Emergency Vehicle Object Detection for Traffic Light Optimization

Mr. K. Saravanan[1], M. Mohamed Aadhil[2], S. Gopinath[3]
Assistant Professor, Department of Computer Science and Engineering[1]
Students, Department of Computer Science and Engineering [2, 3]
Dhanalakshmi Srinivasan University, Tiruchirappalli, Tamil Nadu, India

Abstract: *Urban traffic congestion often impedes the swift movement of emergency vehicles, potentially leading to life-threatening delays. This project presents a real-time vision-based solution titled "Emergency Vehicle Object Detection for Traffic Light Optimization", aimed at improving emergency response efficiency through intelligent traffic control. The system leverages machine learning and computer vision techniques to detect emergency vehicles from live traffic surveillance footage using models like YOLO and OpenCV. Upon detection, the system dynamically overrides standard traffic signal patterns to provide a green corridor, ensuring unhindered passage for emergency responders. Key components include video frame preprocessing, object detection, classification, and communication with the traffic signal controller. The model is trained and validated using annotated traffic video datasets, and its performance is evaluated based on detection accuracy, processing speed, and system responsiveness. Although in prototype stage, the project demonstrates the feasibility of integrating AI with smart traffic infrastructure to enhance emergency mobility and urban traffic efficiency.*

Keywords: Emergency vehicle detection, Traffic light control, Computer vision, Machine learning, YOLO, Real-time object detection, Smart city, Urban traffic optimization

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19