

# EV Smart Charge

Explore how hybrid sensors are transforming electric vehicle (EV) charging by boosting efficiency, safety, and user experience with real-time data and advanced technology



By Shriyal Sethumadhavan

Hybrid sensors in EV charging infrastructure monitor real-time data like temperature and voltage to optimise efficiency, prevent overheating, and manage load distribution, while also enhancing user experience with smart charging and improved battery performance.

Raghav Arora, Co-Founder & CTO, Statiq, shares, “Hybrid sensors help optimise charging speed and efficiency by adjusting power levels based on the vehicle’s battery status and external factors. The sensors ensure that the charging process is both safe and efficient, ultimately leading to improved battery life and performance.”

“By providing real-time data, hybrid sensors help optimise charging rates and improve energy efficiency,” says Vikrant Singh, Co-Founder, BatX Energies. “They ensure that the charging process is as quick and efficient as possible while also protecting the battery’s health by preventing overcharging and overheating.”

Mukesh Taneja, CEO and Co-Founder, GT FORCE, adds, “These sensors combine conventional

measurement techniques with modern innovations such as IoT, AI, and machine learning. They provide real-time monitoring of key parameters like voltage, current, and temperature, ensuring the charging process is both safe and efficient.”

“The sensors manage temperature by monitoring the heat levels of charging cables, connectors, and batteries to prevent overheating, which can lead to inefficient charging or damage,” says Raman Bhatia, Founder & Managing Director, Servotech Power Systems Ltd. “They also contribute to load balancing by efficiently distributing available power among multiple vehicles, preventing grid overload and ensuring stable power delivery.”

“Advanced hybrid sensors also incorporate machine learning algorithms to predict charging patterns and pre-emptively adjust power distribution,” says Kunal Arya, Founder and Managing Director, ZELIO Ebikes. “This integration not only boosts charging speeds but also enhances safety by detecting potential faults or overheating.”

▲ Hybrid sensors optimise charging rates and improve energy efficiency by providing real-time data.

“Hybrid sensors ensure that the charging process is safe and efficient, leading to improved battery life and performance.”

Raghav Arora, Co-Founder & CTO, Statiq



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▲ Mukesh Taneja, CEO and Co-Founder, GT FORCE

### Safety boost

Hybrid sensors boost EV charging safety and reliability by continuously monitoring for overheating and electrical surges.

“These sensors detect anomalies and automatically trigger alerts or shut down the system if any parameters deviate from safe thresholds, thereby preventing potential hazards,” says Taneja. He adds that by leveraging data analytics, hybrid sensors enable predictive maintenance, identifying issues before they escalate into serious problems.

Bhatia mentions, “They also improve safety by identifying electrical leakage in real-time, thereby reducing the risk of electrical shocks or fires. Continuous thermal monitoring helps prevent overheating of batteries and connectors, further minimising fire risks.”

Arya shares, “The advanced data analytics derived from these sensors facilitate predictive maintenance protocols, minimising unexpected downtime and optimising operational efficiency.”

“If something goes wrong, these sensors can automatically adjust the charging process or shut down the system to prevent damage, ensuring the stations stay safe and dependable for users,” confirms Singh.

Arora believes that real-time monitoring ensures that charging stations operate within safe limits, reducing the risk of fires or equipment damage. “As a result, users can rely on a safer charging experience, and operators benefit from lower maintenance costs and downtime.”

### User experience

Hybrid sensors enhance the EV charging experience with real-time updates, accurate data, and intuitive feedback, optimising power delivery and reducing charging times. They integrate with mobile apps and display screens for clear

notifications, resulting in faster, safer, and more convenient charging.

The sensors facilitate real-time communication with users, providing updates on charging status, estimated completion times, and alerts for any issues. “This level of transparency and control enhances the convenience and overall satisfaction of the charging experience,” says Singh.

Arya shares that hybrid sensors streamline the charging process by automatically adjusting to the vehicle’s specific needs, such as optimising charging speed based on battery health and environmental conditions. This leads to faster, more efficient charging sessions and personalised notifications.

Hybrid sensors also offer real-time insights into key parameters like charging speed and battery status, which users can access via intuitive apps or display screens. Taneja believes that this immediate feedback helps users monitor their charging progress and manage their time more effectively.

Bhatia views the integration of hybrid sensors significantly enhancing the EV charging process, making it safer, faster, and more convenient. He says, “Enhanced safety is another key benefit, as continuous monitoring ensures that users can charge their vehicles hassle-free.”

For Arora, the integration of hybrid sensors enhances the user experience by making the EV charging process smoother and more predictable. “Sensors provide accurate data that can be used to inform users of charging times, battery health, and optimal charging conditions.”

### Major challenges

Standardising and ensuring interoperability of hybrid sensors in EV charging infrastructure presents several challenges, as industry experts share:

- There is a lack of consistent industry standards for hybrid sensors.
- Compatibility issues arise between various EVs





▲ **Raman Bhatia**, Founder & Managing Director, Servotech Power Systems Ltd



▲ **Kunal Arya**, Founder and Managing Director, ZELIO Ebikes.

- There is a need for industry collaboration to develop universal standards and protocols.

**Market dynamics**

As the Indian EV market reaches a crucial growth point, hybrid sensors present compelling benefits that attract investment.

“These sensors boost operational efficiency by providing real-time data and enabling predictive maintenance, which reduces downtime and costs,” says Taneja. He adds that they optimise energy use and manage loads effectively, supporting scalable infrastructure and attracting investors.

Integrating hybrid sensors into EV charging stations will significantly impact their development and funding. Singh says, “These sensors enhance station performance, safety, and user experience, making them attractive to both investors and users.”

Investors seek opportunities with reliable returns, operational efficiency, and long-term growth potential. Arya points out that hybrid sensors in EV charging meet these needs by significantly enhancing efficiency and ensuring a steady, predictable revenue stream. These sensors also provide crucial data insights that support strategic planning and optimisation, making the infrastructure more scalable and adaptable to future demands.

Arora notes that hybrid sensors reduce operational costs and extend equipment lifespan by optimising charging processes. “This technology boosts the appeal of EV charging stations to investors with reliable, scalable solutions.” The sensors also provide valuable data for further

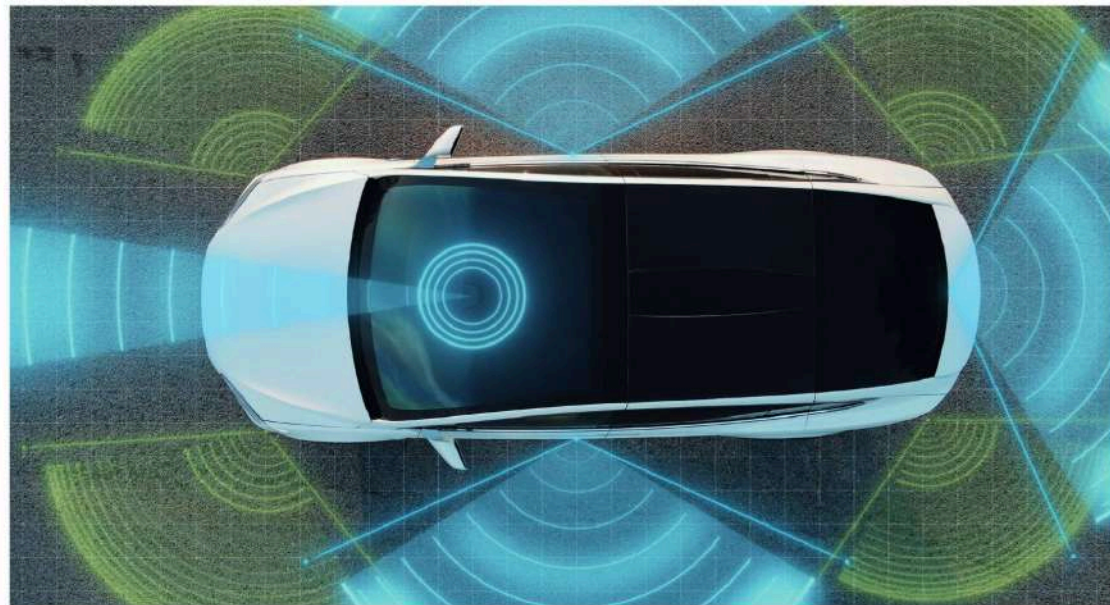
“By leveraging data analytics, hybrid sensors enable predictive maintenance.”

Mukesh Taneja, CEO and Co-Founder, GT FORCE

- and charging stations.
- Diverse communication protocols and data formats create integration difficulties.
- The rapid evolution of technology can lead to compatibility issues with existing infrastructure.
- Newer sensor models may not be compatible with existing systems.
- Integrating data from sensors into existing EV management systems, particularly legacy systems, is complex.
- Initial implementation costs and scalability issues pose significant challenges.
- Fragmentation in technology leads to inefficiencies and increased costs.
- Varying regulatory requirements across regions hinder the development of a unified global standard.
- Achieving backward compatibility with existing infrastructure is also challenging.

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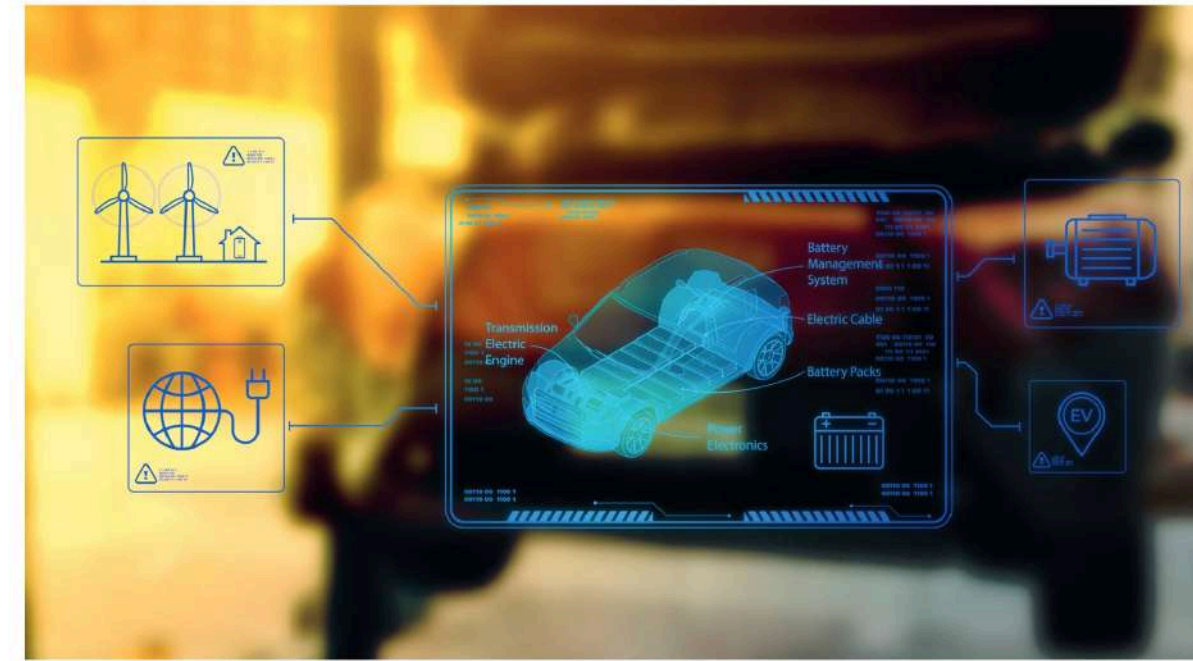
▲ Hybrid sensors automatically trigger alerts or shut down the system when anomalies are detected, preventing potential hazards.

“Hybrid sensors identify electrical leakage in real-time, reducing the risk of electrical shocks or fires.”

Raman Bhatia, Founder & Managing Director, Servotech Power Systems Ltd

“Hybrid sensors offer crucial data insights that enhance scalability and adaptability of the infrastructure.”

Kunal Arya, Founder and Managing Director, ZELIO Ebikes



▲ Hybrid sensors monitor voltage, current, and temperature in real time, ensuring a safe and efficient charging process.

network development and optimisation.

The push for more advanced hybrid sensors will stimulate innovation in sensor technology, leading to more sophisticated charging solutions, says Bhatia. Hence, the expansion of EV charging infrastructure could accelerate, supporting broader EV adoption.

**Future innovations**

As the EV charging industry continues to evolve, experts across the field share their perspectives on the forthcoming advancements in hybrid sensor technology.

- Vikrant Singh:**
- Digital Twin (Connectivity Twin) and real-time data analytics (SMART)
  - Data monetisation strategies for insights into charging patterns, energy consumption, and vehicle performance
  - Advanced sensor technologies for maintaining correct pressure on battery cells
  - Utilisation of second-life and end-life battery data for optimisation

- Mukesh Taneja:**
- Integration of AI and machine learning algorithms for predictive maintenance and fault detection
  - Higher-resolution data and quicker response times for optimised energy management
  - Innovations in wireless and IoT connectivity for smoother integration with smart grids
  - Enhanced sensor durability and miniaturisation

**Raman Bhatia:**

- AI integration for predicting and optimising charging patterns based on user habits
- Wireless EV charging technology and monitoring of inductive charging systems
- Sensors with self-diagnostic capabilities for proactive issue identification
- Integration of blockchain technology for secure and transparent data sharing

**Raghav Arora:**

- AI-driven predictive maintenance and enhanced data analytics
- Integration of IoT and 5G connectivity for seamless communication between vehicles, charging stations, and grid systems
  - Smarter and more adaptive EV charging solutions

**Kunal Arya:**

- Development of self-calibrating sensors for automatic parameter adjustment
- Advanced materials and nanotechnology for higher sensor sensitivity and durability
- Decentralised sensor networks for improved data sharing and network efficiency
- Innovations in sensor fusion for comprehensive insights into charging patterns and infrastructure health

The future of hybrid sensors in EV charging holds transformative potential, poised to redefine efficiency, safety, and scalability while driving unprecedented innovation and investment in the sector. ■