AI Based Traffic Monitoring System Using Yolo And Opencv

1st Md.Khairozzaman
Department of CSE
Green University Of Bangladesh
Dhaka, Bangladesh
khairozzaman91@gmail.com

2nd Jannatul Ferdous
Department of CSE)
Green University Of Bangladesh
Dhaka, Bangladesh
khansheikhsaba@gmail.com

3rdMd. Momtaz Shahriar Faisal
Department of CSE)
Green University Of Bangladesh
Dhaka, Bangladesh
shahriarfaisal1998@gmail.com

***Abstract*—This document is a model and instructions for . AI-based traffic monitoring systems utilizing YOLO and OpenCV have been developed. This system aims to address the challenges posed by the ever-increasing vehicular population and the consequent traffic congestion. By employing the YOLOv3 algorithm, known for its speed and accuracy in real-time object detection, and OpenCV's image processing capabilities, the system can effectively track, identify, and classify vehicles. The integration of convolutional neural networks and other machine learning techniques has significantly improved the precision of vehicle detection and classification, facilitating real-time analysis of extensive data. The deployment of this technology promises to enhance driving safety, optimize traffic flow, and pave the way for autonomous driving advancements highlighting the transformative potential of this era. The system is designed to monitor traffic in detail, providing valuable insights for traffic management, safety analysis, and urban planning. The collected data can be used to generate real-time traffic flow maps, congestion predictions, and anomaly detection alerts. Moreover, the system offers the flexibility to adapt to diverse traffic scenarios, making it applicable for both urban and highway environments by facilitating precise automobile identification and classification, the device no longer simply promises to beautify riding protection but also seeks to optimize traffic float. Its deployment lays the foundation for advancements in self-sustaining driving, as the wealth of real-time facts generated contributes to the improvement of sensible transportation structures. This abstract encapsulates the gadget's competencies, emphasizing its position in mitigating site traffic challenges and propelling the evolution of smart and connected city mobility.**

***Index Terms*—Object detection, Vehicle tracking, Safety analysis, Convolutional Neural Networks (CNN), Anomaly detection, Smart transportation systems.**

I. INTRODUCTION

Road safety and traffic congestion are major issues in today's metropolitan surroundings. The utilization of YOLOv3 and OpenCV in an AI-driven traffic monitoring system offers a viable resolution to these problems."You Only Look Once version 3," or YOLOv3, is a cutting-edge, fast and accurate real-time object detection technology.The system demonstrates impressive effectiveness in detecting, tracking, and classifying automobiles on the road when used in conjunction with OpenCV, a powerful library for computer vision tasks.The architecture of the system is made to process traffic camera video streams and analyze the visual data using deep learning techniques.Vehicles are recognized in the video frames by the YOLOv3 algorithm, and OpenCV offers the resources for additional image processing and analysis.This integration makes it possible to continuously monitor vehicle counts, traffic flow, and the identification of infractions, all of which lead to better road safety and more intelligent traffic management.In addition to improving the management of vehicular traffic, the AI-based traffic monitoring system lays the groundwork for autonomous driving in the future.The system helps to design intelligent transportation systems that can adapt to changing road settings by accurately reading traffic circumstances. Please observe the conference page limits.

II. RELETED WORKS

Existing System

We found many of AI based traffic monitoring system bt we will discuss some of existing system's feature

A. Development of AI-Based Vehicle Detection and Tracking System for C-ITS Application.

To collect real-time data about the traffic environment, it makes use of a variety of data sources, including cameras and LiDAR. The system uses a deep learning model to recognize vehicles and image processing techniques to extract features. Vehicle movements are tracked over time using a tracking algorithm. Through communication with the C-ITS infrastructure [**?**] , the technology improves safety and traffic management. Metrics for assessing performance include tracking precision and detecting accuracy.The study concludes with a discussion of constraints and potential future enhancements.It highlights potential benefits for traffic flow, safety, and autonomous vehicles.[1]

B. Intelligent Traffic Monitoring System (ITMS) for Smart City Based on IoT Monitoring. Smart City, based on IoT monitoring

The technology that uses real-time monitoring to improve urban traffic management.It incorporates several sensors and devices to gather and analyze traffic data by utilizing Internet of Things technologies.As a result, the system can offer quick insights regarding accidents, traffic patterns, and congestion. By boosting total urban mobility, decreasing traffic, and increasing transportation efficiency, the ITMS [**?**] aids in the creation of Smart Cities. In the context of a smart city, the study probably discusses the architecture, data processing techniques, and effects of the ITMS on urban traffic dynamics.[2]

C. A vision-based real-time traffic flow monitoring system is being developed for road intersections.

The technology using visual data from cameras to track and evaluate traffic patterns in real-time at crossings.The system can identify and monitor vehicles, evaluate traffic density, and identify possible congestion using computer vision algorithms.VBRTN [**?**]Immediate insights into traffic dynamics are intended to help with traffic management and boost intersection efficiency overall.The architecture of the system, the computer vision techniques employed, and how real-time data might improve traffic control and optimization decisions at crossings are probably covered in this paper.[3]

D. An Acoustic traffic monitoring system: Design and implementation

How this system tracks and evaluates traffic conditions using sound sensors.The system can identify and monitor vehicles, evaluate traffic flow, and spot anomalies through the collection and processing of sound data .ATMSDI [**?**]The intention is to provide a substitute or enhancement to conventional vision-based systems, particularly in situations where eyesight is limited. The design of the system, the techniques for analyzing acoustic data, and the possible advantages of such a system for traffic monitoring applications are probably covered in the paper.[4]

E. The system enables real-time visual detection and tracking for traffic monitoring.

The technology that quickly recognises and tracks vehicles in real-time using visual data from cameras.It analyzes the video feed using computer vision algorithms, making it possible to identify and track traffic trends.RTVDTSTM [**?**] To support efficient traffic management, the system seeks to deliver real-time insights regarding traffic conditions.The architecture of the system, the computer vision techniques used, and the real-time capabilities for prompt decision-making in traffic monitoring applications are expected.[5]

III. PROPOSED METHODOLOGY

Our proposed traffic monitoring system captures real-time videos from CCTV cameras at railway crossings for real-time evaluation using object detection and processing. image. image. The system is provided for vehicle detection, vehicle tracking, vehicle type detection, and speed measurement algorithms. , YOLO integration, as shown in the picture. Find data to fully monitor traffic, the number of each type of vehicle such as cars, bicycles, buses, CNG, and trucks. Our proposed traffic monitoring system uses video input for a detailed analysis of traffic conditions. The process starts by gathering raw video footage from strategically placed cameras, followed by normalization to ensure consistent data quality. The Yolo object detection engine is then employed for real-time and accurate identification of various objects, including vehicles. Background and foreground extraction isolates moving vehicles, enhancing analysis. Training data refines the YOLO engine's accuracy, and traffic flow insights. Statistical data is collected and analyzed, providing valuable information for decision-making. The system outputs real-time vehicle detection, continuous tracking, and precise speed measurements, contributing to improved traffic management and road safety.

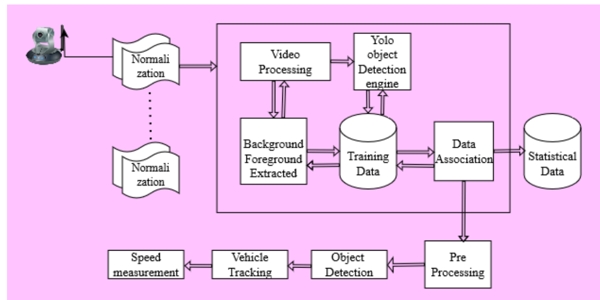

Fig. 1. Use Case Diagram Image

IV. TOOLS AND TECHNOLOGY

A. Overview

This chapter presents the proposed system design and architecture.This section clarifies the steps for planning and using the framework. The document impresses with its use of data flow diagrams, use case diagrams, and ER diagrams.Here the execution stage combines the necessities and plan stage yields and forms them utilizing the suitable technologies, strategies include a set of rules improvement for real-time information analysis, visitors waft monitoring, and anomaly detection, alongside alert technology.The structured database stores analyzed information and configuration settings. The design prioritizes adaptability to diverse visitor situations, scalability for smart cities, and capability of IoT integration.The final result is a sophisticated AI-based total traffic tracking system aiming to decorate protection, optimize site visitors go with the flow, and make a contribution to sensible transportation structures.

B. Implementation Requirements

After a thorough analysis of theoretical concepts and techniques, the traffic monitoring system sets out a set of requirements for this task. The following items will likely be required:

C. Hardware and software prerequisites

- Operating System (we used Windows)
- Hard Drive (16 GB)
- RAM (Minimum 16 GB Ram)
- Graphics Processing Unit (GPU)

D. Developing Tools

- Python Environment
- PyCharm IDE
- Google Collab

- Cameras.
- Monitor & Central processing unit (CPU).
- Hard Disk (Data Center)
- Data is collected from multiple cameras.
- Video streaming and recording.
- Computer Vision Algorithms (OpenCV)
- Object Detection Model (YOLOv3)
- Data Processing and Analysis

V. MOTIVATION

The AI-Based Traffic Monitoring System, utilizing YOLOv3 and OpenCV, is a project aimed at improving urban traffic management and optimizing vehicle flow. The system uses advanced computer vision techniques to accurately detect and track vehicles, pedestrians, and other objects in real-time, enabling traffic authorities to make informed decisions to improve traffic flow and reduce congestion. It can also detect potential traffic violations, such as reckless driving or red light running, and alert authorities in real-time, preventing accidents and ensuring safety for both drivers and pedestrians. The system also contributes to a more sustainable transportation system by optimizing traffic flow, reducing congestion, and reducing fuel consumption and emissions, ultimately promoting a greener environment.

The project presents a detailed analysis of the research issues amidst these challenging situations.

- Develop innovative image processing techniques to eliminate noise from video streams resulting from camera shake or inadequate lighting conditions.
- The project aims to develop and refine new object detection methods for identifying and distinguishing vehicles from incoming video images.

The study utilized YOLOv3 (You Only Look Once) to create an object detection model using specific training data. The vehicle's sensor output was used to track and link objects across consecutive frames, with Euclidean distance measuring similarity. All data related to vehicle type and trajectory was stored in JSON format for future use.

VI. SYSTEM GOAL

Our project goal is to improve traffic flow and safety The system can help improve traffic flow by accurately identifying, tracking and measuring vehicle speed, identifying congestion points and visualizing when an intervention to reduce congestion is required. Additionally, the system improves safety by monitoring vehicle speed, detecting hazards such as speeding, and alerting authorities to take the necessary measures to reduce the risk and ensure the safety of all road users.

VII. USE CASE DIAGRAM

Here is the use case diagram of our project which is graphically represent that how actors or uses interact with the system.

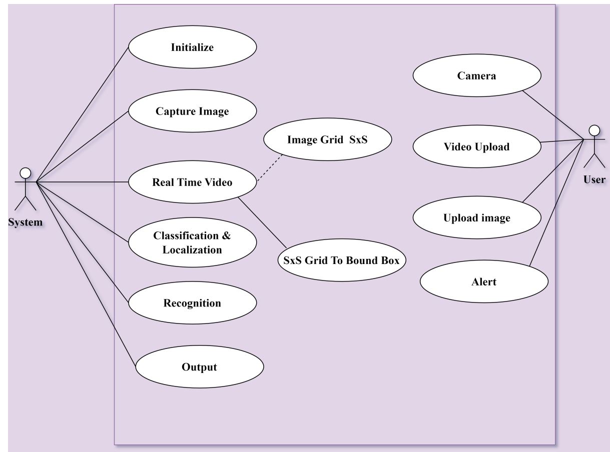

Fig. 2. Use Case Diagram Image

VIII. E-R DIAGRAM

Here is the Entity Relationship Diagram or E-R Diagram of our project which helps to represent relationship between entities

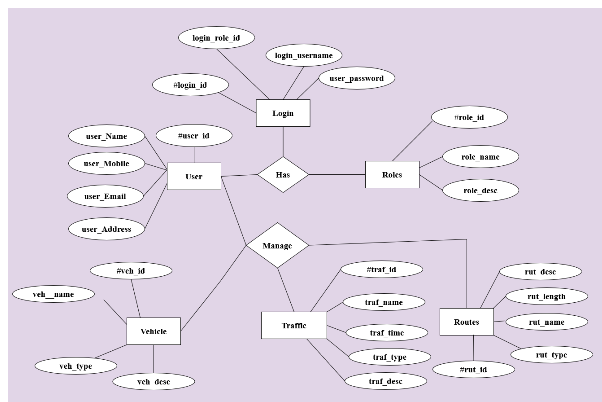

Fig. 3. ER Diagram Image

IX. PICTURES OF OUR PROJECT

Our system achieves real-time object detection by efficiently processing video streams to identify vehicles, not only pedestrians, cyclists,and other relevant objects powered by YoloV3 and openCV,allowing us to analyze dynamic traffic scenes with minimal latency.

X. FUTURE WORK

In the near future, we will try to recognize license plates in the traffic field. In the future, License Plate Recognition (LPR) will effectively identify license plates, collect tolls, monitor traffic, enforce laws, and support parking management. We can integrate Google Maps for more accurate future analysis; we can expand our data set; and we will also train our data set. Automatic Number Plate Recognition (ANPR) technology in traffic monitoring systems will play a pivotal role in future traffic monitoring, real-time flow analysis, incident detection,

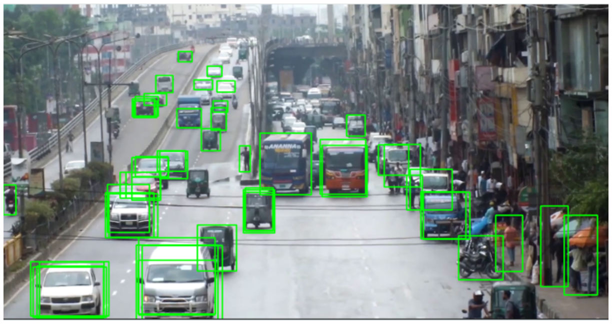

Fig. 4. ER Diagram Image

and ensuring efficiency and safety. We will work on developing challenging algorithms that involve advanced image processing, video processing, and adaptive algorithms that can indeed optimize the performance of AI-based traffic monitoring systems. Camera quality, AI algorithm accuracy, and traffic complexity play equally important roles in determining the overall effectiveness.

XI. CONCLUSION

Our primary focus has been on developing a versatile and practical solution- time for traffic management, specifically targeting object tracking, detection, and speed measurement. Our proposed method dynamically adjusts the timing of real-time traffic conditions, prioritizing directions with higher traffic volumes. This innovative approach not only addresses sociology-demographic challenges by reducing pollution and fuel conconsumption but also demonstrates significant improvements over existing methods. This project can benefit streamlined traffic control and help traffic management decisions-makers better understand the current traffic system and find better solutions. The intent-gratin of YOLOV3 and Open CV represents a cutting-edge solution for addressing various challenges in traffic management, with their real-time capabilities and accurate object detection contributing to improved road safety, traffic flow, and overall trans- importation efficiency

ACKNOWLEDGMENT

Our work on integrating YOLOv3 and OpenCV technologies has significantly advanced our understanding and capabilities in real-time traffic analysis and management. We also extend our appreciation to the authors of the referenced papers for their valuable insights and methodologies that have been instrumental in shaping our research and development efforts.

REFERENCES

[1] Sehyun Tak, Jong-Deok Lee, Jeongheon Song, and Sunghoon Kim. Development of ai-based vehicle detection and tracking system for c-its application. Journal of advanced transportation, 2021:1–15, 2021

[2] Arman Syah Putra and Harco Leslie Hendric Spits Warnars. Intelligent traffic mon- itoring system (itms) for smart city based on iot monitoring. In 2018 Indonesian Association for Pattern Recognition International Conference (INAPR), pages 161– 165. IEEE, 2018

[3] Y Na, Y Guo, Q Fu, and Y Yan. An acoustic traffic monitoring system: Design and implementation, 2015 ieee 12th intl conf on ubiquitous intelligence and com- puting and 2015 ieee 12th intl conf on autonomic and trusted computing and 2015 ieee 15th intl conf on scalable computing and communications and its associated workshops (uic-atc-scalcom), 2015.

[4] Mauro Fernandez-Sanjurjo, Brais Bosquet, Manuel Mucientes, and Victor M Brea. Real-time visual detection and tracking system for traffic monitoring. Engineering Applications of Artificial Intelligence, 85:410–420, 2019.