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ORGANIZING SAFE PEDESTRIAN TRAFFIC USING MODERN TECHNOLOGIES

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Abstract
This article explores the reduction of road traffic accidents involving pedestrians through the implementation of modern technologies. The study analyzes the causes and frequency of pedestrian-related incidents and presents practical recommendations for improving pedestrian safety at intersections, roadways, and urban environments. Special attention is given to the use of intelligent traffic light systems, sensor-based pedestrian detection, and real-time traffic monitoring tools. These solutions are aimed at minimizing risks and enhancing the efficiency of pedestrian traffic management in smart city frameworks.
Keywords: pedestrian, intersection, road, traffic accident, traffic light

Introduction

In the context of rapid urbanization and increased vehicular traffic, pedestrian safety has become a pressing issue in cities worldwide. According to global traffic safety reports, a significant portion of road accidents involve pedestrians, often resulting in severe injuries or fatalities. Ensuring the safety of pedestrians is not only a matter of traffic management but also a key aspect of sustainable and inclusive urban development.

Traditional pedestrian infrastructure, such as crosswalks and signalized intersections, often falls short in preventing accidents due to human error, limited visibility, and inadequate enforcement of traffic rules. Therefore, there is a growing need to integrate modern technologies into the planning and management of pedestrian traffic. Intelligent traffic light systems, automated pedestrian detection sensors, and data-driven traffic control platforms represent some of the most promising innovations in this field.

This article aims to examine the effectiveness of such technologies in reducing pedestrian-related traffic incidents. By analyzing current practices and presenting practical solutions, the study contributes to the development of safer urban environments that prioritize pedestrian well-being and mobility.

Materials and methods

Since gaining independence, the Republic of Uzbekistan has experienced rapid socio-economic development. This progress has led to an increase in transportation demand, accompanied by a parallel rise in the number of vehicles and, consequently, road traffic accidents (RTAs). According to official statistics, a total of 4,056 people lost their lives in RTAs during 2019–2020 (Figure 1).

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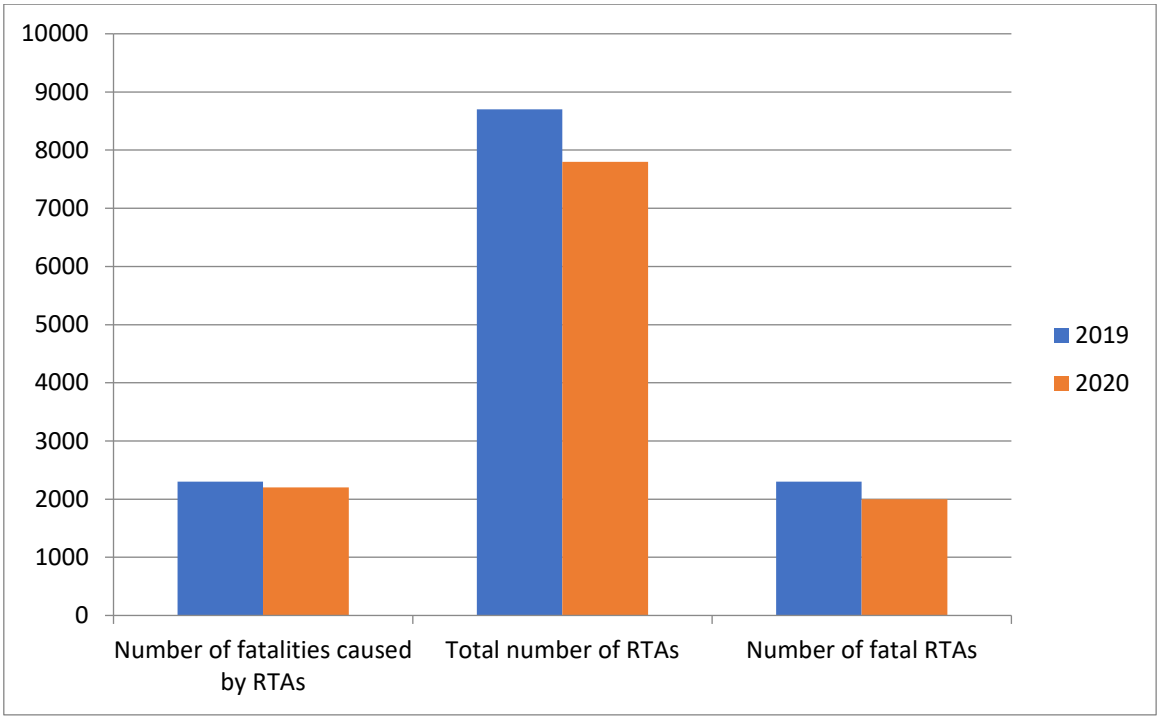

Figure 1. Consequences of Road Traffic Accidents in 2019–2020

Data from the Main Directorate of Road Traffic Safety (YHXBB) under the Ministry of Internal Affairs of the Republic of Uzbekistan [1] indicates that the number of accidents involving or caused by pedestrians has increased in recent years. These statistics reveal that a majority of such incidents are attributed to pedestrian error. Alarmingly, while three years ago pedestrians were involved in or responsible for every third accident, today every second RTA involves a pedestrian either as a participant or at fault.

In response to this situation, several decrees and resolutions have been adopted by the government to improve road safety. One such example is Presidential Decree No. 3127, dated July 11, 2017, titled *"On Measures to Further Improve the Road Traffic Safety System"* [2]. Additionally, the Cabinet of Ministers adopted Resolution No. 841 on October 20, 2018, *"On Measures for Implementing National Goals and Objectives in the Field of Sustainable Development Until 2030"*, which sets the target of halving the number of RTAs in Uzbekistan by 2025. By 2030, it is envisioned to ensure safe, affordable, accessible, and environmentally sustainable transport systems, with expanded public transport usage and focused attention on vulnerable social groups.

To support the implementation of these objectives, significant efforts are currently underway at the national level to enhance the quality and attractiveness of public transportation services, ensure the rational use of existing infrastructure, and prevent potential RTAs. This study focuses on regulated pedestrian crossings as key urban elements and analyzes the influence of attention-diverting objects (e.g., smartphones, books, newspapers) on pedestrian behavior during road crossings.

The subject of the study centers on pedestrian distractions while crossing roads, particularly due to mobile phones, headphones, or reading materials, which have been identified as major causes of pedestrian-involved accidents. As a preventive solution, this study

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evaluates the effectiveness of "in-ground" LED traffic signals—embedded in the pavement at pedestrian crossings—which have shown potential in reducing pedestrian-related accidents by 10–15% (Figure 2).

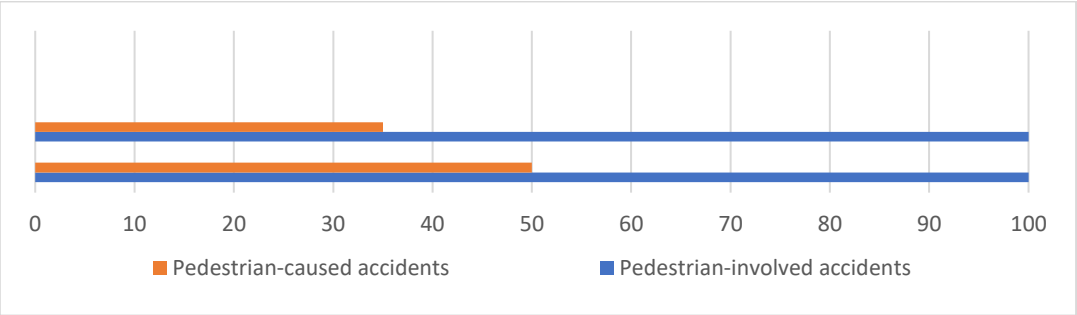

Figure 2. Diagram of an in-ground traffic light before and after installation.

Considering that when a pedestrian crosses an intersection or a designated section of the road using various gadgets, his field of vision is mainly focused on the smartphone and the surface of the road, an alternative solution to the existing problem is to introduce special "in ground traffic lights" (Figure 3) for pedestrians in the road infrastructure.

Figure 3. "in-ground traffic light"

In Uzbekistan, ongoing research and initiatives aimed at reducing road traffic accidents must involve a comprehensive analysis of the existing problems concerning both pedestrians and vehicular traffic. In this context, it is essential to study pedestrian flow patterns and develop recommendations for the construction and optimization of underground and overground pedestrian crossings. Furthermore, the spacing of these crossings should be redesigned to ensure maximum convenience and accessibility for pedestrians, thereby enhancing both safety and efficiency in urban mobility planning.

Conclusions

This study emphasizes the critical role of modern technologies in improving pedestrian safety and reducing traffic accidents in urban environments. The statistical data from recent years indicate a significant share of traffic accidents involving pedestrians, many of which are caused by distraction due to mobile device usage and other visual or auditory interferences during road crossings.

The implementation of intelligent solutions such as in-ground LED traffic signals, sensor-based warning systems, and real-time pedestrian detection technologies can significantly mitigate the risk of pedestrian-related accidents. Moreover, a systematic approach to the design and spacing of underground and overground pedestrian crossings, based on pedestrian flow analysis, is essential for ensuring safety and convenience.

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Government initiatives and policy frameworks adopted in Uzbekistan, such as the Presidential Decree No. 3127 (2017) and the National Sustainable Development Strategy (Resolution No. 841, 2018), provide a foundation for long-term improvements in traffic safety. To further strengthen these efforts, it is recommended that urban planning authorities integrate data-driven decision-making and smart traffic management systems in future infrastructure development.

The findings of this research can contribute to national strategies aimed at halving the number of road traffic accidents by 2025, as well as achieving the broader goals of safe, inclusive, and sustainable urban mobility by 2030.

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