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Survey on Heads-Up Display for Automobiles

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ABSTRACT:

A heads-up display (HUD) is a technology that displays information in the driver's line of sight, typically on a transparent screen or the vehicle windshield. This information can be speed, RPM, fuel status, cabin temperature, etc. which can help the driver to know about the critical information without having to bend their necks to look in the vehicle dashboard. Originally developed for military aviation, HUDs are now used in a variety of industries, including automotive, sports, and gaming. They are designed to enhance safety, productivity, and user experience by providing critical information without requiring the user to look away from the task at hand. This study provides an overview of the market for HUD technology and outlines some of the key benefits and applications along with drawbacks of this innovative technology.

Keywords: Heads up display, line of sight, automobiles, safety.

Introduction:

Heads-up Display (HUD) is a technology that has been used in aviation for decades to provide pilots with essential information without requiring them to take their eyes off the cockpit instruments. With the advancements in technology, the automotive industry has started to adopt this technology for automobiles as well.

HUD is a system that projects information on the windshield or a separate transparent display, providing the driver with real-time information about speed, navigation, and other relevant vehicle data. This information is displayed in the driver's line of sight, making it easier for them to access the information without losing focus on the road ahead.

The introduction of HUD in automobiles has made driving safer and more comfortable by reducing the need for drivers to take their eyes off the road to check information on the dashboard. In addition to providing vital information to drivers, HUD can also enhance the overall driving experience by providing additional features such as night vision, collision warning, and lane departure warnings.

As more automobile manufacturers are adopting HUD technology, it is likely that this will become a standard feature in modern vehicles, making driving safer, more comfortable, and more efficient.

Literature Survey:

[1] The 1980 NASA Technical Paper 1711 titled "Cognitive issues in head-up displays" by Fischer, Haines, and Price examines the cognitive aspects of heads-up displays (HUDs) and their impact on human performance in flight. The paper highlights how HUD technology, which projects flight data into the pilot's line of sight, can improve safety and reduce pilot workload by allowing pilots to keep their attention focused on the outside environment. However, the authors also identify potential cognitive issues that may arise from the use of HUDs, such as the possibility of information overload, decreased attention to the cockpit environment, and the potential for increased reliance on automation. The paper concludes by recommending future research to address these issues and improve the design and implementation of HUD technology in aviation.

[2] The 1980 NASA Technical Paper 1720 titled "Head-up transition behavior of pilots with and without head-up display in simulated low-visibility approaches" by Haines, Fischer, and Price examines the impact of heads-up display (HUD) technology on pilot behavior during simulated low-visibility approaches. The authors found that pilots using HUDs had shorter reaction times and better accuracy in transitioning from instrument flight to visual flight compared to pilots without HUDs. The paper also highlights the potential benefits of HUDs in improving safety and reducing workload in low-visibility conditions. The authors conclude by recommending further research on the use of HUDs in aviation to improve pilot performance and safety.

[3] The 1989 SAE Technical Paper No. 890228 titled "The first head-up display introduced by General Motors" by Weihrauch, Melocny, and Goesch describes the development and implementation of the first heads-up display (HUD) system in automobiles by General Motors. The paper provides an overview of the system's components, including the projector, combiner, and optics, and describes how the system projects information such as speed and navigation onto the windshield. The authors highlight the potential benefits of HUDs in improving safety and reducing driver distraction, as well as

the challenges involved in developing and implementing the technology. The paper concludes by discussing the future potential of HUDs in automobiles and other applications.

[4] The chapter "The application of head-up displays to cars" by Swift and Freeman in the book "Vision in Vehicles" examines the potential benefits and challenges of implementing heads-up display (HUD) technology in automobiles. The authors discuss how HUDs can improve driver safety by reducing the need for drivers to take their eyes off the road to check instrument displays. They also describe the technical requirements for HUDs in cars, such as the need for a wide viewing angle and a system that is compatible with different vehicle designs. The chapter concludes by highlighting the potential future applications of HUD technology in automobiles, including the use of augmented reality displays and driver-assistance features.

[5] The paper "Contribution of head-up displays (HUDs) to safe driving" by Sakata, Okabayashi, Fukano, Hirose, and Ozone presented at the Eleventh International Technical Conference on Experimental Safety Vehicles, investigates the potential benefits of heads-up displays (HUDs) in improving driver safety. The authors conducted an experiment to evaluate the impact of HUDs on driving performance, focusing on the reduction of visual distraction and the improvement of driver reaction time. The study found that drivers using HUDs had improved reaction times and were less likely to look away from the road, leading to the conclusion that HUDs have the potential to improve driver safety. The paper concludes by discussing the need for further research on the use of HUDs in automobiles and other applications to enhance safety.

[6] The 1992 SAE Technical Paper Series No. 920740 titled "Head-up display in automotive/aircraft applications" by Enderby and Wood examines the use of heads-up displays (HUDs) in both automotive and aircraft applications. The authors compare the similarities and differences between HUDs in these two domains, such as the type of information displayed and the viewing angles required for optimal performance. The paper also explores the technical challenges involved in developing and implementing HUDs in these contexts, including the need for compatibility with different vehicle designs and the need for a high level of accuracy and reliability. The authors conclude by discussing the potential future applications of HUD technology in both automotive and aviation industries.

[7] The article "The effect of a head-up speedometer on speeding behavior" by Briziarelli and Allan, published in Perceptual and Motor Skills, investigates the impact of heads-up speedometers on driver behavior. The authors conducted an experiment in which drivers were given a HUD speedometer and were asked to drive on a test course. The study found that drivers who used the HUD speedometer were less likely to speed and more likely to maintain a consistent speed compared to those who used a traditional dashboard speedometer. The authors suggest that HUDs could be an effective tool in reducing speeding behavior and improving driver safety on the roads.

[8] The paper "Automotive head-up displays for navigation use" by Fukano, Okabayashi, Sakata, and Hatada, presented at the 14th International Technical Conference on Enhanced Safety of Vehicles, explores the use of heads-up displays (HUDs) for navigation purposes in automobiles. The authors discuss the technical requirements and challenges involved in developing HUDs for navigation, such as the need for accurate and up-to-date mapping data and the ability to display real-time information in a clear and concise manner. The paper also presents a prototype HUD navigation system that was developed and tested by the authors, which included features such as turn-by-turn directions and distance-to-turn information. The study found that the use of HUDs in navigation systems has the potential to improve driver safety and reduce driver distraction. The authors conclude by discussing the future potential of HUD technology in navigation and other automotive applications.

[9] The article "Development of heads-up display for motor vehicle" by Iino, Otsuka, and Suzuki, published in Automotive Electronic Displays and Information, presents the development process of a heads-up display (HUD) for use in motor vehicles. The authors describe the technical challenges in designing a HUD for automotive use, such as the need for a compact and lightweight design that is easy to read in various lighting conditions. The paper discusses the HUD prototype that was developed and tested by the authors, which included features such as speed, RPM, and fuel consumption displays. The study found that the HUD was effective in providing drivers with important information without causing excessive distraction. The authors conclude by discussing the potential for further development of HUD technology in the automotive industry.

[10] The article "Visibility of head up display for automobiles" by Inzuka, Osumi, and Shinkai, presented at the 35th Annual Meeting of the Human Factors Society, explores the issue of visibility of heads-up displays (HUDs) in automobiles. The authors conducted a study to evaluate the effectiveness of HUDs in displaying important information to drivers, such as speed and fuel level. The study found that the visibility of HUDs was affected by various factors, such as the driver's height and seating position, the brightness of the display, and the type of information being displayed. The authors conclude that further research is needed to improve the visibility and effectiveness of HUDs in automotive applications.

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