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TRAFFIC MANAGEMENT SYSTEM

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Abstract: In an era characterized by rapid urbanization, the efficient management of traffic stands as a paramount necessity. The challenges posed by traffic congestion, road accidents, and the ever-evolving landscape of infrastructure development require innovative solutions. This project introduces an intelligent traffic management and prediction system harnessing the power of Artificial Intelligence (AI) and Machine Learning (ML). It sets out to revolutionize the management and control of traffic, with a focus on streamlining traffic flow, reducing congestion, enhancing road safety, and supplying critical data for informed infrastructure development. Beyond traditional traffic management, this system offers a suite of advanced features, including convoy route planning and dynamic journey optimization, which is designed to benefit both traffic authorities and road users. This abstract encapsulates the essence of a visionary system that aspires to usher in a smarter, safer, and more organized approach to urban traffic management, poised to harmonize the needs of our ever-growing cities with the demands of modern transportation.

Keywords: Deep Learning, Vehicle Detection, Intelligent Traffic Control

I. INTRODUCTION

In today's rapidly urbanizing world, efficient traffic management is an everpressing need. Traffic congestion, road accidents, and infrastructure development are critical issues that cities and communities face. To address these challenges, the concept of an intelligent traffic management and prediction system powered by Artificial Intelligence (AI) and Machine Learning (ML) emerges as a promising solution.

This project aims to design an innovative traffic management, control, and prediction application system that leverages AI and ML technologies to streamline traffic flow, reduce congestion, enhance road safety, and provide essential data for infrastructure development. This application goes beyond conventional traffic management systems by offering additional features such as convoy route planning and journey planning. It is intended to serve as a comprehensive solution for traffic management, benefiting both authorities and road users.

This pioneering project is on a mission to redefine the way we perceive and handle traffic management. By harnessing the cutting-edge technologies of AI and ML, this system seeks to revolutionize the management, control, and prediction of traffic patterns.

Its primary objectives are to streamline traffic flow, alleviate congestion, enhance road safety, and provide valuable data for informed infrastructure development decisions. Going beyond the boundaries of traditional traffic management, this application introduces innovative features such as convoy route planning and journey planning, aiming to provide a holistic solution that benefits both authorities and road users.

II. LITERATURE SURVEY

Gaurav Meena, Deepanjali Sharma, and Mehul Mahrishi [1], aim to forecast accurate traffic flow data, considering disruptions like signals, crashes, rallies, and road repairs. Emphasizing informed decision-making for drivers and autonomous cars, they advocate for big data principles in transportation due to the exponential increase in traffic data. Existing prediction approaches are deemed unsuitable, leading to the development of a solution using machine learning, genetic algorithms, soft computing, and deep learning. Image processing aids traffic sign detection for testing self-driving cars. Despite recognizing the importance of deep learning and genetic algorithms, the paper argues for their underrepresentation in the ML community. The proposed algorithm surpasses current precision and enhances dataset complexity.

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Mr. B Srinath and Mr. A J Rajasekhar's [2], aims to forecast precise traffic flow considering disruptions. It emphasizes informed decision-making for drivers and autonomous cars, urging the application of big data principles in transportation. Unhappy with existing approaches, they propose a solution using machine learning, genetic algorithms, soft computing, and deep learning. Image processing aids traffic sign detection for testing self-driving cars. Despite recognizing the importance of deep learning and genetic algorithms, the paper argues for their underrepresentation in the ML community. The proposed algorithm surpasses current precision and enhances dataset complexity.

Razib Hayat Khan, Jonayet Miah, S M Yasir Arafat, M M Mahbubul Syeed, and Duc M Ca [3], investigate the use of Graph Neural Networks (GNNs) in traffic forecasting, focusing on three architectures - Graph Convolutional Networks (GCNs), GraphSAGE, and Gated Graph Neural Networks (GGNNs). The study extensively examines each architecture's methodologies, layer configurations, and hyperparameters, with GGNNs proving most effective. Evaluation metrics like Root Mean Squared Error (RMSE) and Mean Absolute Error (MAE) highlight GGNNs' superior predictive performance. The study acknowledges result variability due to factors like dataset characteristics and graph structure. Currently, the authors are collecting traffic data from the Bangladesh Road and Transport Authority for analysis. The study concludes by emphasizing GGNNs' potential in accurate traffic forecasting, contributing to enhanced traffic management in intelligent transportation systems.

V. Geetha, C K Gomathy, T. Harshitha, and P. Vijay Nagendra Varma [4], integrates Intelligent Transportation Systems (ITS) to tackle traffic control issues. ITS, leveraging technology like sensors and communication methods, aims to enhance transportation efficiency, addressing congestion and safety concerns. The paper emphasizes the role of over speeding, introducing the Doppler Phenomenon for speed measurement. Keywords include Traffic Environment, Genetic Algorithm, Machine Learning, Big Data, and Image Processing. It outlines key ITS functions, focusing on data collection, processing, and decision-making systems, with an emphasis on Sensing Technologies, Wireless Communication, and Infrastructure and Vehicle Sensors. The study utilizes various technologies to improve technical capabilities and safety in transportation, underscoring their significance in addressing traffic challenges and enhancing overall efficiency.

Xiangyang Chen and Ruqing Chen [5], focus on predicting traffic flow challenges in smart cities. They emphasize the relevance of machine learning and new data sources for accurate evaluations. The study extensively examines existing traffic prediction methods, particularly in short-term forecasting, highlighting associated challenges. Emphasizing three key aspects—statistical analysis models, advanced AI technology adoption, and multi-traffic parameter cointegration theory—the paper anticipates a dynamic future in short-term traffic flow prediction. It acknowledges the significant role of big data-driven approaches in estimating traffic parameters from diverse sources, indicating a promising research direction.

III. METHODOLOGY

Proposed System

The proposed system the system starts with input from a video capturing device or a video from storage as a video feed to the algorithm. This video feed is then passed over to the graphical user interface to be displayed on the dashboard. Along with that, the video feed is also passed to the main algorithm of the system to select frames at certain intervals. The extracted frames can then be passed for image processing like scaling to the correct resolution and with correct colour formats.

This must be done in order to make all the input from each lane uniform before sending them into the neural network for the next task. Once the inputs are all in the same format, they can be passed to the object detection algorithm where with the help of Convolutional Neural Network (CNN) the vehicle types, counts and positions can be found out. This detection data can then be stored in a local database for any future use.

The vehicle counts are then converted to a magnitude of densities on each lane and passed over to the timing algorithm which will give the resultant timers to be set for the next lane to go with a green signal. All the data generated so far, like the vehicles' coordinates, their types, timers will be sent to the graphical user interface for monitoring on the dashboard. All the functions mentioned above will be explained more briefly in the upcoming section of this article.

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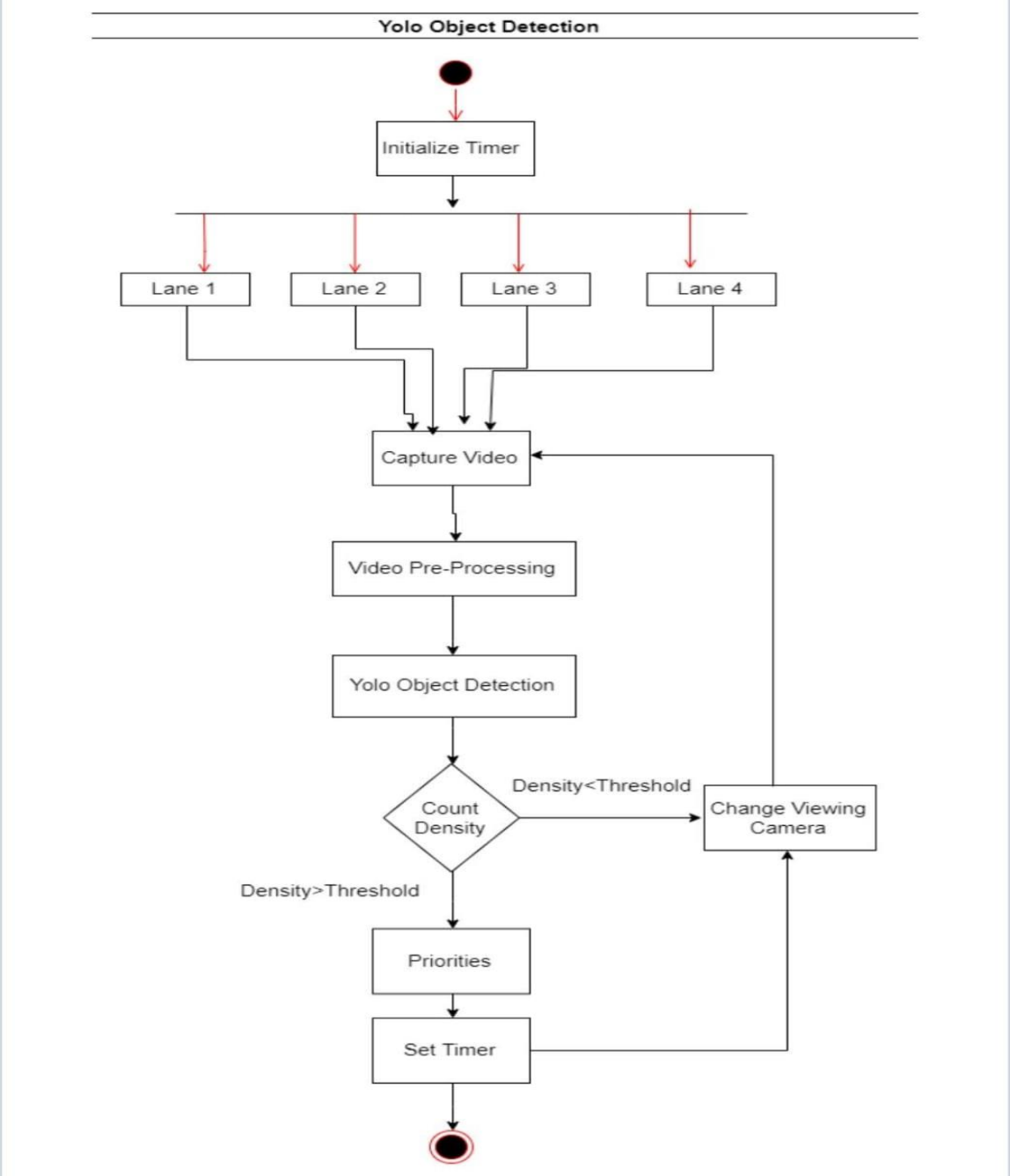

fig 1. Proposed System

IV. CONCLUSIONS

In conclusion, the proposed intelligent traffic management system, driven by AI and ML technologies, offers a transformative solution to urban congestion and road safety challenges. By integrating advanced features like convoy routing and real-time traffic prediction, it promises streamlined traffic flow, reduced congestion, and enhanced road safety.

With its adaptive control mechanisms and scalability, it addresses existing system limitations while paving the way for smarter, safer urban mobility. This innovative system represents a significant leap towards a more efficient, organized, and sustainable approach to traffic management, benefitting both authorities and road users alike.

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