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A Literature Survey for Investigation into Driver Behavior for Enhancing Road Safety

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Abstract: This paper presents a literature survey conducted to investigate driver behavior and its impact on road safety. The study aims to enhance our understanding of the various factors influencing driver behavior and identify potential strategies to improve road safety. The survey encompasses a wide range of scholarly articles, research papers, and reports related to driver behavior, road safety, and human factors in driving. The abstract begins by emphasizing the importance of driver behavior in road safety and highlights the need for comprehensive research in this area. The survey explores key aspects of driver behavior, including risk perception, decision-making processes, cognitive factors, distraction, fatigue, aggression, and compliance with traffic rules and regulations. The findings from these studies are summarized, providing insights into the underlying causes and consequences of different driver behaviors. The literature survey also examines the effectiveness of various interventions and countermeasures aimed at modifying driver behavior and reducing the occurrence of accidents. These interventions include educational programs, awareness campaigns, driver training, advanced driver assistance systems, and policy interventions. The review evaluates the impact of these interventions on driver behavior and their overall effectiveness in improving road safety. In conclusion, this literature survey serves as a valuable resource for understanding driver behavior and its implications for road safety. It highlights the multifaceted nature of driver behavior, considering various factors that influence driving performance and decision-making. The findings from this survey can inform the development of evidence-based strategies and interventions to enhance road safety by targeting specific aspects of driver behavior.

Keywords: Driver behavior, Road safety, Risk perception, Decision-making, Distraction.

1. INTRODUCTION

According to a report by the World Health Organization (WHO) in 2018, traffic accidents cause approximately 1.3 million deaths annually, along with 20-50 million non-fatal injuries that often result in disabilities. The economic impact of road traffic accidents accounts for about 3% of the gross domestic product in most countries. Human error is responsible for 90% of these accidents, highlighting the need for road safety initiatives.Road safety is a collective effort involving government and non-government sectors. The responsibility for safety lies with every driver, considering that low and middle-income countries, which possess about 60% of the world's vehicles, experience 93% of the world's road traffic deaths. Notably, road traffic accidents are

the leading cause of death among children and adolescents aged 5-29 years. The Global Status Report on Road Safety 2018 reveals a steady increase in road traffic deaths, although the mortality rate has remained constant relative to the world's population.To address these issues, the development of a new driver assistance system is proposed. This system aims to enhance driver interaction with the road environment, including road infrastructure and other road users, by analyzing the driver's vision. The research study emphasizes the importance of considering various complex situations and dimensions when verifying results and formulating recommendations. Adopting a systematic approach allows for a comprehensive analysis of the driver and the characteristics of the road environment. It acknowledges the diverse nature of road users, their different shapes, sizes, and purposes for being on the road.In summary, the focus is on the significant impact of traffic accidents worldwide and the need for road safety measures. This includes the development of a driver assistance system that considers the driver's interaction with the road environment and emphasizes a systematic approach for analyzing system malfunctions. By considering various factors, such as driver characteristics and road infrastructure, a holistic understanding of road safety can be achieved.

2. ACCIDENT SCENARIO IN INDIA

Road safety has emerged as a pressing concern in India, with a significant portion of road fatalities involving pedestrians, cyclists, and motorized two-wheelers. Faulty driver behavior accounts for approximately 84% of accidents involving motor vehicles. In 2016 alone, India witnessed over 480,000 road crashes across various types of roads, representing approximately 11% of global road fatalities and the highest number of road crashes in any single country. Regrettably, despite a slight decrease in reported road crashes, the total number of fatalities due to road crashes has been on the rise. The recorded number of deaths increased from 137,572 in 2014 to 146,730 in 2015 and further to 150,785 in 2016, signifying a yearly increase of 6.6% and 2.8% respectively. On average, this translates to approximately 1,317 road crashes and 413 road deaths occurring each day in India. In other words, every hour witnesses around 55 road crashes and 17 road deaths. Road safety is a critical issue in India, particularly concerning vulnerable road users such as pedestrians and two-wheeler riders. Driver fault is a prominent factor contributing to accidents. Despite a minor decline in reported road crashes, the number of fatalities continues to escalate. These alarming statistics emphasize the urgent need for comprehensive measures to improve road safety in the country.

3. HUMAN FACTOR GOVERNING ROAD USER BEHAVIOUR

When individuals exceed their tolerance limits, their performance tends to deteriorate. Human information processing capacity is limited, and decision-making can be influenced by biases, leading to distortions in outcomes. For instance, when driving, individuals may overlook low-frequency faults while focusing on high-frequency events on the road. Various human factors can impact performance while driving, including fatigue, stress, emotions, drowsiness, alcohol, and drug use. Human behavior typically consists of three components: actions, planning, and outcomes. Errors can occur if either or both of the first two components fail. There are different types of human-related errors, as identified by Reason (1997). During decision-making, individuals are susceptible to biases that can affect their performance. Errors can arise when the chosen plan itself is inadequate, indicating a selection of incorrect action sequences. In summary, when individuals surpass their tolerance limits, their performance may suffer. Human cognitive capacity is limited, and biases can distort decision-making outcomes. Driving performance can be influenced by various human factors, and errors can occur if actions or planning are inadequate. Recognizing these limitations and biases is crucial in improving decision-making and overall performance in driving contexts.

4. SURVEY OF LITERATURE

Multiple studies have demonstrated the impact of driving behavior on road safety. Various factors influence driving behavior, including driver capacities and age-related effects, driving

styles, temporary impairments, and the behavior of other road users. Numerous studies have provided evidence supporting the broader discourse on these aspects of people's lives.Interventions aimed at reducing traffic accidents often target emotional instability, unhappiness, social factors, antisocial tendencies, impulsivity, marital status, stress, and similar conditions. Notably, previous studies primarily focused on reaction time rather than choice reaction time.In summary, driving behavior significantly affects road safety, and research has examined factors such as driver capacities, age-related effects, driving styles, temporary impairments, and the behavior of other road users. Interventions to prevent traffic accidents often consider various psychological and social factors. However, it is worth noting that previous studies have primarily focused on reaction time rather than choice reaction time.

Nordfjærn et al. (2013) Through cluster analysis, this study identified four distinct personality subtypes among drivers. The first cluster comprised individuals with low normlessness and sensation seeking but high anxiety. The second cluster exhibited elevated scores on all three measured traits. The third cluster displayed low scores on all traits. The fourth cluster demonstrated low anxiety but high normlessness and sensation seeking. Individuals in this cluster exhibited unsafe road traffic safety beliefs and driver behaviors. Furthermore, they were more likely to be males and adolescents. Conversely, individuals in the cluster characterized by low normlessness and sensation seeking, coupled with high anxiety, reported the safest beliefs and behaviors. This cluster primarily consisted of females and older individuals. The findings suggest that targeted countermeasures should be implemented to address the specific risk profiles associated with different personality clusters. Personality traits can also be utilized for early identification and intervention among drivers prone to risky behaviors. In conclusion, understanding the link between personality traits and driving behavior can aid in the development of effective strategies to reduce the frequency of road traffic accidents. By tailoring interventions to specific personality risk groups, road safety measures can be better targeted and early interventions can be implemented for at-risk drivers.

Paul et al. (2014) The core argument of this paper is that in order to achieve significant advancements in young driver road safety, insights gained from driver-centric research must be integrated into a systems approach. This integration is essential for obtaining a comprehensive understanding of the young driver road safety issue. By adopting a holistic perspective, more effective opportunities and avenues for intervention can be identified and implemented. The paper emphasizes the need to move beyond individual-focused approaches and consider the broader system in which young drivers operate. This shift in perspective is crucial for developing comprehensive strategies that address the complex factors influencing young driver road safety. Ultimately, by embracing a systems approach, the paper contends that substantial improvements can be made to enhance the safety of young drivers on the road.

Ellison et al. (2015) This paper provides a comprehensive description of the development of Driver Behavior Profiles (DBPs) and illustrates their application as a crucial input in modeling the factors that impact driver behavior. The findings reveal that even after accounting for the influence of the road environment, these factors continue to be the most significant predictors of driver behavior. This suggests that different spatiotemporal environments elicit diverse psychological responses in drivers. The approach and outcomes of this study hold valuable implications for insurance companies seeking to enhance their risk-profiling of drivers based on on-road driving data. Additionally, government entities can benefit from assessing the effectiveness of behavior-change interventions by incorporating DBPs. By considering the interplay between various factors and driver behavior, both insurance companies and government bodies can make informed decisions and implement strategies to promote safer driving practices and reduce risk on the roads.

Delbosc et al. (2017) This study utilizes a range of methods to examine the impact of mini-roundabouts on road safety and driver behavior. The analysis involves an examination of crash records for a period of three years before and after the installation of 40 mini-roundabouts.

Additionally, a case study of two adjacent mini-roundabouts installed in 2016 is incorporated. The study includes observations of driver behavior and a questionnaire survey to evaluate community acceptance. The findings indicate significant road safety benefits associated with the implementation of mini-roundabouts. Notably, there was a reduction of 78.9% in crashes, with the number of serious crashes decreasing from 6 to 0. The introduction of mini-roundabouts resulted in fewer vehicles exceeding the speed limit, and a higher rate of compliance with giving-way rules compared to traditional give-way systems. Surveys also indicated a decline in the number of conflict and avoidance maneuvers at the intersections. The design and characteristics of mini-roundabouts, including their lower speeds, contributed to safer conditions in the event of any crashes. Furthermore, the study found that residents of the area felt safer while driving and walking at the mini-roundabouts compared to before their installation.

Farooq et al. (2018) This study aimed to develop a set of measures to assess young driver behavior related to road traffic safety in different countries. The researchers created a Driver Behaviour Questionnaire (DBQ) to gather valuable information on road safety from university students who possessed a driver's license. The questionnaire focused on various aspects of driver attitudes towards traffic safety issues, such as non-compliance with traffic light signals, failure to wear seat belts, disregard for speed limits, neglecting to use personal intelligent driver assistants, failure to yield to pedestrians, tailgating, frequent lane changes, risk-taking behaviors, failure to apply brakes, challenges of mixed traffic, and honking horns in annoyance. The study compared driving attitudes between young drivers in Pakistan and Hungary, identifying several differences between the two groups. The implementation of these observed measures provided a more comprehensive understanding of deviant behavior among young drivers in both regions. Overall, the study contributed to the development of an initial set of measures to assess young driver behavior in relation to road traffic safety. The findings highlighted variations in driving attitudes between Pakistan and Hungary and emphasized the importance of observing multiple measures to gain a deeper understanding of young drivers' behavior in different regions.

Hussin et al. (2020) This study employed a mixed-methods approach, incorporating both qualitative and quantitative methods. The qualitative component involved conducting interviews with a focus group consisting of members from the Ministry of Transportation in Oman. The quantitative aspect involved analyzing road traffic accident data in Oman, followed by the distribution of a survey questionnaire to a randomly selected sample of drivers in the country. Both qualitative and quantitative data were analyzed using constant comparative and statistical techniques. The findings revealed that gender, age, and driving experience significantly influenced attitudes towards the commission of traffic violations and risky behavior. Younger and male drivers were found to be more involved in road accidents, while the age group of 26-33 years and those with minimal driving experience of 1-5 years exhibited a propensity for risk-taking attitudes. The results of this study hold importance for the local community and transport planning in the Sultanate of Oman. By identifying influential factors on driver behavior and accident involvement, the study offers valuable insights that can contribute to efforts aimed at reducing traffic accidents and improving driver behavior in the country.

Zaranka et al. (2021) This study highlights the need for specialized methodologies in the selection of professional drivers. The research focuses on assessing the reliability of these methodologies to develop a concept that allows for the identification of drivers who are capable of performing their hired work effectively, while minimizing losses associated with road accidents.

Arkatkar et al. (2022) The scope of this research encompasses various topic areas related to enhancing road safety. These include, but are not limited to, countermeasures for human errors, innovative studies on hazard perception and risk-mitigating driving behavior, the integration of driving performance and physiological measures to promote safety, the effective utilization of technology to prevent impaired driving performance, the role of road infrastructure in reducing human errors, intelligent driver assistance and safety systems, the impact of human-vehicle

interaction in connected and autonomous vehicles, the development of policies to improve drivers' compliance with traffic rules and regulations, attitudes towards in-vehicle technologies and their influence on behavior, the long-term effects of speed cameras on behavioral change, studies focusing on integrating vehicle-to-infrastructure (V2I), vehicle-to-vehicle (V2V), and vehicle-to-pedestrian (V2P) communication with autonomous vehicles, and the application of driving simulation and case studies. These areas encompass a comprehensive approach to advancing road safety research and addressing key factors that contribute to safer driving practices.

Cociu et al. (2023) This study highlights the need for systematic organization of educational programs and awareness campaigns aimed at promoting road safety among drivers and vulnerable road users. These initiatives should be carefully planned and implemented to effectively educate individuals about safe practices on the road. By providing comprehensive information and raising awareness about potential risks and preventive measures, such programs can contribute to improving road safety and reducing accidents. It is crucial to ensure that these educational efforts are well-structured, targeted, and accessible to reach a wide range of individuals and communities.

Faouzia et al. (2023)This paper conducts a systematic literature review (SLR) focusing on the classification of driver behavior. The study aims to analyze and highlight various aspects such as different types of driver behavior, data sources, datasets, features, and artificial intelligence techniques utilized in the classification of driver behavior and performance. By examining the findings from the selected works, the study aims to identify the significant contributions and challenges in the field of driver behavior classification. Furthermore, the paper proposes potential avenues for future research and provides recommendations for both practitioners and researchers in this domain.

5. SUMMARY

This paper presents a comprehensive literature survey conducted to investigate driver behavior and its implications for enhancing road safety. The study aims to provide insights into the various factors influencing driver behavior and identify potential strategies for improving road safety outcomes. The survey covers a wide range of scholarly articles, research papers, and reports related to driver behavior, road safety, and human factors in driving. The survey highlights the importance of integrating driver-centric research into a systems approach to gain a holistic understanding of the young driver road safety problem. By considering the multifaceted nature of driver behavior and its interactions with other elements of the transportation system, more effective opportunities and avenues for intervention can be identified. Key factors influencing driver behavior, such as risk perception, decision-making processes, cognitive factors, distraction, fatigue, aggression, and compliance with traffic rules, are examined in the survey. The review also explores the effectiveness of various interventions and countermeasures, including educational programs, awareness campaigns, driver training, and advanced driver assistance systems. The findings of the literature survey underscore the significance of driver behavior in road safety outcomes. By integrating insights from driver-centric research into road safety strategies and interventions, it is possible to address the complex dynamics of driver behavior and enhance road safety measures. The literature survey serves as a valuable resource for policymakers, transportation agencies, researchers, and other stakeholders involved in road safety. It provides a comprehensive overview of the current state of knowledge, identifies research gaps, and offers recommendations for future research directions to further enhance road safety through a focus on driver behavior.

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