ID 154

A Comprehensive Review of Advanced Driver Assistance Systems (ADAS) and Their Role in Enhancing Human and Road Safety

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Abstract

Advanced Driver Assistance Systems (ADAS) play a crucial role in enhancing road safety by leveraging technological advancements to minimize the risk of accidents. This review highlights the importance of ADAS in mitigating risks, even when human reflexes fall short, by enabling drivers to adapt quickly to changing situations. Key technologies such as Adaptive Cruise Control, Emergency Brake Assistance, and Lane Departure Warning rely on sensor fusion involving radar, LiDAR, and camera imaging, which enhance vehicle responsiveness and provide timely warnings to drivers. The findings emphasize the significance of Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communication in facilitating real-time data exchange. This not only improves traffic safety but also accelerates the transition toward fully autonomous driving systems. However, challenges remain, such as ensuring sensor accuracy in adverse weather conditions and addressing security concerns related to data sharing. Further research is necessary to resolve these issues and fully realize the potential of ADAS technologies. The literature review was conducted using highly cited research papers from sources such as ResearchGate, Elsevier, ScienceDirect, and Google Scholar, following the PRISMA workflow to ensure quality and relevance. Results indicate that ADAS contributes significantly to road safety while laying a foundation for adaptive automated driving systems. For instance, emergency braking systems automatically respond to detected faults, and computer vision technology helps identify environmental hazards and driver blind spots, reducing the likelihood of accidents. In conclusion, ADAS not only enhances safety for all road users but also contributes to the development of flexible and safe automated driving systems. By addressing existing challenges, ADAS can further revolutionize road safety, offering society a reliable means of travel with minimal risk, ultimately shaping the future of transportation.

Keywords: *Advanced Driver Assistance Systems, Human safety, Sensor fusion, Accident prevention*