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AI-based Traffic Detection and Autonomous Signal Operation

Vaibhav Wagh[1], Nikhil Terkar[2], Rohit Terkar[3], Khushi Sharma[4], Prof. Sandhya Aghav[5]
Department of Computer Engineering,
SND College of Engineering & Research Center, Yeola, Maharashtra, India

Abstract: *This survey paper presents a comprehensive overview of AI-based traffic detection and autonomous signal operation systems, focusing on the integration of advanced technologies such as cameras, Raspberry Pi, and image processing algorithms, particularly YOLO (You Only Look Once). With the rapid urbanization and the increasing number of vehicles, efficient traffic management has become crucial for improving road safety and reducing congestion. Our survey examines various methodologies employed in traffic detection, including real-time monitoring and classification of vehicles, pedestrians, and cyclists. We analyze the effectiveness of using Raspberry Pi as a low-cost computing platform in conjunction with high-resolution cameras for image acquisition and processing. The paper highlights the performance of YOLO in detecting traffic objects in diverse environments, showcasing its speed and accuracy in real-time applications. Furthermore, we discuss the challenges faced in deploying these systems in real-world scenarios, including environmental variability, data privacy concerns, and the need for robust infrastructure. Finally, we propose future directions for research, emphasizing the importance of integrating machine learning with IOT solutions to create smarter, more responsive traffic management systems. This survey aims to provide insights for researchers and practitioners in developing sustainable traffic solutions leveraging AI technologies.*

Keywords: AI-based traffic detection, Yolo Algorithm, Real-time traffic analysis, Traffic cameras, Raspberry pi, Image processing

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