Evaluating effectiveness and acceptance of Advanced Driving Assistance Systems (ADAS) using Field Operational Test
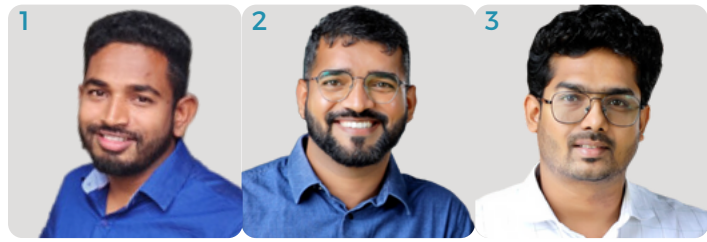
With the ever-increasing population of vehicles on the road and road network, societies are met with challenges by witnessing the loss of human life due to frequent and severe road traffic crashes. According to the World Health Organization (WHO, 2018), approximately 1.3 million people die each year as a result of road traffic crashes. According to the Ministry of Road Transport and Highways, In India, approximately 28,712 (fatal) and 81,800 (non-fatal) rear-end collisions were reported in 2021 (MORTH, 2022). These crashes (such as rear-end, sideswipe, and angle crashes) are often caused by the interaction of various factors, including the road environment, vehicles, and human factors. Several driving performance factors contribute to these collisions, including driver inattention/distractions, unintentional lane departure, speeding, poor performance due to alcohol impairment, limitations in the human visual system, and a combination of these factors. Lack of driver attention has been identified as the cause of 91% of driver-related accidents, and almost all traffic accidents are attributed to human errors. However, drivers' ability to remain continuously alert and attentive for prolonged periods is limited in real-world traffic conditions. Therefore, driver warning systems are necessary to reduce the risk of accidents by assisting drivers in advance.

One such driving aid is the Advanced Driver Assistance System (ADAS), which is designed to alert, warn, and assist drivers in unsafe situations in real-world traffic conditions. Past research studies revealed that, by integrating ADAS in vehicles, we can reduce the number of fatalities and injuries and the severity of those that cannot be avoided. The ADAS includes features such as Lane Departure Warning (LDW), Forward Collision Warning, and Traffic Speed Recognition Warning. However, the ADAS concept is relatively new in India, and it is ambiguous whether these systems can significantly affect driver behavior in actual traffic scenarios. Specifically, the acceptance and ADAS effectiveness on various roadways and with varying driver characteristics need to be justified using a Field Operational Test (FOT). With this motivation, the present research aims to evaluate the ADAS effect on driving performance and driver characteristics in various road environments based on an FOT. The real-world driving data was collected using the instrumented vehicle with Movon Driver Assistance System- 9 (MDAS-9), which alerts the driver for unintentional lane departures and following too closely (see **Figure 1**).
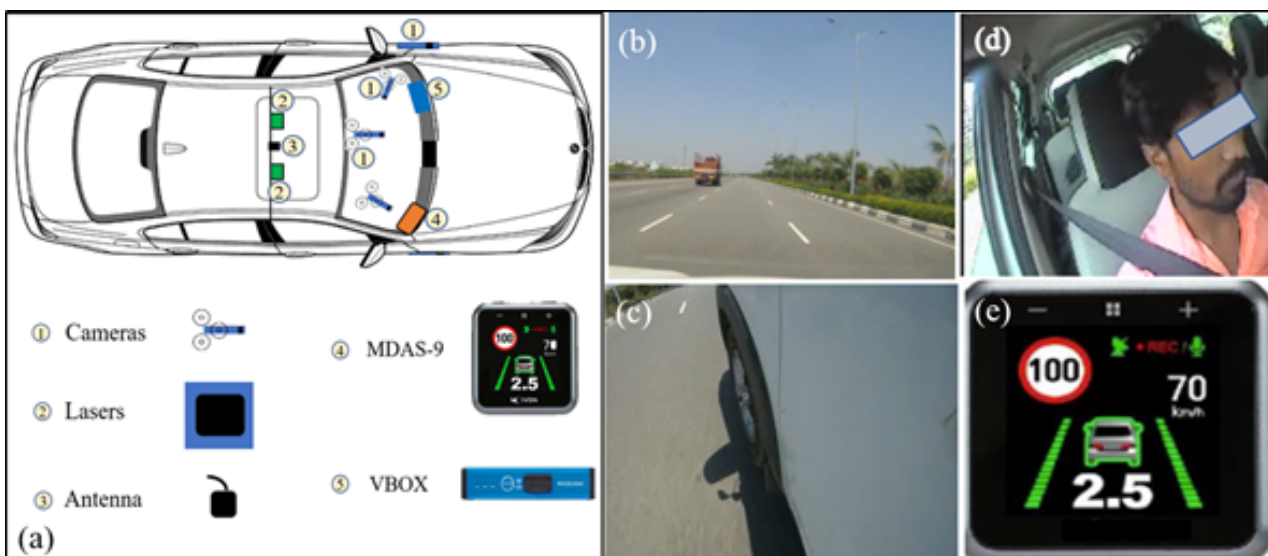

Figure-1: Instrumented vehicle
(a) Test vehicle with instruments; (b) Camera 1- road data;
(c) Camera 2- driver data; (d) Camera 3- LDW data;
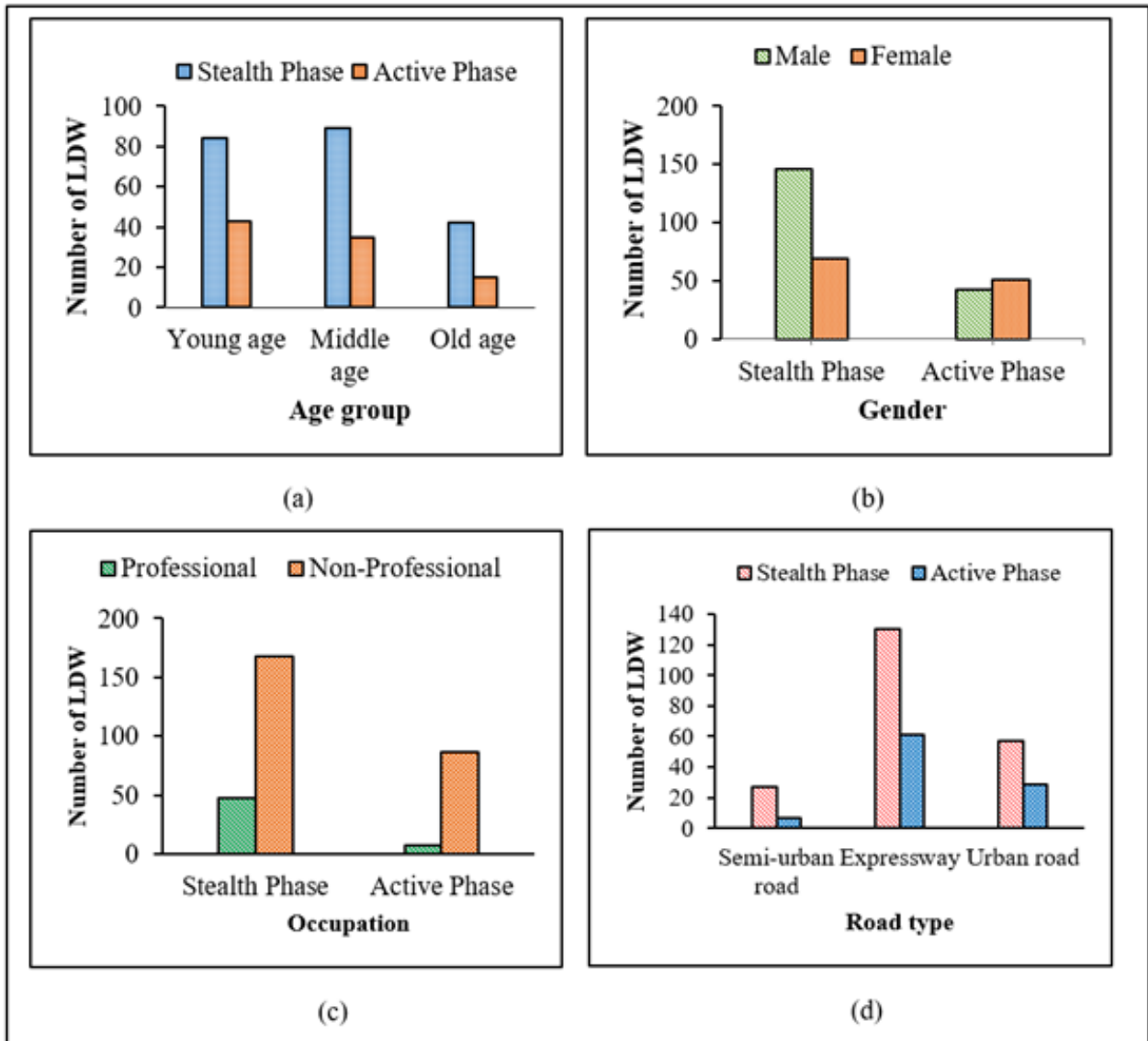(e) Camera 4- ADAS data

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Figure-2: LDW count: a) age group, b) gender, c) occupation, and d) road type

Conclusion:

The findings of this study results showed that the number of lane departures decreased when the drivers were alerted with ADAS Support in the different road environments (see Figure 2 (d)). Male and non-professional drivers showed significant improvement in lane departure compared to female and professional drivers when provided with LDW support (see Figure 2 (b and c)). Furthermore, the drivers of the older-aged group showed a lesser number of lane departures than the young- and middle-aged groups in both stealth (Without ADAS) and active phases (With ADAS), inferring that the older drivers drive safely. Furthermore, the drivers showed a positive attitude towards the acceptance of the ADAS technology for the LDW assistant feature. The findings of this study support the future development of ADAS, policy development, and induce trust in the public for the technology adoption to improve road traffic safety in India.

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