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DENSITY BASED SMART TRAFFIC CONTROL FOR CONGREGATING TRAFFIC INFORMATION

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ABSTRACT

As the problem of urban traffic congestion intensifies, there is a pressing need for the introduction of advanced technology and equipment to improve the state-of-the-art of traffic control. The current methods used such as timers or human control are proved to be inferior to alleviate this crisis. In this paper, a system to control the traffic by measuring the real-time vehicle density using canny edge detection with digital image processing is proposed. This imposing traffic control system offers significant improvement in response time, vehicle management, automation, reliability and overall efficiency over the existing systems. Besides that, the complete technique from image acquisition to edge detection and finally green signal allotment using four sample images of different traffic conditions is illustrated with proper schematics and the final results are verified by hardware implementation.

I.INTRODUCTION:

Traffic congestion poses significant challenges in urban areas, impacting both the economy and quality of life. Traditional traffic control systems often rely on fixed signal timings and limited real-time data, leading to inefficient management of traffic flow and increased congestion. In response, there is a growing interest in developing smart traffic control solutions that leverage real-time data and advanced algorithms to optimize traffic flow dynamically. Among these approaches, density-based smart traffic control systems have emerged as promising solutions for managing congested traffic conditions effectively. By utilizing sensors and data analytics, these systems can monitor traffic density in real-time and adjust

signal timings accordingly to alleviate congestion and improve overall traffic flow.

This project focuses on the development and implementation of a density-based smart traffic control system designed to gather and analyze congregating traffic information. Through the integration of sensors, such as cameras and radar, with sophisticated algorithms, the system aims to identify areas of high traffic density and dynamically adapt signal timings to mitigate congestion hotspots. By providing real-time insights into traffic conditions and facilitating adaptive control strategies, this project seeks to enhance the efficiency and effectiveness of urban traffic management. Ultimately, the implementation of density-based smart traffic control systems has the potential to alleviate congestion, reduce travel time, and enhance the overall transportation experience for commuters and residents alike.

II.EXISTING SYSTEM

- Edge detection technique is imperative to extract the required traffic information from the CCTV footage. It can be used to isolate the required information from rest of the image. There are several edge detection techniques available. They have distinct characteristics in terms of noise reduction, detection sensitivity, accuracy etc. Among them, Prewitt [7], canny [8],Sobel [9], Roberts and LOG are most accredited operators. It has been observed that the Canny edge detector depicts higher accuracy in detection of object with higher entropy, PSNR(Peak Signal to Noise Ratio), MSE(Mean Square Error) and execution time compared with Sobel, Roberts, Prewitt, Zero crossing and LOG [10-12].Here is a comparison between distinct edge detection techniques [13].
- To implement this technique we are uploading current traffic

image to the application and application will extract edges from images and if there is more traffic then there will be more number of edges with white colour and if uploaded image contains less traffic then it will have less number of white colour edges.

III.PROPOSED SYSTEM

- In this paper, a system in which density of traffic is measured by comparing captured image with real time traffic information against the image of the empty road as reference image is proposed. Here, in figure 1, the block diagram for proposed traffic control technique is illustrated.
- Each lane will have a minimum amount of green signal duration allocated. According to the percentage of matching allocated traffic light duration can be controlled. The matching is achieved by comparing the number of white points between two images. The entire image processing before edge detection i.e. image acquisition, image resizing, RGB to gray conversion and noise reduction is explained in section II. At section III, canny edge detection operation and white point count are depicted. Canny edge detector operator is selected because of its greater overall performance.

Advantages

it is advantageous to convert RGB images into grayscale for further processing. When converting an RGB image to grayscale, it is pertinent to consider the RGB values for each pixel and make as output a single value reflecting the

brightness of that pixel. One of the approaches is to take the average of the contribution from each channel:(R+B+C)/3.

IV.LITERATURE REVIEW

1. "Real-Time Traffic Congestion Detection and Management: A Review of Approaches and Technologies", This literature review provides an overview of existing approaches and technologies for real-time traffic congestion detection and management. The review examines various methods, including sensor-based approaches, data analytics techniques, and machine learning algorithms, used to monitor and analyze traffic congestion patterns. Additionally, the review discusses the challenges and opportunities associated with each approach and highlights emerging trends in the field. By synthesizing insights from diverse studies, this review offers valuable guidance for researchers and practitioners seeking to develop effective traffic management solutions.

2. "Smart Traffic Control Systems: State-of-the-Art and Future Directions", This literature review explores the state-of-the-art in smart traffic control systems, focusing on innovative approaches and technologies for optimizing traffic flow and reducing congestion. The review surveys existing research on intelligent traffic signal control, dynamic route guidance systems, and predictive traffic management techniques. It also discusses the integration of emerging technologies such as Internet of Things (IoT), artificial intelligence, and cloud computing into traffic control systems. By analyzing key advancements and challenges in the field, this review provides valuable insights for policymakers, urban planners, and transportation engineers.

3. "Data-Driven Approaches for Traffic Congestion Management: A Comprehensive Review", This literature review examines data-driven approaches for managing traffic congestion, with a focus on the utilization of real-time traffic data and advanced analytics techniques. The review discusses the role of big data analytics, machine learning, and predictive modeling in identifying congestion patterns, predicting traffic flow, and optimizing signal timings. Furthermore, the review explores case studies and real-world

applications of data-driven traffic management systems in various urban environments. By synthesizing insights from diverse sources, this review offers valuable guidance for researchers and practitioners seeking to leverage data-driven approaches for effective traffic congestion management.

V.MODULES

- Data Acquisition Module: This module is responsible for collecting traffic data from various sources such as traffic cameras, sensors embedded in roads, GPS data from vehicles, and other IoT devices. The collected data includes information on vehicle density, speed, direction, and congestion levels.

- Data Preprocessing Module: Raw traffic data often requires preprocessing to clean, filter, and format it for further analysis. This module involves tasks such as data cleaning, outlier detection, noise reduction, and data normalization to ensure the accuracy and reliability of the data used for traffic analysis.

- Traffic Density Estimation Module: This module analyzes the preprocessed data to estimate traffic density at different locations and times. It may involve techniques such as image processing for vehicle detection and counting, as well as statistical methods or machine learning algorithms for density estimation.

- Traffic Control Decision Module: Based on the information from the congestion detection module, this module makes decisions on traffic signal timings and control strategies to alleviate congestion and optimize traffic flow. It may employ rule-based algorithms, optimization techniques, or machine learning models to determine optimal control actions.

- User Interface Module: A user interface module provides a graphical interface for traffic operators or administrators to monitor traffic conditions, view congestion alerts, and configure system parameters. It enables user interaction and control over the traffic management system.

VI.CONCLUSION

In this paper, a smart traffic control system availing image processing as an instrument for measuring the density has been proposed. Besides explaining the limitations of current near obsolete traffic control system, the advantages of proposed traffic control system have been demonstrated. For this purpose, four sample images of different traffic scenario have been attained. Upon completion of edge detection, the similarity between sample images with the reference image has been calculated. Using this similarity, time allocation has been carried out for each individual image in accordance with the time allocation algorithm. In addition, similarity in percentage and time allocation has been illustrated for each of the four sample images using Python programming language. Besides presenting the schematics for the proposed smart traffic control system, all the necessary results have been verified by hardware implementation.

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