


# Eyes on the Road: An AI-Based Fatigue Detection System for Safeguarding Professional Drivers

**Priyanka Sundararajan**

 <http://orcid.org/0009-0006-3983-9569>

*Christ University, India*

**Kimaya Gokul Dafale**

 <http://orcid.org/0009-0001-5607-7387>

*Christ University, India*

**Nithina Odayammadathu Malethu Veedu**

 <http://orcid.org/0009-0000-1319-8560>

*Christ University, India*

**K. Abilash**

 <http://orcid.org/0000-0002-4341-2385>

*Christ University, Bengaluru, India*

## ABSTRACT

*Fatigue is a major contributing factor to accidents involving professional drivers. Traditional methods of detecting fatigue such as self-reported questionnaires or observation are often ineffective and impractical. Artificial intelligence offers a promising solution to this problem by providing a real-time, objective, and non-intrusive way to detect fatigue. This review aims to outline AI-based fatigue detection systems that can be implemented for long-haul drivers. It uses technology to identify and track the driver's behavior and physiological indicators to detect signs of fatigue. Integrating an AI-based fatigue detection system into the vehicle's dashboard could provide real-time alerts when the drivers are drowsy as well as provide data to fleet managers to target interventions to drivers at risk of drowsy driving. This kind of fatigue detection system is relatively inexpensive to implement and can reduce the number of accidents caused by drowsy driving significantly.*

DOI: 10.4018/407390

Copyright ©2027, IGI Global Scientific Publishing. Copying or distributing in print or electronic forms without written permission of IGI Global Scientific Publishing is prohibited. Use of this chapter to train generative artificial intelligence (AI) technologies is expressly prohibited. The publisher reserves all rights to license its use for generative AI training and machine learning model development.

## INTRODUCTION

Driving is a complex daily living task that demands a combination of operational and higher cognitive skills. It requires an individual's situational awareness and attention resources. However, we fail to address driver fatigue or fatigue among professional drivers, often arising from insufficient rest and extended working hours which poses a substantial risk to road safety.

The Centers for Disease Control and Prevention has stated that approximately 1 in 25 adult drivers in America admit to having fallen asleep while driving, and many more acknowledge driving when sleep-deprived. This highlights the grave consequences of driver fatigue and provides a baseline for understanding the importance of fatigue detection technologies. When drivers are tired, they experience impaired reaction times, reduced hazard awareness, and an elevated likelihood of road accidents. These factors not only endanger lives but also result in substantial economic consequences, imposing significant costs on society as a whole.

One of the main causes of many traffic accidents is driver fatigue. Fatigued drivers lose control of their vehicles in 40% of traffic accidents (Chen et al., 2020). According to recent statistics, fatigue-related accidents cause 1200 fatalities and 76,000 hospital admissions each year. Furthermore, it is believed that operating a vehicle after being alert for more than 20 hours is the same as having 0.08% alcohol in the bloodstream.

In 2020, the Save Life Foundation reported that nearly half of professional truck drivers suffer from fatigue while driving due to long working hours and insufficient rest. Long-haul truck drivers are particularly vulnerable due to the demanding nature of their profession, monotonous drives, harsh environmental conditions, and the operation of heavy vehicles. Moreover, factors such as sleep deprivation, time constraints due to tight schedules, and scarcity of parking spaces contribute to this fatigue. Thus, potentially increasing the risk of severe accidents.

Examining the data related to driving fatigue presents a significant challenge, particularly because data collection efforts have ceased in some cases, resulting in a gap in available information. This gap in data raises concerns about our understanding of the current status of the driver fatigue issue. To address this issue effectively, the researchers find it imperative to investigate and tackle driver fatigue by exploring existing technologies and methodologies, even in the absence of comprehensive data. In doing so, we can work towards comprehensive solutions with the help of artificial intelligence for mitigating the risks associated with driver fatigue and enhancing road safety.

## FATIGUE

Fatigue is an extreme sense of tiredness and lack of energy that can interfere with a person's daily activities (*NCI Dictionary of Cancer Terms*, n.d.). It is a common symptom, regardless of health or illness.

Fatigue has been classified into two broad categories: Central and Peripheral (Zwarts et al., 2008). The former originates in the central nervous system and affects cognition, motivation and motor control. It is closely linked to neurotransmitter imbalances and neural circuit dysfunctions. Increased serotonin levels are linked to lethargy and reduced alertness, while reduced dopamine levels impair motivation and focus (Enoka & Duchateau, 2016). This disruption in neurotransmitter functioning can be worsened by pro-inflammatory cytokines in chronic fatigue situations. The elevation of cytokines level can induce "sickness behaviour," a state marked by lethargy and reduced activity (Davis &

18 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

[www.igi-global.com/chapter/eyes-on-the-road/407390](http://www.igi-global.com/chapter/eyes-on-the-road/407390)

## Related Content

---

### Leveraging AI for Personalized Customer Experiences

Shivani Thapliyaland Raghav Bindal (2025). *Strategic Brand Management in the Age of AI and Disruption* (pp. 303-324).

[www.irma-international.org/chapter/leveraging-ai-for-personalized-customer-experiences/369945](http://www.irma-international.org/chapter/leveraging-ai-for-personalized-customer-experiences/369945)

### Transformative Impacts of AI in Emerging Technologies in Business

(2025). *Transformative Impact of Artificial Intelligence on Management Information Systems* (pp. 131-164).

[www.irma-international.org/chapter/transformative-impacts-of-ai-in-emerging-technologies-in-business/382989](http://www.irma-international.org/chapter/transformative-impacts-of-ai-in-emerging-technologies-in-business/382989)

### Supporting Structured Group Decision Making Through System-Directed User Guidance: An Experimental Study

Harold J. Lagroue III (2008). *International Journal of Intelligent Information Technologies* (pp. 57-74).

[www.irma-international.org/article/supporting-structured-group-decision-making/2435](http://www.irma-international.org/article/supporting-structured-group-decision-making/2435)

### Psychological Effects of Dominant Responses to Early Warning Alerts

Thomas Jack Huggins, Lili Yang, Jin Zhang, Marion Lara Tanand Raj Prasanna (2021). *International Journal of Ambient Computing and Intelligence* (pp. 1-15).

[www.irma-international.org/article/psychological-effects-of-dominant-responses-to-early-warning-alerts/279583](http://www.irma-international.org/article/psychological-effects-of-dominant-responses-to-early-warning-alerts/279583)

### Symmetric Uncertainty Based Search Space Reduction for Fast Face Recognition

C. Sweetlin Hemalatha, Vignesh Sankaran, Vaidehi V, Shree Nandhini S, Sharmi P, Lavanya B, Vasuhi Sand Ranajit Kumar (2018). *International Journal of Intelligent Information Technologies* (pp. 77-97).

[www.irma-international.org/article/symmetric-uncertainty-based-search-space-reduction-for-fast-face-recognition/211193](http://www.irma-international.org/article/symmetric-uncertainty-based-search-space-reduction-for-fast-face-recognition/211193)