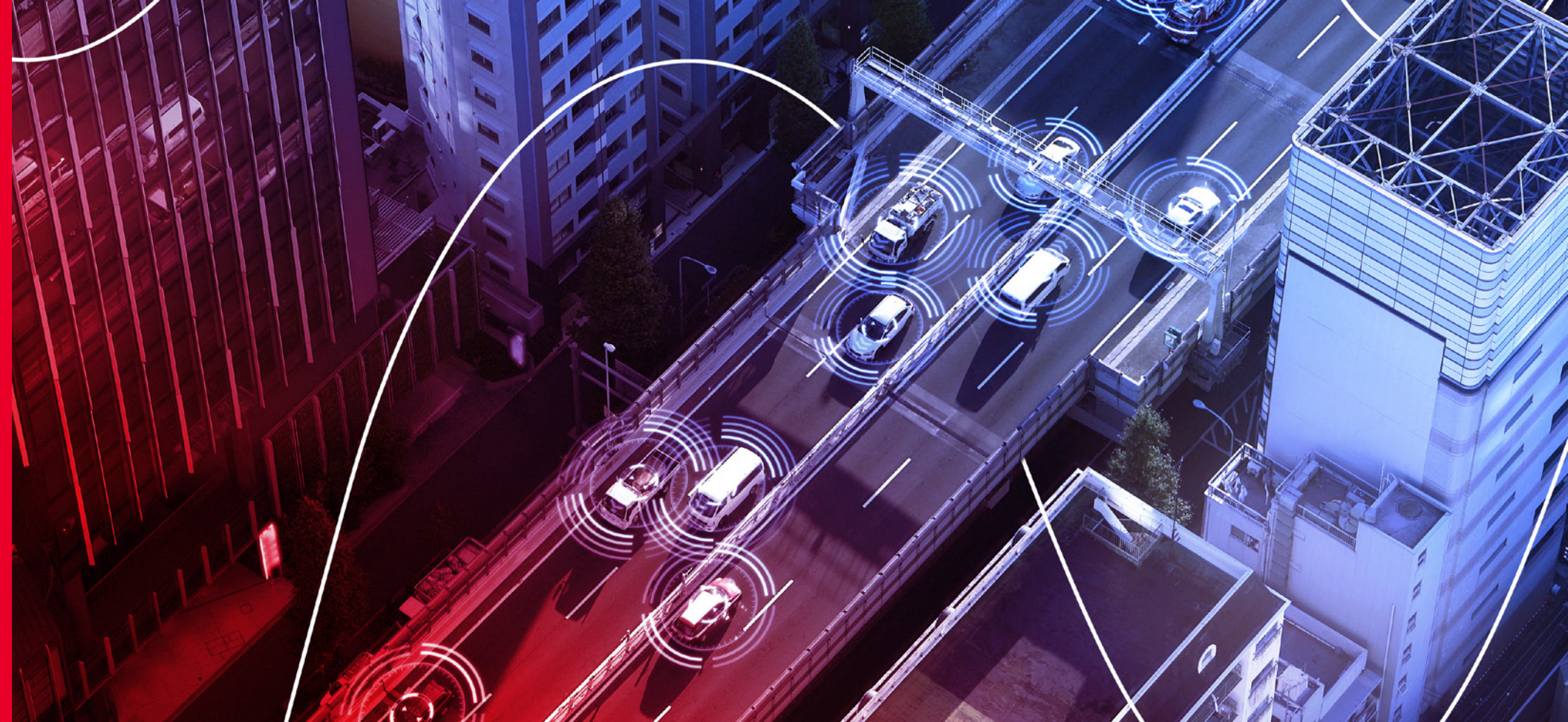




Testing the Future of Automotive HMI

Decoding human-machine interface testing

eBook

 KEYSIGHT

Testing the Future of Automotive HMI

The automotive sector pioneered industrialization's digital transformation, and the industry continues to be an innovation leader today. Key to these efforts is harnessing the latest technological advances to push the boundaries of what's possible and develop new products, on-demand services, and offerings. To do this effectively, automotive manufacturers and other industry stakeholders must prioritize the performance of their technology. As **Henry Ford**, arguably the industry's most famous innovator, put it, "Quality means doing it right when no one is looking."

In Ford's era, this meant sourcing the right parts and labor to build automobiles that made transportation faster, easier, and more accessible. In today's age of always-on and connected technology, automotive development is more complex and digital. However, the importance of quality has only grown more critical. This eBook examines the emergence of the digital cockpit and what the trend means for manufacturers, application developers, network providers, and other stakeholders — if these groups can ensure software quality even as innovations enter the market.

When it comes to testing code, automated testing gives developers the tools to test at scale and find and resolve bugs.



Dashboard 2.0: The new face of automotive displays

Automotive dashboards are evolving from relatively static driver information centers to interactive, multidomain integrated systems that offer a range of services and conveniences for drivers and passengers alike.

Once upon a time, every task in a car required manual intervention, from tuning the radio and adjusting the volume to playing music from tapes or CDs. The dashboard was basic, featuring gauges for speed and temperature and perhaps a tachograph. Driving offered a wholly analog experience.

Modern dashboard displays present a wealth of information. They offer a thoroughly digital experience, providing numerous avenues for connectivity and data display. Systems operation is now possible via steering wheel controls, voice commands, or personalized adjustments to displays, gauges, and more.

In addition to its role in infotainment, human-machine interface (HMI) technology is advancing to accommodate emerging needs. These include facilitating the transfer of control from automated driving systems (ADS) to human drivers in semi-autonomous or autonomous vehicles, known as driver-vehicle handover, and managing emergencies.

Given these and other conveniences, it's easy to understand why market researchers estimate the HMI system market will reach nearly \$87 billion by 2030.

Despite the numerous advantages for consumers, the design and development of these innovations involve significant challenges. Effective HMI technology hinges on seamless communication with nearby vehicles, infrastructure, and various systems. As features and functions expand, HMIs inevitably grow more intricate. How can companies effectively test across diverse platforms and interconnected technologies to unlock the potential of in-vehicle innovation?

AI-powered innovation demands AI-driven testing

Artificial intelligence (AI) is a prime driver of automotive HMI, and the technology has also transformed software and application testing. Drawing on AI, companies can expand automation beyond test execution to the entire testing process.

As automobile dashboards continue to incorporate graphical user interfaces, ensuring their accuracy and real-time responsiveness in displaying vital information like speed and location becomes imperative for safety.

The reliability of tools employed in end-to-end testing of HMI systems holds the utmost importance. Every action must flawlessly succeed across thousands of iterations to ensure safety and functionality. Maintaining this high standard not only ensures accurate results but also enhances the efficiency of the testing process, instilling confidence in the system's performance and reliability.



The right AI-driven platform for in-vehicle technology

An AI-driven approach to testing helps companies reduce errors, free up resources, and remedy technology glitches before they impact performance. While these are certainly important benefits, developers of in-vehicle technology also must test the full user experience across all platforms.

Keysight Eggplant takes a unique “synthetic human” approach, combining computer vision, machine learning, and automation to test systems visually and functionally as a real user would, without needing access to the underlying source code. This approach is device-agnostic, enabling you to test mobile phones, heads-up display, in-vehicle infotainment, and more. Keysight Eggplant also integrates seamlessly with a large array of tools and components in your testing environment.

By continuously monitoring how customers interact with technology, Keysight Eggplant feeds back to develop critical intelligence that can help drive the release of higher-quality software.

In addition, Keysight Eggplant extends test and validation for in-vehicle technology’s ability to communicate with other connected systems, cars, and telematics infrastructures. Advanced driver-assistance systems (ADAS) and intelligent telematics systems (ITS)

provide advanced safety capabilities such as automatic emergency braking, pedestrian detection, surround view, and driver tiredness detection. These are among the many ADAS and ITS applications that assist drivers with safety-critical functionality, notifications, and alerts to reduce collisions and save lives.

Through our platform, Keysight is paving the way for continued innovation in the automotive sector. Keysight is helping companies realize the promise of our connected future by providing advanced and unique user experience, driver assistance, and telematic systems validation.



Digital cockpit multidomain testing and validation

In the realm of end-to-end system validation for critical automotive technologies like ADAS, ITS, and controller area network (CAN) bus integration, Keysight Eggplant Software Test Automation emerges as a pivotal player.

Its multifaceted capabilities enable comprehensive testing of various interconnected components in automotive systems. An intuitive interface and robust automation features make it possible to seamlessly combine the emulation of car systems with the testing of HMI, user interface (UI), and overall user experience.

These capabilities ensure the reliability and functionality of individual components and guarantee the cohesive operation of the entire system under real-world conditions.



Driving Digital Transformation with Eggplant

Keeping pace with connected cars

Keysight Eggplant Test uses low-code testing, AI, and analytics to expand automation beyond execution across the full testing process.

Obtain actionable intelligence to optimize the digital experience you deliver

- Apply additional intelligence to your most important user journeys and automatically create a model of the application.

Access enterprise-scale testing capabilities via a single user interface

- Use a single tool to perform application programming interface (API), mobile, HMI, dashboard, and data-driven testing.
- Easily scale execution, set limits for time and coverage levels, and provide actionable insight that moves beyond static pass / fail notices to identify root causes of failures.

Test any technology at every layer in any way

- Keysight Eggplant conducts testing across every layer of the system, including UI, WebElements, APIs, databases, and the command line. It enables seamless interaction with a wide range of systems, such as a CAN bus.

- Furthermore, harnessing our model-based testing capabilities not only boosts efficiency and accuracy but also advances the traceability of your testing processes.
- Keysight Eggplant seamlessly integrates with your preferred continuous integration and continuous delivery / deployment platform, whether you opt for script-based or model-based testing approaches. This approach ensures smooth workflow integration.

Accelerating innovation

Mainstream adoption of 5G, autonomous vehicle advances, telematics, and other emerging technology trends will only increase the possibilities inherent in HMI complexity. The potential to deliver live streaming services to vehicles already exists. The challenge now is for the industry to develop, test, and deploy fast enough to reach the next level, combining multidomain systems and service capabilities with the corresponding real usage and user profiles.

In this environment, modernizing testing by focusing on user safety and experience and using AI and analytics to automate this process is imperative. Keysight Eggplant makes this possible and paves a path to long-term success for any organization involved in HMI technology development.



Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.

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