Unplugged: Engineers Develop Wireless Charging System for Electric Wheelchairs

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News Release — LOGAN, UTAH — Sept. 17, 2018 — Researchers at Utah State University are rethinking a 30-year-old technology and giving new meaning to the words limited mobility.

Electric Wheelchair Smart Charging System

- Pad Charging Area: 8 square feet
- Wireless Power Transfer: 250 watts
- Charging Pad Power Coils: 48
- Coil Alignment Tolerance: free positioning
- Docking Modes: manual, remote or autonomous
- Smartphone App: Android and iOS compatible
- ADA Compliant: Yes
- Magnetic Field Monitoring and Safety System: Protects users from harmful levels of electromagnetic fields

A team of electrical engineers created the first-ever prototype of an electric wheelchair that charges via wireless power transfer. The innovative smart charging system eliminates the need for a plug-in charger and promises to significantly improve user mobility. The system recharges the wheelchair when it's positioned over a specially-designed charging pad. The pad detects the position of the chair and activates one of its 48 overlapping charging coils. By activating just one coil at a time, the system protects users and nearby people or pets from harmful levels of magnetic fields.

A user-friendly smartphone app gives users full control over the docking and charging process. Remote or autonomous docking modes allow the wheelchair to find the charging pad without the user's help.

Electrical engineers at USU created the first-ever electric wheelchair that charges wirelessly.

For inventors Zeljko Pantic and Calvin Coopmans, the wireless charging system represents an important step in assistive technology. "This is about freedom and mobility," said Pantic, an assistant professor of electrical engineering and lead researcher on the project. "This has the potential to completely change a user's independence and quality of life."

Pantic and Coopmans and a team of student researchers spent nearly two years developing the technology. The team has extensive experience in wireless power transfer, but the wheelchair project presented a difficult new challenge.

"Electric wheelchairs are both a blessing and curse," said Coopmans, a research faculty at USU. "They provide mobility to users who may not otherwise be able to use a manual wheelchair, but they require long charging periods, meaning users can be immobile for long periods while batteries recharge."

The team identified three main problems with traditional electric powered mobility devices: limited driving range, issues in using a plug-in style charger and battery life.

"The battery is the single most problematic piece to electric mobility," said Pantic. "Traditional lead-acid batteries haven't changed much in over 30 years. Our goal is rethink not only the battery, but the entire ecosystem: the user, the chair, the charger and the lifestyle of the user."

A key advantage to the wireless charging system is that it lets users charge more frequently. When a battery maintains a state of higher charge, says Pantic, it lasts longer and provides more power.

Ujjwal Pratik, Prof. Cal Coopmans, Prof. Zeljko Pantic, Ahmed Azad and Brady Houston developed an electric wheelchair that charges via wireless power transfer.

"So instead of charging the battery at night and then draining it to zero the next day, users can take advantage of opportunistic charging throughout the day," he said. "They don't have to be confined to one location for long periods at a time."

Pantic says the smart charging system could be expanded into a community-wide network with locations inside homes, businesses, cinemas, hospitals, restaurants, bus stops and more. It's all part of the creators' vision to improve the user's quality of life and community involvement.

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The project is a joint effort between Utah State University, University of Colorado and Sunrise Medical of Fresno, Calif. The company donated a Quickie Power 6 wheelchair for the development of the first-generation prototype. Additional technical assistance was provided by Cathy Bodine of the University of Colorado Denver and USU's Regan Zane. Students Reza Tavakoli, Ahmed Azad, Ujjwal Pratik, Chakridhar Reddy Teenet, Ethan Payne, Brady Houston and Jonathan Scheelke helped develop the technology.

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