INTELLIGENT TRAFFIC CONGESTION CONTROL USING REAL-TIME VEHICLE TRACKING

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Traffic congestion is a serious problem, especially in urban areas where it continues to deteriorate, making real-time road traffic density monitoring vital for efficient signal control and traffic management. Various reasons contribute to congestion, such as limited road capacity, unregulated demand, and extended red-light waits. While the first two causes are partly connected, the constant nature of traffic signal delays, independent of traffic circumstances, underscores the necessity for modeling and improving traffic management to handle rising demand. In recent years, image processing and surveillance technologies have become important to traffic control, delivering real-time passenger information, ramp metering, and updates. Traffic density estimation may be performed via image processing. This project intends to utilize live picture feeds from cameras at traffic crossings to determine real-time traffic density and implement a Signal Switching Algorithm that dynamically adjusts traffic light timings based on vehicle density. This algorithm analyzes vehicle data to set optimal green signal durations, ensuring that heavily trafficked lanes receive more time, while lanes with low traffic do not experience unnecessary green lights. By adjusting signals in real-time, the algorithm aims to minimize road congestion, reduce accidents, provide safer travel, and cut fuel consumption and waiting times. Additionally, it will create valuable data for future road design and research. In future phases, synchronizing several traffic signals may further minimize congestion and enhance the free flow of traffic. Unlike previous systems that depend on electrical sensors embedded in the pavement, this system employs cameras mounted beside traffic signals to collect image sequences. Image processing offers a more efficient approach for regulating traffic light status changes, reducing congestion by preventing unnecessary green lights on empty lanes. It is also more reliable in detecting vehicle presence by utilizing real traffic images, demonstrating greater practicality and effectiveness compared to systems that detect vehicles based on their metal content.

Keywords: Adaptive signal control, Image processing, Real-time monitoring, Traffic management, Vehicle detection.