EVALUESERVE

Industry Insight – Future Mobility Radar

Outlook for futuristic in-vehicle display technologies

In-vehicle displays are turning modern cars into smart gadgets. Here's a look at some of the top in-vehicle display technologies.

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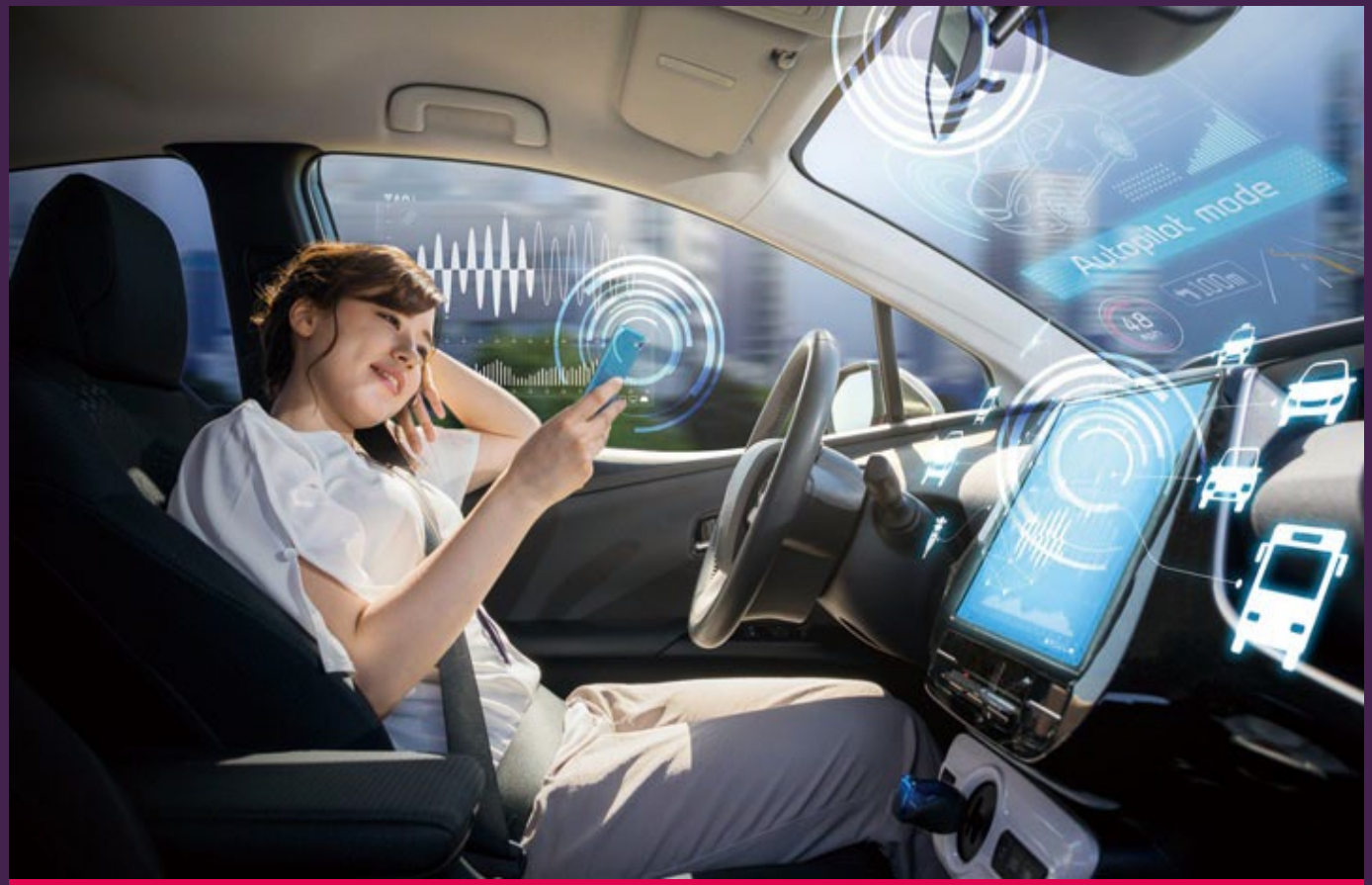


Image Credit: Huawei

Over the years, vehicles have undergone many advancements – digital dashboards have replaced analog dashboards, touchscreen infotainment systems have become the norm, and rear seats have been given their own entertainment displays. These are a few of the changes in vehicle interiors through which new technologies are regularly making an appearance.

Vehicles today have onboard computers with huge processing capabilities. These computers are connected to multiple sensors and cameras to provide active safety systems, advanced entertainment and sound systems, and accurate driver and navigation information. Together, these applications provide drivers with a high level of visual information and require them to control multiple functions. Automotive displays have become the main human-machine interface (HMI) through which in-vehicle temperature is controlled and audio, media, navigation, and telematics systems are accessed.

As connected and autonomous vehicles gain traction, smart in-vehicle display systems will gain prominence in the context of user safety and comfort. The importance and growing popularity of these displays are reflected in their impressive, estimated sales trajectory. Globally, sales of in-vehicle displays are projected to reach 160 million in 2023 from just 40 million in 2011.

Companies across the world are working on different display technologies to create a safer and more personalized driving experience. Let's look at some of the top in-vehicle display technologies detected by Evalueserve's Future Mobility Radar (FMR).

Source – ieeexplore

Holographic displays

With OEMs adding more features and HMIs to vehicles, traditional in-vehicle displays often prove inadequate in offering an intuitive interface and immersive experience. Furthermore, traditional displays present information in 2D, which is somewhat lackluster when compared with information presented through 3D-enabled systems.

Therefore, automotive suppliers and manufacturers are focusing on holographic displays that offer a three-dimensional and more natural viewing experience, as well as better depth. Holographic displays are based on the technique of holography, which records the shape of light waves as they bounce off an object. These display systems enable new ways of presenting information (such as traffic jam warnings) or driver assistance notifications (such as blind-spot detection).

Image Credit: Continental

Latest developments in the holographic display space (as per FMR)

3D display-related innovations

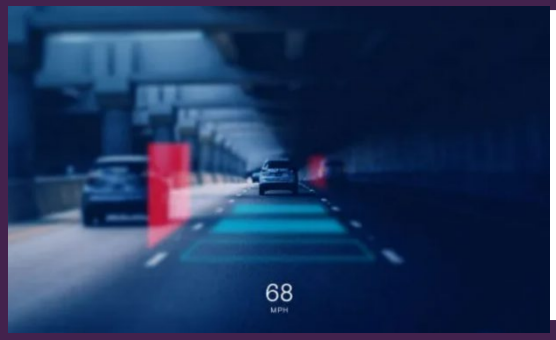
SeeReal Technologies and Volkswagen have been working together since 2018 to enable SeeReal's 3D technology for augmented reality (AR) applications in Volkswagen cars.

Source – SeeReal Technologies

Ceres Holographics and Covestro have been collaborating to develop and improve the Bayfol HX film, a transparent and thin film with a light-sensitive and self-developing photopolymer that produces volume holograms for light-guiding applications.

Panasonic

Panasonic is collaborating with Envisics and Phiar to add depth and breadth to data-driven visuals in its AR head-up displays (HUDs). Phiar provides 3D localization technology and AI navigation and situation awareness analytics, while Envisics provides its holographic platform.



Vividq has been collaborating with its partners to create reference designs and integrated solutions to directly bring displays with computer-generated holography to the market.

VIVIDQ

Continental
The Future in Motion

Leia Inc.

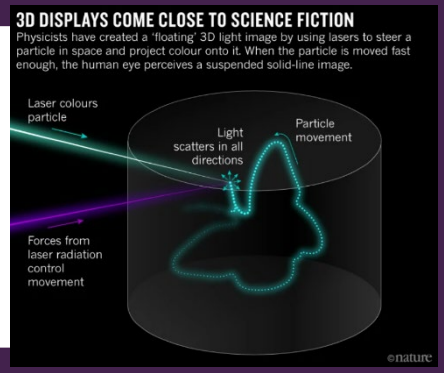
Continental has partnered with Leia to add the latter's 3D lightfield technology, which not only offers clear 3D images but also enables real-time presentation of information to drivers, to its Natural 3D Lightfield Instrument Cluster. 3D lightfield does not need a head-tracking camera, thereby eliminating the need for additional hardware and reducing costs.

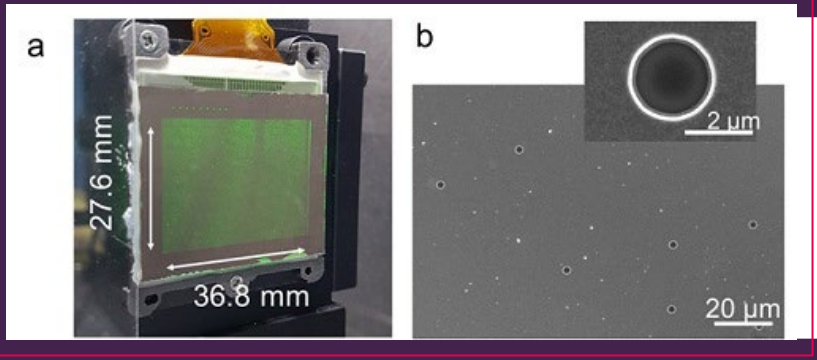
Source – Covestro, Panasonic, Continental, VividQ

New technologies for volumetric holograms

The study by Nora Broy at BMW Group Research and Technology, stated the use of an eye tracking mechanism in a 3D autostereoscopic display to enhance the 3D effect. This also perceived quality of the user interface (UI) and enhanced the presentation of spatial information, compared to 2D.

Researchers at Brigham Young University have developed a method of using near-invisible laser beams to capture and manipulate cellulose particles at an ultra-high speed to create 3D images.





South Korean scientists have successfully developed 3D holographic displays by placing a titanium film, covered with tiny pinholes, behind the LCD monitor.

Source – ScienceDaily, Florian

To make 3D holographic displays a more popular choice, Evalueserve's FMR suggests that the 3D system manufacturers and automakers must focus on:

1. Understanding which information needs to be presented, so as not to distract drivers
2. Mitigating the effect of sunlight on quality and accuracy of holographic images
3. Eliminating eye fatigue

Curved / flexible displays

With connected and autonomous cars becoming more prominent, the popularity of larger and multiple displays is gaining traction. Often, in-vehicle displays need to conform to a vehicle's curved surface and remain unnoticeable. As currently available flat screen displays do not meet these evolving requirements, flexible display technologies can be the solution of choice due to multiple reasons.

When used in outside rear-view mirrors, curved / flexible displays can widen the field of vision and eliminate blind spots. They also offer an immersive user experience for both drivers and passengers, save space, and enable a clutter-free in-vehicle experience.

Current glass-based LCD automotive displays can only be curved to a certain extent; are difficult to cut into non-rectangular shapes; and are thick, heavy, and prone to breakage. As such, OLCD and OLED technologies offer a significant advantage. OLCDs can be manufactured at a lower temperature and cost than other flexible displays. They also have a longer life, provide high-contrast images, and conform to the requirements of automotive applications. Flexible OLED technology, which is already being used in smartphones and smartwatches, is another option for in-vehicle displays. However, this technology is not suitable for vehicular applications, as it is less reliable due to its shorter life span, lower brightness, and higher cost.

Latest developments in the curved / flexible display space

In June 2019, Novares integrated and displayed a curved OLCD in a concept car, highlighting the possible application of 'surface-integrated displays' in vehicle interiors.

NOVARES
Beyond plastics

CORNING

In January 2020, Corning started the production of curved automobile display systems using its ColdForm technology.

In February 2020, General Motors unveiled the 2021 Cadillac Escalade with LG Electronics' P-OLED technology, marking the first curved OLED display in a production car.

gm

Source – Novares, Corning, GM

Mercedes-Benz

In September 2020, Mercedes-Benz launched the S-Class with a curved display spanning the width of the car's dashboard.

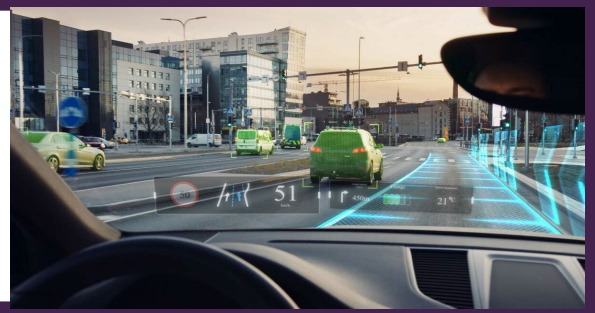
The upcoming 2023 BMW Alpina XB7 features a large curved display that combines a 12.3-inch instrument cluster and a 14.9-inch control panel.

BMW

Although flexible displays enable futuristic designs and seamless HMIs, they involve complex lamination and assembly to suit each vehicle's interior, as well as additional systems and software. Therefore, Evalueserve's FMR recommends that collaboration among display manufacturers, tier-1 suppliers, and OEMs is a must for the successful integration of such displays in various vehicles.

Augmented reality head-up displays

Traditional HUDs can only project tiny images and limited information (such as direction and speed). They are not capable of using data generated by in-vehicle sensors to create a seamless HMI. As such, they do not offer an optimal experience and can also be distracting for drivers.



Source – Mercedes-Benz, BMW

On the other hand, AR HUDs perform better in providing visual cues of objects in a driver's line of sight as they project virtual images, graphics, and text at multiple focal distances. They perform better in regard to navigation, hazard avoidance, location updates, and spontaneous interaction with physical objects. By placing graphics in a driver's field of view, AR HUDs significantly improve their situational awareness. For instance, an AR HUD can identify a potential safety hazard, such as a pedestrian or a piece of debris, and mark it for the driver for improved situational awareness.

Latest developments in the AR HUD space

In February 2022, HARMAN acquired Apostera to integrate the latter's AR and mixed reality (MR) software solutions to improve its automotive AR / MR offerings.

HARMAN
APOSTERA

Panasonic

At Consumer Electronics Show 2022, Panasonic unveiled AR HUD 2.0 with an eye-tracking system (ETS), a patented technology that enables the automatic identification of a driver's height and head movement to make dynamic adjustments to images in his / her line of sight. ETS includes features such as driver monitoring, dynamic parallax compensation, and dynamic autofocus.

In August 2021, Mercedes-Benz demonstrated its AR HUD technology on its brand-new S-Class.

Mercedes-Benz

Source – Harman, Panasonic, Mercedes-Benz

WAYRAY

In 2018, WayRay showcased its aftermarket solution Navion, a holographic AR display that can be used as a navigation system in cars.

AR HUDs can prioritize information to be projected on a driver's field of vision, enabling the shortest possible reaction time in a highly dynamic driving environment. When HUDs become capable of projecting clear and bright navigation images and providing easy access to infotainment features, they will be able to replace traditional in-car dashboards and navigation screens.

There are many other challenges that need to be mitigated before AR HUDs become a mainstream product. The most prominent are the technical hurdles related to size, which make it harder to design its optical path. Therefore, one of the key takeaways of FMR suggests that it is crucial for OEMs and other automotive display manufacturers to develop lighter and thinner devices.

Image Credit: Faurecia

Future of in-vehicle displays

Vehicles in the future will likely be equipped with highly customized display panels that provide a connected, safe, personalized, intelligent, productive, and entertaining end-to-end experience. AR has become the most evident choice among automakers and is witnessing increased commercialization. We believe that the position of AR HUDs will become stronger in automotive market of the future.

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