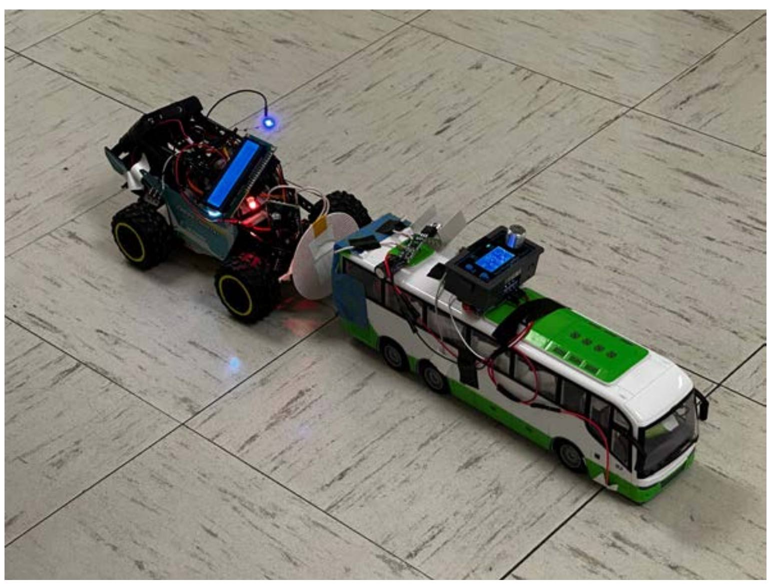

Figure 4: Alpha MED Model.

Conclusion: The proposed project has potential impact on the relevant field and application. The project successfully developed a wireless charging track that allows wireless charging at any point along the track. It ensures that this track will allow dynamic charging along it without any feedback power returning into the power source. Also, a car-to-car wireless power transfer was implemented. Further designs of the track or vehicle system would need to be investigated for this to take up less space and minimize cost.