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EV Ground Truth Testing: accurate, streamlined, and data-driven enhancement for seamless charging journeys

Challenge

Electric Vehicles (EVs) are gaining increasing popularity in the United States. Unlike traditional vehicles powered by internal combustion engines (ICE), EVs utilize an electric motor and rechargeable batteries for propulsion. With the rising number of EVs on the road, the development of charging infrastructure has become a significant challenge.

Numerous companies currently offer electric charging services across the US and globally, including well-known names like Electrify America, SemaConnect, ChargePoint, and EVgo. Public charging stations are becoming more prevalent in urban areas and along major highways. However, EV drivers planning long trips encounter substantial challenges. They must decide where to charge their EVs, considering factors such as the lack of infrastructure in many rural areas, compatibility with charging ports like NCAS/CCS/CHAdeMO, available charging levels, and the real-time status of these stations.

To alleviate EV driver anxiety and enhance customer acceptance of EVs, Original Equipment Manufacturers (OEMs) are strategizing to furnish their customers with real-time information, regardless of their travel destination.

Unfortunately, much of the data provided by charging companies has proven to be inaccurate, primarily due to continuous software updates. This discrepancy poses significant obstacles for drivers, especially when their vehicles have a low charge. EagleTC has forged a partnership with an OEM to conduct ground truth testing aimed at identifying inaccuracies. Ground truth testing involves validating the accuracy and reliability of data provided by charging companies to the OEM, which is then displayed on their infotainment systems.

Solution

EagleTC deployed four test engineers and a program manager exclusively to the project. Following a thorough examination of the OEM requirements, the engineering team devised a comprehensive 2-phase approach for ground truth testing. The two phases, described below, were strategically designed to ensure accuracy and reliability:

Phase One: Formulation and Planning
- EagleTC developed a suite of test cases aligning with customer requirements. Examples of requirements validated in these test cases include:

    - Accuracy of address and route guidance.

    - Real-time availability of various charger types.

    - Operating hours and payment options at each station.

    - Distinguishing between public and private access.

- EagleTC devised driving routes based on a predefined list of EV charging locations spanning multiple cities and states. The list encompassed diverse charging companies offering different types of chargers, located in places such as apartment communities, parking structures, and store parking lots. Refer to Figure (1) for a sample route featuring EV charging station data.

- To prepare for Phase Two testing, EagleTC downloaded various EV charging station apps for comparison with the infotainment systems. This meticulous approach ensured that the apps were ready for thorough examination. See Figure (2) for a glimpse of the apps and the data they provide.

This strategic and detail-oriented methodology underscores EagleTC's commitment to delivering precise and reliable ground truth testing results.
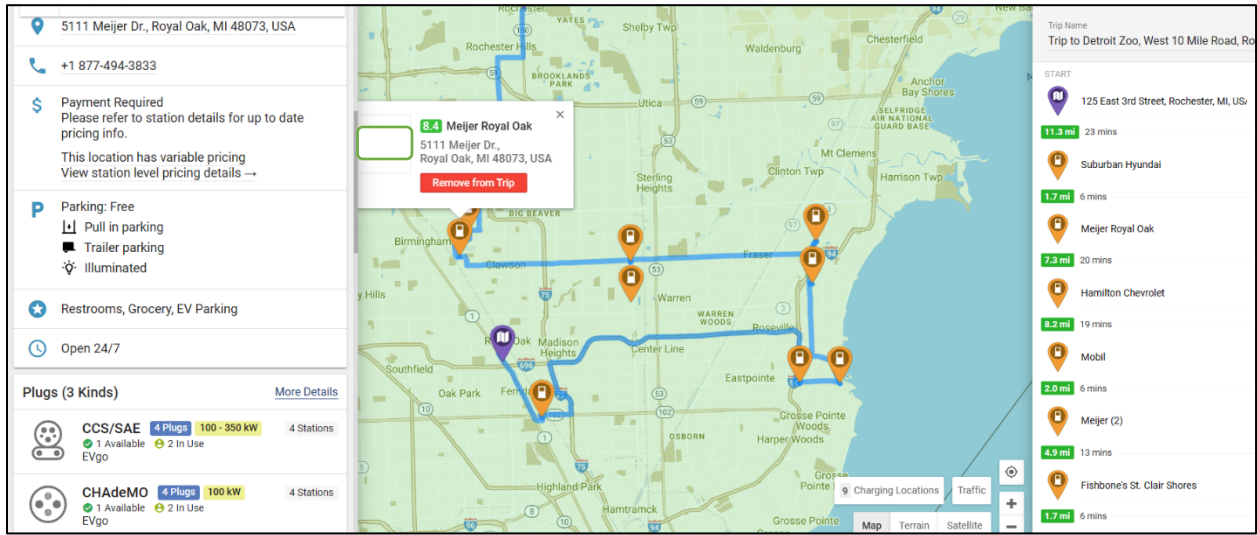
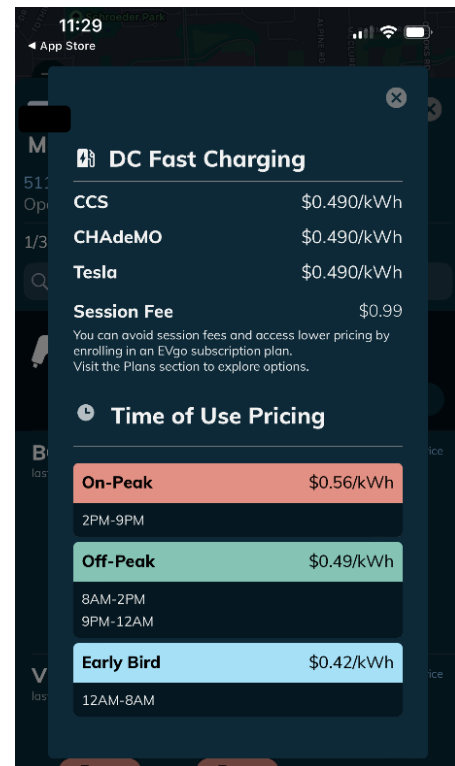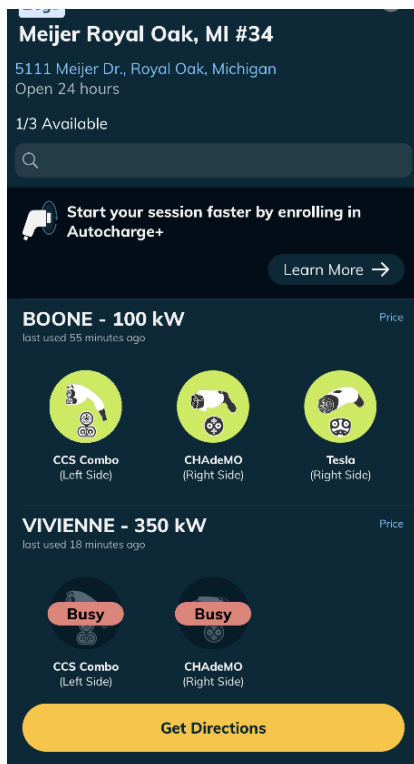Figure (1) - Sample route with EV charging station data.

Figure (2) - Example of EV charging station apps data.

Phase Two: Groundwork

In this phase, the testing unfolded across two vehicles equipped with distinct infotainment platforms. The essential equipment for ground truth testing encompassed laptops, cameras, power stations, a jump starter tool set, hotspot devices, and phones.

- Refer to Table (1) for a comprehensive breakdown of the coverage of charging companies, charger types, locations, and the apps employed.

- Our adept test engineers embarked on a journey to each identified charging station along the designated route. At each location, they meticulously gathered all pertinent details for every test case. Subsequently, the gathered data was compared with the information displayed on both the infotainment system and the charging company's app. A test case was deemed unsuccessful if any disparities were detected in the data. To substantiate the testing process, pictures were taken at each location, serving as evidence for the testing conducted.

This meticulous approach ensures the thoroughness and accuracy of our ground truth testing, demonstrating our unwavering commitment to delivering reliable results.

Charging Companies	Charger Types	Apps	States	Locations
Blink ChargePoint Electrify America EVgo SemaConnect	CCS/DC – Fast Charger Type1/AC Charger	A Better Route Planner (ABRP) Blink ChargePoint Electrify America EVgo PlugShare SemaConnect	Indiana Georgia Kentucky Michigan Ohio Tennessee	Apartments Businesses Parking Structures Shopping Malls Gas Stations

Table (1) – Coverage of Ground Truth Testing.

Results

Since being entrusted with this project in 2023, EagleTC has collaborated closely with the customer to conduct EV charging ground truth testing in numerous locations across the United States. Throughout this partnership, we have consistently provided valuable feedback, meticulously documenting inaccuracies in the data disseminated to consumers. The following highlights underscore EagleTC's competence in executing this project with distinction:

- EagleTC conducted successful tests on over 150 EV charging stations spanning six states. Detailed test results were presented, accompanied by documented photos, and logs were furnished as needed.

- Navigation issues and other noteworthy observations related to EV charging data were promptly reported by EagleTC.

- Leveraging their findings, EagleTC delivered a comprehensive list of lessons learned to the OEM, aiming to enhance processes, expand testing coverage, and optimize costs.

- Daily progress reports were diligently provided to the customer, ensuring transparency and constant communication.

- Upon completion of the project, EagleTC compiled a concise summary of the test results for the OEM.

This project exemplifies EagleTC's ongoing ability to:

- Mobilize ground teams swiftly, creating and implementing test cases and processes with short notice.

- Offer cost-effective solutions by minimizing overhead costs, assigning appropriate resources for designing test strategies, providing thorough training for testers, and employing robust program management processes.

- Identify and analyze issues in real-time, resulting in continuous improvements for future projects and an enhanced user experience.

- Adapt seamlessly to variable circumstances while consistently delivering precise and timely results.