White Paper

Smart Cities & Critical Infrastructure
Intel® Distribution of OpenVINO™ Toolkit, Intel® Processors

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Redefining Electric Vehicle Charging:
A Seamless Integration of AI and Technology

Innodisk and Intel are revolutionizing electric vehicle charging with an AI-driven solution, ensuring efficient, safe, and seamless experiences at charging stations.

"It is an honor to cooperate with Intel and introduce our cutting-edge AI in EV charging solutions to worldwide customers. Intel's OpenVINO toolkit plays a pivotal role in Innodisk's AI strategy and enhances our edge computing offerings. This helps us ensure that our solutions are at the forefront of technological innovation."

- Don Yu
Special Assistant to the Chairman

innodisk

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Executive summary

The growing need for sustainable transportation options around the world, has increased the demand for EV's. These vehicles need efficient and intelligent smart charging solutions.

Innodisk, a leader in industrial embedded flash and memory solutions, has joined forces with Intel to usher in a newer, smarter mode of EV charging that leverages cutting-edge Artificial Intelligence of Things (AIoT) technology . Together, they are paving the way for a new era in electric vehicle charging, where intelligence, efficiency, and innovation converge to offer a revolutionary charging experience.

The Rising Tide of Electric Vehicles

The automotive industry is undergoing a paradigm shift, moving away from traditional fossil fuel-based vehicles due to environmental concerns, government initiatives promoting clean energy, and the increasing awareness of individual consumers regarding their carbon footprint. This has led to an emerging need for Electric Vehicles (EVs) thus,reshaping not only the way we commute but also our approach towards sustainable mobility. Over 2.3 million EVs were sold globally in the first quarter of 2023, which is about 25% more than the same period last year[1]. With the global transition towards greener alternatives, the adoption of EVs has soared, and with it comes a pressing need for innovative and efficient EV charging solutions.

According to projections, there will be a total of 12.9 million publicly available EV charging stations by 2030[2]. This means efficient EV charging infrastructure is not merely a convenience for EV owners; it is a cornerstone of the green mobility ecosystem. A seamless charging experience encourages more individuals to embrace electric vehicles, fostering widespread adoption and reducing our collective dependence on fossil fuels. Moreover, it plays a significant role in addressing environmental concerns by curbing harmful emissions and minimizing the carbon footprint associated with transportation.

In 2030
Charging will be faster. EVs will be able to charge in **5 minutes or less** at an electric current of **1,400 amperes.** *(That's a **169% increase** from 2022's 520 amperes.)*
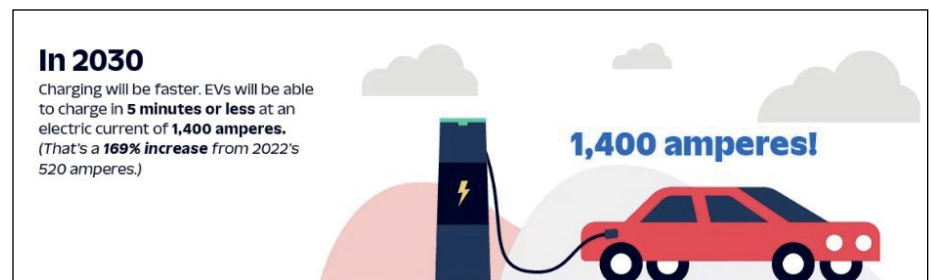
1,400 amperes!

Figure 1: An infographic showing the exponential growth in the speed and number of EV charging stations (Source: twilio.com)

The Need for Efficient EV Charging

Electric Vehicle (EV) charging systems are at the heart of the global shift towards sustainable transportation. However, as the demand for EVs rises, challenges in charging infrastructure become increasingly complex.

In urban landscapes where EV charging spots are limited, efficient usage is paramount. Unauthorized vehicles occupying these spots pose a significant challenge. Advanced machine vision and AI algorithms are crucial to accurately identify violations, ensuring EV-exclusive usage. By maximizing spot efficiency, these technologies enhance accessibility and streamline existing infrastructures.

Environmental conditions impact charging station efficiency. Real-time monitoring of air quality, temperature, and humidity is essential. Comprehensive monitoring detects factors like PM2.5, CO2, and NO2. Constant analysis ensures optimal operation. Deviations trigger alerts, allowing swift interventions. This guarantees consistent, reliable charging services regardless of environmental variations.

Maintaining seamless charging operations, especially in remote locations, is vital. Out-of-band remote management is key. It enables instant diagnosis and troubleshooting, even during system crashes. Operators can resolve issues remotely, minimizing downtime. This ensures continuous, uninterrupted charging experiences for EV owners.

Revolutionizing EV Charging Through AIoT

Innodisk, with its rich heritage in industrial-grade memory and storage solutions, recognized the criticality of EV charging in the context of sustainable urban development. In response to the surging demand for smarter and more efficient EV charging solutions, Innodisk pioneered the development of AIoT-based platforms specifically tailored for the EV charging industry.

By seamlessly integrating cutting-edge Artificial Intelligence (AI) technologies with the Internet of Things (IoT) framework, Innodisk's innovative platform is designed to address the intricate challenges faced by the EV charging sector. This holistic approach not only ensures faster and more efficient charging processes but also revolutionizes the way we interact with our urban environments, paving the way for a greener, smarter future.

These innovations marking the beginning of a new era characterized by intelligent solutions such as:

- **Smart Parking Violation Detection:** Innodisk's AI-powered detection systems utilize cutting-edge machine vision technology to accurately identify and flag parking violations in real-time. By distinguishing between electric and non-electric vehicles, these systems optimize the utilization of charging spots. Through instant alerts and notifications, operators can take swift actions, ensuring that charging spaces are exclusively utilized by EVs, thereby enhancing accessibility for EV owners.

- Real-Time Environmental Monitoring: Innodisk's solutions incorporate Sysinno's iAeris air quality monitors, which offer real-time environmental data collection. These monitors assess a myriad of factors, including PM2.5, PM10, TVOC, CO2, CO, HCHO, O3, NO2, and SO2. By constantly monitoring the charging station's surroundings, these systems ensure that optimal environmental conditions are maintained. Any deviations from the desired standards trigger immediate alerts, enabling timely interventions and maintenance. This real-time monitoring guarantees consistent and reliable charging experiences for EV owners, regardless of the environmental challenges.

- Remote Management: Innodisk's InnoAgent, an industrial-grade module, provides out-of-band remote management capabilities. Even in situations where the charging station encounters system crashes or complete offline status, InnoAgent allows operators to diagnose and resolve issues remotely. This instant remote management ensures uninterrupted operation, minimizing downtime and maximizing user satisfaction. Through remote troubleshooting and maintenance, Innodisk's solutions guarantee the seamless functioning of EV charging stations, enhancing the overall charging experience for EV owners.

Enabling Seamless and Efficient EV Charging

Innodisk's iGreengo AI Electric Vehicle Charging Network Management System redefines the charging experience. This comprehensive solution optimally manages charging piles, incorporating suburban area support, efficient maintenance, and plate recognition. Innodisk's commitment to seamless charging experiences is evident through its AI-driven approach.

Intel's technology plays a pivotal role in Innodisk's innovative EV charging solution. By leveraging Intel's powerful processors and advanced technologies, Innodisk has created an unparalleled synergy.

Enhancing the EV Charging Experience with the Power of Intel

At the core of Innodisk's solution lie Intel's technologies and products, which enable optimal performance, reliability, and efficiency.

- **Intel® Distribution of OpenVINO™** toolkit optimizes AI applications, ensuring seamless deployment of deep learning models. It serves as the backbone of the solution's AI capabilities. This advanced toolkit optimizes AI algorithms, enabling real-time analysis of charging station data. By providing a streamlined environment for AI model deployment, OpenVINO™ empowers the solution to interpret complex data sets, make intelligent decisions, and enhance the efficiency of EV charging stations. OpenVINO's real-time analysis capabilities ensure that charging stations operate optimally, promoting a seamless and reliable charging experience for EV owners.

▪ **Intel® Core™ processors:** Innodisk's solution harnesses the computational prowess of Intel® Core™x i5-1245UE Processor processors. These powerful processors facilitate rapid data processing, seamless user interactions, and real-time decision-making. By leveraging Intel's processing capabilities, Innodisk's solution delivers a responsive and intuitive user interface, enhancing the overall charging experience for EV owners.
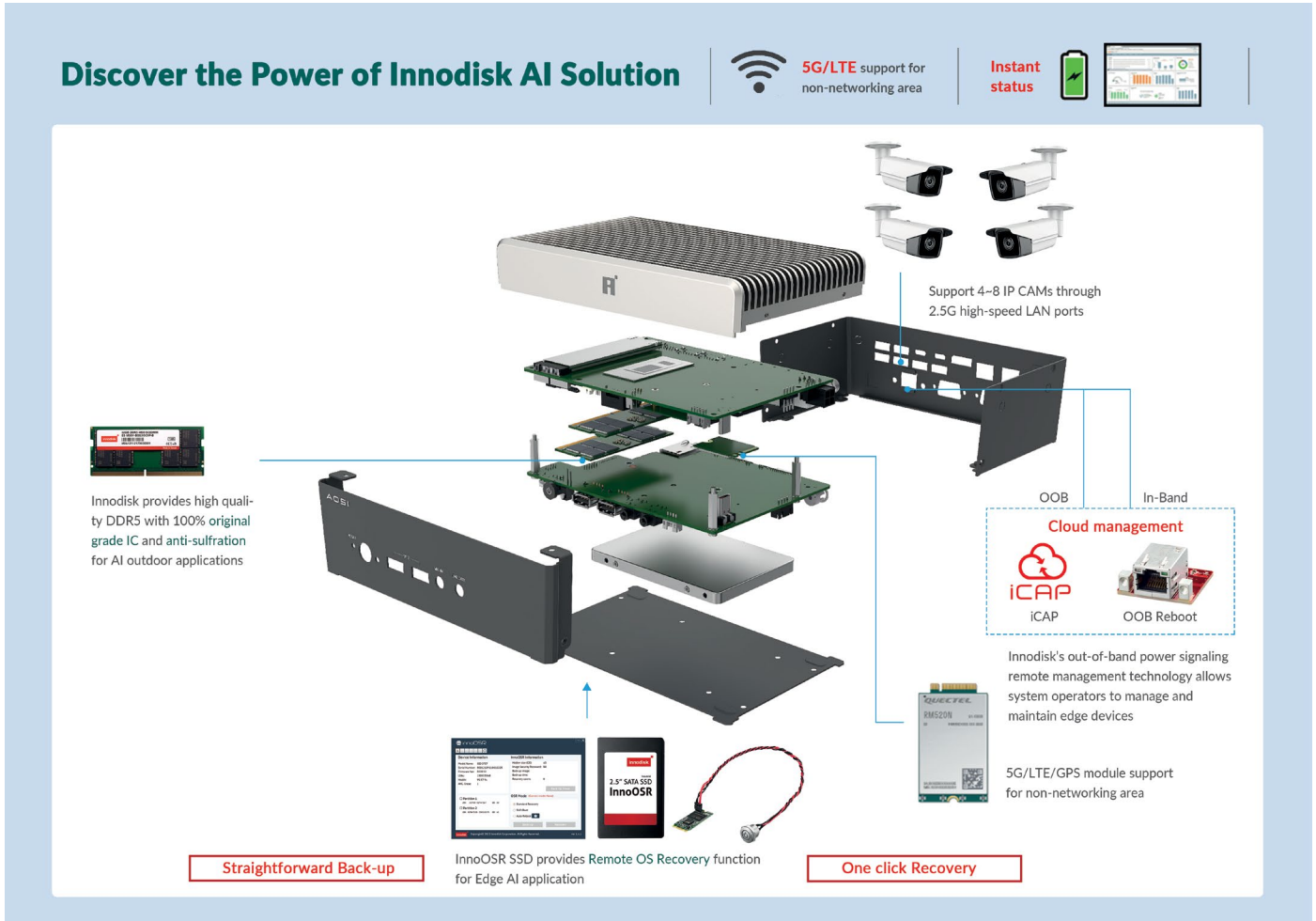

Figure 2: An overview of Innodisk's iGreenGo evaluation kit that forms the cornerstone of the AI-enabled EV charging solution

Collaborating to Transform the EV Charging Landscape

Intel's technology and Innodisk's AI expertise combine to offer EV drivers a trifecta of groundbreaking features that create a seamless charging experience.

In essence, the fusion of Innodisk's innovative approach, Intel's cutting-edge technology, and the power of AI creates a solution that not only meets the demands of the present but also anticipates the needs of the future such as:

▪ **Smart Management of EV Charging Networks:** Innodisk's AI-driven optimization ensures that charging networks operate at peak efficiency. By intelligently managing the charging stations, the solution minimizes downtime, maximizes availability, and optimizes charging resource usage. This intelligent network management guarantees that EV owners can access charging stations when needed.

▪ **Plate Recognition and Charging Status Updates:** The integration of cutting-edge plate recognition technology provides real-time updates on charging station availability and usage status. Through AI-driven plate recognition, users can effortlessly identify charging stations, check their availability, and monitor their usage status in real-time.

▪ **Efficient Maintenance and Repair:** Predictive maintenance, powered by AI algorithms, ensures timely identification of potential issues within charging stations. By analyzing vast amounts of data in real-time, the solution can predict equipment failures before they occur. This proactive approach to maintenance minimizes downtime, enhances the longevity of charging infrastructure, and ensures a reliable charging experience for EV owners. Intelligent, data-driven decisions enable prompt repairs, guaranteeing that charging stations remain operational and accessible, reinforcing user confidence in the EV charging ecosystem.

Enabling Real-world Impact

Innodisk's AI-driven EV charging solution can enable a new era for the electric vehicle industry, setting unprecedented benchmarks and reshaping the way EV charging is perceived.

Innodisk's AI for Electric Vehicle Charging provides optimized charging infrastructure, leading to a significant reduction in downtime. By intelligently managing charging networks, the solution ensures that charging stations are consistently operational, minimizing disruptions for EV owners. This optimization has not only enhanced user satisfaction but also increased the accessibility and availability of charging stations, promoting the widespread adoption of electric vehicles.

Through real-time plate recognition and charging status updatesEV owners can have access to instant information about charging station availability and usage status, allowing for efficient trip planning and seamless charging experiences. This enhanced user interface eliminates uncertainties and frustrations while delivering improved customer experiences.

The implementation of predictive maintenance powered by AI algorithms enhances the longevity of charging infrastructure. By identifying potential issues before they escalate, the solution enables timely repairs and preventive measures. This proactive approach can not only reduce operational costs but also contribute to a sustainable and eco-friendly charging ecosystem.

Innodisk's solution also facilitates data-driven decision-making in the EV charging industry. By harnessing the power of data analytics, operators can gain valuable insights into charging patterns, station utilization, and user behavior. This data-driven approach can pave the way for informed business strategies, enabling operators to adapt their services to meet evolving customer needs. It can also foster innovation, allowing for the continuous improvement of charging station services based on real-time feedback and user preferences.

Ethical Considerations

Innodisk's commitment to ethical AI is evident in the design of its solution. The system does not store or transmit user data, such as license plate numbers or personal information. This commitment to user privacy and data security ensures that EV owners can enjoy the benefits of AI-driven charging without compromising their privacy or security.

Conclusion

Innodisk's AI for Electric Vehicle Charging, powered by Intel's advanced technology, has not only addressed existing challenges in the EV charging industry but is also transforming the entire ecosystem. The solution's impact on charging infrastructure optimization, user experience enhancement, proactive maintenance, data-driven decision-making, and ethical considerations marks a shift in the way the industry functions. As electric vehicles continue to gain prominence, Innodisk's innovative approach stands as a testament to the limitless possibilities of AI-driven solutions, shaping a future where EV charging is not just a necessity but a seamless, intelligent, and sustainable experience for all.

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