



Evaluation of Wireless EV Charging Efficiency and User Experience Survey

Built on the vision of creating the global standard for wireless charging, HEVO, Inc. (Hybrid & Electric Vehicle Optimization), located in Brooklyn, NY, is a Service Disabled Veteran Owned Small Business. HEVO, Inc's mission is to accelerate the adoption of electric vehicles (EV) through the deployment of its wireless charging network. HEVO, Inc's goal is to provide a safe, fast and cost effective method of charging EVs that eliminates the hazards and inconveniences associated with plug-in charging.

CHALLENGE

The objective of this project was to independently evaluate the performance of a HEVO-One Prototype charging system based on the spatial and environmental parameters in a laboratory setting and to solicit feedback from a group of users regarding their experience using the charging system.

New York State Pollution Prevention Institute (NYSP2I) at Rochester Institute of Technology (RIT) supported HEVO, Inc. through the evaluation of specific performance characteristics associated with their new HEVO-One Prototype wireless vehicle charging system and provided information that was key for HEVO, Inc. in the development of their parking application for smart phone devices. The performance characteristics included a sensitivity analysis comprised of screening and latitude testing of the system's charging efficiency to variations in linear and angular position of the receiver relative to the transmitter.

SOLUTION

NYSP2I and HEVO, Inc. focused on tasks that would help them achieve their project objective. The initial tasks of this project involved a laboratory evaluation of the HEVO-One Prototype System. The HEVO-One Prototype electric vehicle charging system was installed at RIT's test laboratory, providing exposure to multiple conditions. The work performed incorporated a sensitivity analysis including screening and latitude testing of the System's charging efficiency in relation to the relative spatial positioning of the transmitter to receiver.

Additionally, a participant survey was designed by NYSP2I to capture user feedback on the experience of using an installed HEVO-One Prototype System. The System was installed on a GEM Electric Vehicle and a user survey, consisting of 37 questions, was developed and administered. Survey participants were each asked to park the GEM vehicle in a section of the RIT laboratory space. A two-part alignment system was devised to guide drivers into correct alignment with the transmitter. The survey solicited information regarding the efficacy of the parking alignment system as well as user feedback on the HEVO-One Prototype System in general.

CHALLENGE

- Independently evaluate the performance of the HEVO-One Prototype charging system based on the spatial and environmental parameters in a laboratory setting
- Solicit feedback from a group of users regarding their experience using the charging system

SOLUTION

- NYSP2I performed a sensitivity analysis including screening and latitude testing of the System's charging efficiency in relation to the relative spatial positioning of the transmitter to receiver
- A participant survey was designed by NYSP2I to capture user feedback on the experience of using an installed HEVO-One Prototype System

RESULTS

- 95% of the HEVO-One Prototype System's available charging efficiency was captured within a vehicle parking alignment of 15 cm
- Study participants were able to successfully park a GEM test vehicle within the 15 cm tolerance zone in 8 out of 12 trials, maximizing the charging efficiency of the HEVO-One Prototype System
- NYSP2I lab testing identified the significant factors affecting system charging efficiency and estimates of noise immunity of various factor levels
- Results from this project will assist HEVO, Inc. to further develop and market their system, expanding the ease of use for electric vehicle charging

TESTIMONIAL

“NYSP2I was instrumental in providing us with the resources and expertise to effectively evaluate the HEVO-One Prototype charging system. The collaboration between HEVO, Inc. and NYSP2I reinforced our mission of accelerating the adoption of electric vehicles through the deployment of its wireless charging network. Their support will help us further develop and market our system, expanding the ease of use for electric vehicle charging.”

– Jeremy McCool, President & CEO
HEVO, Inc.

RESULTS

The goal of the latitude testing was to compare charge efficiency to variations in linear and angular position of the receiver relative to the transmitter. The testing provided useful results identifying the significant factors affecting system charging efficiency. The testing also provided estimates of noise immunity of various factor levels. The feedback collected from the survey was used to measure the ability of users to correctly align the two main components (transmitter and receiver) of the HEVO-One Prototype charging system while parking. The feedback helped HEVO, Inc. understand the factors that affected that ability, and to collect general feedback on their user experience and opinion of the charging system usability.

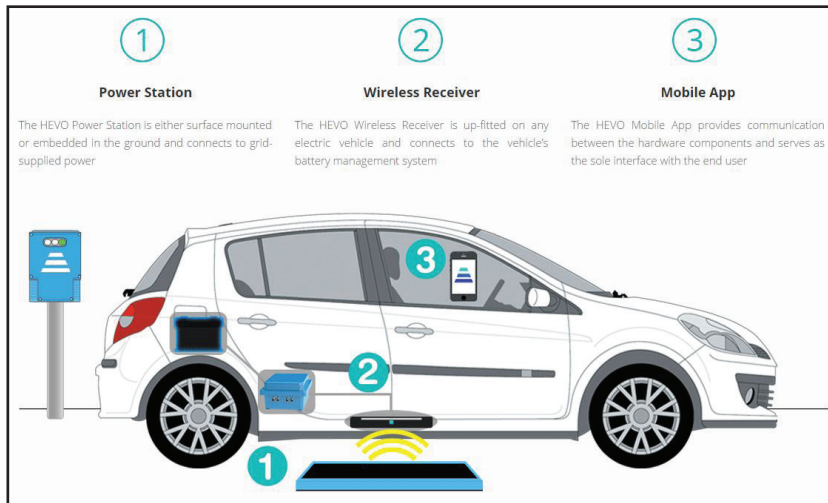


Photo Credit: <http://hevopower.com/#work>

NYSP2I's evaluation of the HEVO-One Prototype System performance in a laboratory environment identified that vehicle parking alignment within a 15 cm diametrical location provided 95% of the system's available charging efficiency. The maximum charging efficiency measured in a lab environment, from power source to a simulated GEM vehicle 72 volt lead acid battery bank, was 66%. The charging rate was limited to 1 kilowatt to simulate the GEM vehicle 110 volt charging system. The charging efficiency reduced exponentially relative to parking misalignment, and reduced linearly with vertical separation of the transmitter to receiver of 15 cm and greater.

As previously mentioned, the participant survey of the HEVO-One Prototype System was disseminated during GEM vehicle testing. Overall, the combination of parking alignment aids, as combined with the HEVO-One Prototype System was rated as effective. In 8 out of 12 trials (66.7% of the time), the measured misalignment of the participants was within the 15 cm diameter of tolerance identified through the sensitivity analysis, which meant that most of the time, participants were accessing 95% or more of the systems charging efficiency. Misalignment of the vehicle to the HEVO-One Prototype transmitter during parking maneuvers consistently decreased between each participant's first and second parking attempt. Participants had a more accurate perception of their alignment in the X-direction (front to back) than in the Y-direction (side-to-side) and parking misalignment in the X direction was consistently lower than that in the Y direction. Those who did report difficulty parking rated the maneuverability of the GEM vehicle as the biggest contributor to that difficulty, suggesting that improvements could be made.

The results of this project will assist HEVO, Inc. to further develop and market their system, expanding the ease of use for electric vehicle charging. Success of this product line is projected to create up to 18 NYS jobs over three years.

NYSP2I PARTNERS



New York Manufacturing Extension Partnership

Funding provided by the New York State Department of Environmental Conservation.

© 2016 Rochester Institute of Technology
Any opinions, results, findings, and/or interpretations of data contained herein are the responsibility of Rochester Institute of Technology and its NYS Pollution Prevention Institute and do not represent the opinions, interpretation or policy of the State.

For more information please contact us:

111 Lomb Memorial Drive, Bldg. 78
Rochester, NY 14623

Tel: 585-475-2512
Web: nysp2i.rit.edu
E-mail: nysp2i@rit.edu

