Team EV-e-olution

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ABSTRACT

•Team EV-e-olution is proud to showcase an innovative electric vehicle charging simulation designed to revolutionize the way we charge our cars.

•Using cutting-edge technology, the simulation allows users to test different charging scenarios, from fast charging to trickle charging, and see the impact on battery life and charging time.

•We invite visitors to experience the simulation firsthand and learn about the latest developments in electric vehicle charging technology, highlighting the importance of sustainability, cybersecurity and environmental responsibility in the automotive industry.

•Presenting the electric vehicle charging simulation as a valuable tool for both individual consumers and businesses, helping them make informed decisions about charging their electric vehicles and promoting the widespread adoption of sustainable transportation solutions.

CONTACT

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INTRODUCTION

•As the world becomes increasingly aware of the need for sustainable transportation solutions, electric vehicles are gaining popularity. However, charging infrastructure is still a major hurdle for widespread adoption. That's why we're excited to present our electric vehicle charging simulation at this design fair, showcasing a potential solution to this challenge.

•At the forefront of innovation in the automotive industry, we're proud to present our latest development in electric vehicle charging technology. Our simulation provides a unique way to test and optimize charging scenarios, giving users greater insight into the charging process and helping them make more informed decisions about their electric vehicles.

PURPOSE

Sustainability and environmental responsibility are crucial considerations for any modern business or individual. With our electric vehicle charging simulation, we're proud to showcase a potential solution to the challenge of sustainable transportation, giving visitors to this design fair a unique opportunity to learn more about the latest developments in electric vehicle charging technology.

The purpose of our project is to support potential areas in future research:

- Improving charging circuit efficiency: With the increasing adoption of electric vehicles, it is important to improve the efficiency of the charging circuit to reduce charging time and maximize the vehicle's range. Research can focus on developing new charging algorithms and protocols, optimizing power electronics, and integrating renewable energy sources.
- Cybersecurity of charging infrastructure: As EVs become more connected and reliant on software, the risk of cyber attacks on the charging infrastructure increases. Research can focus on developing secure communication protocols, implementing advanced encryption techniques, and developing intrusion detection and prevention systems.

FUTURE

•Integration with smart grid technology: Our EV charging simulator model can be integrated with smart grid technology to optimize energy usage and reduce costs.

•Incorporation of wireless charging technology to eliminate the need for cords and cables.

•Implementation of user authentication and billing features to provide secure and convenient payment options.

•Collaboration with EV manufacturers to improve compatibility with their products and provide a seamless user experience.

•Implementation of machine learning algorithms to optimize the charging process and improve the user experience.

•Development of a mobile application to allow users to control and monitor the charging process remotely.

TECH STACK/MODEL DETAILS

•We are using MATLAB for modelling and simulation of the charging circuit system components.

•The GUI is programmed in python.

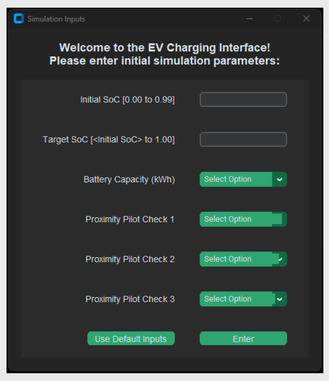
•GUI takes the user input and sends the input parameters to the MATLAB model, where all the processing on the charging circuit side is done and then the output data is sent to the GUI again in order to display the output.

•The output consists of the error messages, the processing log which contains the states and the communication messages exchange timestamps.

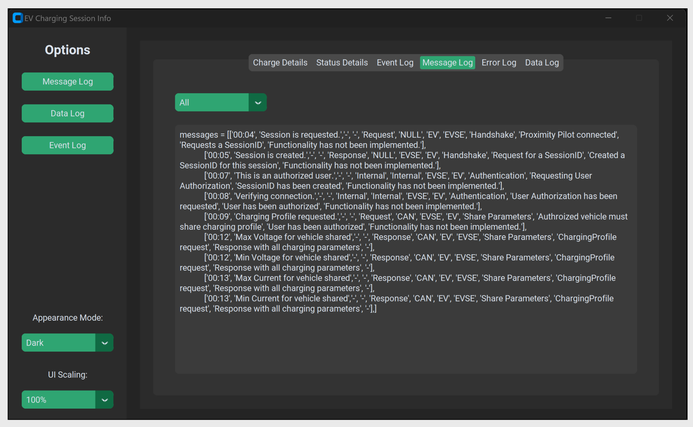
•The scope block in MATLAB allows us to display the data with respect to a specific time domain.

•The use of MATLAB for modelling and simulation of charging circuit components allows for accurate representation of the system's behavior and dynamics, which can help in designing and optimizing various charging circuit components.

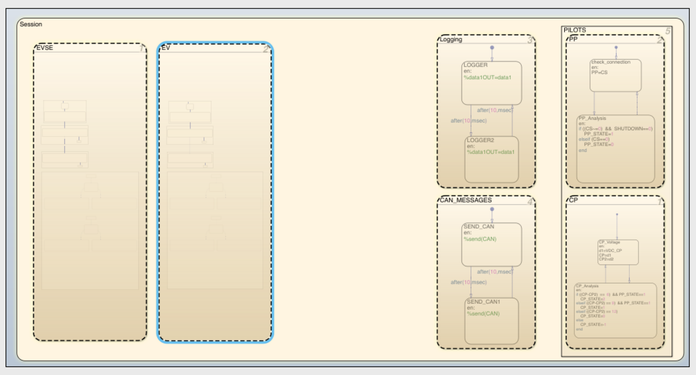
SNAPSHOTS



Picture 1. Input GUI



Picture 2. Output GUI.



Picture 3. High level overview of EV state machine.

CONCLUSIONS

•Our capstone project on electric vehicle charging has identified key challenges and opportunities for adoption, including the need for efficient infrastructure and intelligent control systems. It involves smart charging stations and advanced algorithms and our work can be surely applied in improving system performance and making electric charging systems more efficient. We believe our project has contributed to the advancement of this important area of research with potential impact on the future of transportation and energy.

REFERENCES

1. C. Y. Chong and Y. B. Tan, "Electric vehicles: progress, challenges and future perspectives," Energy Procedia, vol. 75, pp. 2880-2886, 2015.
2. J. M. Guerrero et al., "Electric vehicles and renewable energy sources for sustainable transportation: A review," Sustainability, vol. 10, no. 4, p. 1156, 2018.
3. R. A. Moreno et al., "Impact of electric vehicles on the power system operation and control: a review of recent advances," Renewable and Sustainable Energy Reviews, vol. 153, p. 111918, 2022.