The modern digital cockpit: Beyond just infotainment

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Introduction

The digital cockpit is a significant advancement over traditional infotainment systems, evolving into a comprehensive in-car experience that integrates various functionalities and interfaces into a unified system.

Unlike the conventional infotainment framework that focused on providing entertainment and basic information to the driver, the digital cockpit encapsulates a broader spectrum of features and technologies. This evolution is driven by integrating advanced hardware and software technologies that combine instrument clusters, head-up displays, and infotainment systems into a cohesive unit. The key components of a digital cockpit include:

Instrument clusters
Digital instrument clusters replace analog gauges and dials, offering a dynamic display of critical vehicle information such as speed, fuel levels, and engine status. The digital format allows for more flexible and customizable displays, enabling drivers to choose which information is displayed and how it is presented.

Head-Up displays
Head-Up Displays (HUDs) project vital driving information onto the windshield, allowing drivers to access essential data without taking their eyes off the road. This feature enhances safety and convenience by reducing the need to look down at the instrument cluster.

Infotainment systems
Modern infotainment systems go beyond playing music or showing GPS navigation. They now integrate with smartphones, access real-time traffic information, provide voice-controlled functionality, and offer a range of apps and services designed to enhance the driving experience.

Connectivity
The digital cockpit facilitates seamless connectivity with external devices and networks, enabling features like smartphone integration, voice recognition, and internet access. This connectivity extends the functionality of the cockpit, providing drivers and passengers with a wide range of information and entertainment options.

User-centric interaction
An intuitive user interface is at the heart of the digital cockpit, ensuring that the multitude of features and information is easily accessible and understandable. Touchscreens, voice commands, and haptic feedback are among the interactive technologies that make navigating the digital cockpit a user-friendly experience.

Safety and monitoring
Safety features are integrated within the digital cockpit, providing driver assistance systems, monitoring driver behavior, and offering real-time alerts to ensure a safer driving experience.

Integration capabilities
With the architecture designed to be adaptable and upgradeable, the digital cockpit is poised to incorporate future technological advancements, making it a future-ready component of modern vehicles.

Key drivers shaping the future of digital cockpit

The automotive industry is accelerating toward a more connected and intelligent future, and the digital cockpit is emerging as a focal point of innovation. Here are the features and customer expectations that are propelling the evolution and shaping the future landscape of the digital cockpit.

In-car experiences

Immersive interaction: With multimodal interfaces and a plethora of applications, coupled with connectivity to personal devices, wearables, and bio-informatics, the cockpit offers a richer, more immersive interaction.

Comfort & ambiance: Advances in ventilation and air conditioning systems contribute to an enhanced in-car ambiance.

Advanced safety: Features like driver distraction prevention and monitoring are integrated, leveraging intelligence from the external environment to bolster safety.

Connected and extended reality

Workspace extension: With the integration of cloud-based collaborative tools, the digital cockpit enables real-time document sharing and virtual meetings, turning commute time into productive work sessions for today's always-connected professionals.

Personalized engagement: Imagine a family on a road trip passing by a town around lunchtime. The digital cockpit, integrated with geo-location services and local business databases, could alert them to discounts at a nearby family-friendly restaurant. In another scenario, while driving through a city, a driver could receive notifications of a flash sale at a nearby electronics store where they had previously shopped. These custom, location-based offers keep drivers and passengers engaged, making the commute feel like a natural extension of their living world, blurring the lines between digital interaction and physical experiences.

Tailored experiences: The Mercedes-Benz MBUX Hyperscreen, powered by NVIDIA's AI[1], exemplifies extreme personalization, offering a single surface extending from the cockpit to the passenger seat, displaying all necessary functions at once. The AI technology powering the system enables it to learn and adapt to user preferences over time, offering a personalized user experience. For instance, if a driver regularly calls a particular contact in the evenings, the system could proactively display that contact around the same time.

Tech giants eyeing infotainment through SDV avenue

The entry of tech giants like Apple, Google, and Sony into the automotive cockpit domain underscores a growing trend of cross-industry collaborations, enriching the digital cockpit landscape. These companies, armed with substantial expertise in software, hardware, and user interface design, are venturing into automotive infotainment:

Apple

Apple's CarPlay has already significantly impacted the automotive industry by providing a seamless interface between the iPhone and car infotainment systems. CarPlay allows users to access various iOS apps, make calls, send messages, and navigate using Apple Maps directly from the car's infotainment system, enhancing the in-car experience with a user-friendly interface familiar to iPhone users.

Google

Google's Android Auto and Android Automotive OS are great examples of Google's foray into the automotive infotainment sector. Android Auto provides a robust platform for accessing Android apps, navigation, and voice-controlled functionalities within the vehicle. On the other hand, Android Automotive OS is a more integrated approach, providing a full-fledged operating system for in-car infotainment systems that OEMs can customize to their requirements.

Sony

Sony, in collaboration with Honda, launched a new venture named Sony Honda Mobility Inc., which was unveiled at CES 2023 alongside its brand "AFEELA"[2]. This venture introduced a prototype showcasing a blend of infotainment and automotive design, portraying a fresh perspective on the relationship between individuals and mobility. The prototype, revealed a day prior to the event's public opening, was driven on stage, emphasizing Sony and Honda's collective stride into the automotive infotainment within the self-driving vehicle domain.

Software-defined cockpits

The transition to Software Defined Vehicles (SDVs) has catalyzed the evolution of the Software Defined Digital Cockpit (SDDC), opening up new business models and revenue streams via software and SaaS-based solutions. A notable cost reduction benefit arises at the application layer, where the SDV approach significantly lowers application development costs due to reduced integration and testing necessities, creating an avoided cost of around USD 14 billion per Roland Berger's research[3].

Hardware and software evolution

The migration from distributed Electronic Control Units (ECUs) to a more centralized computing model is a marked trend, with OEMs at disparate levels of adoption contingent on their investment capabilities. For instance, Tesla's centralized computing approach underscores this trend, streamlining hardware architecture to bolster software efficiency and flexibility. Major OEMs are nurturing their digital cockpit ecosystems, crafting bespoke solutions. In contrast, others are exploring standardized platforms like Android Automotive or supporting projection technologies like Apple CarPlay and Android Auto to provide a seamless user experience with lesser investment. The recently launched VW One infotainment[4] system embodies this evolution as an integral component of the operating system and rooted in Android Automotive, it aims to refine user interfaces and amplify the overall user experience in VW vehicles, setting a precedent for integrated, user-centric infotainment systems.

Opportunities ahead for OEMs

The movement towards large-scale software solutions and integration demands upfront investment and engagement with a new segment of stakeholders. This road, although challenging, opens the door to innovative partnerships and collaborations akin to the alliance between Google and Renault-Nissan-Mitsubishi for infotainment systems. The wide array of technical skills required encompasses a spectrum from Android to C++ app development, middleware integrations to cloud integrations, and advanced edge analytics. This makes it important for automotive OEMs to blend automotive and software expertise, building a conducive environment for cross-domain knowledge exchange and innovation in their organizations.

Quest Global, with a robust legacy in Infotainment Systems, has been a reliable partner for automotive OEMs and Tier 1 suppliers. Offering comprehensive solutions, including high-performance computing platforms and test automation solutions for cockpits, we are well-positioned to assist automotive manufacturers in navigating the complexities of creating next-generation vehicles ready to redefine our mobility experience.

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