

Innovating Mobility: The Evolution of Vehicle Display Technology

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▪ ABSTRACT

This study delves into the transformation of vehicles from mere transportation means into multifunctional living spaces, facilitated by Software-Defined Vehicles (SDVs), autonomous technologies, and cutting-edge Human-Machine Interfaces (HMIs). It highlights how the integration of advanced display technologies—such as flexible and transparent displays, holography, and Augmented Reality (AR)—revolutionizes content generation and interaction within these new spaces.

▪ DIGEST

The emergence of Software-Defined Vehicles (SDVs) represents a fundamental shift in the automotive industry, steering the evolution of transport into multifunctional living spaces. This transition leverages the seamless integration of autonomous driving and electrification technologies, alongside pioneering advancements in in-vehicle Human-Machine Interface (HMI) designs. These innovations are redefining content generation and consumption, challenging traditional paradigms and establishing new benchmarks for user engagement.

At the heart of this transformation are advanced HMI technologies, which establish a dynamic, customizable in-vehicle environment. High-speed communication technologies are crucial, enabling real-time access to diverse content such as entertainment, shopping, and healthcare services. This paper explores the potential of innovative display technologies—including flexible and transparent displays, holography, and Augmented Reality (AR)—to significantly enhance in-vehicle experiences. These technologies not only improve visual engagement but also introduce new dimensions to user interaction, making content more immersive and accessible.

Moreover, this analysis discusses the implications of these technological innovations for autonomous driving, illustrating how they enhance safety and efficiency. For example, AR can augment driver perception with important navigation cues directly in the line of sight, while flexible displays offer adaptable interfaces that cater to both driver and passenger needs.

In conclusion, integrating Software-Defined Vehicle capabilities with state-of-the-art HMI technologies and display innovations is critical for realizing the future of vehicle interiors. Technologies such as pillar-to-pillar displays, articulation displays, holography-based transparent displays, and Computer-Generated Holography (CGH) based AR-HUDs are set to become increasingly vital. These advancements emphasize the necessity for ongoing innovation and adaptation to meet the evolving needs and expectations of users, pushing vehicles beyond their traditional roles and transforming them into holistic living and working spaces.



Fig. 1. Future vehicle display example based on HUD technology