IARJSET ISSN (O) 2393-8021, ISSN (P) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Impact Factor 8.066 ⁒ Peer-reviewed & Refereed journal ⁒ Vol. 11, Issue 3, March 2024

DOI: 10.17148/IARJSET.2024.11334

Intelligent Traffic System for Urban Conditions Using Real-time Vehicle Tracking

B. Haritha[1], Ch. Venkata Yamuna[2], M. Alfa Chandrika[3], A. Chandi Priya[4]

M. Tech, Computer Science and Engineering, Bapatla Women's Engineering College, Bapatla, India[1]

B. tech, Computer Science and Engineering, Bapatla Women's Engineering College, Bapatla, India[2-4]

Abstract: Persistent congestions of varying intensities and durations within dense transportation networks provide the biggest obstacle to sustainable mobility. This type of congestion is beyond the scope of traditional Adaptive Traffic Signal Control. In order to enhance decision-making regarding traffic length estimates, deep learning-based algorithms have demonstrated their importance in predicting adjective outcomes. This work shows that depending on the length of the vehicle, DL models can effectively alleviate traffic congestion by only permitting traffic to pass through a signal.

Keywords: Traffic, Image Processing, YOLO, Deep Learning.

I. INTRODUCTION

Conventional techniques such as Adaptive Traffic Signal Control are not very effective at handling different levels of congestion. Deep learning models have the potential to help with congestion prediction by providing reliable predictions of traffic outcomes. Through the use of these models, this research seeks to transform traffic management by improving system collaboration, giving priority to efficient vehicle flow based on traffic length, and optimizing signal timing for more seamless traffic regulation in real-time settings. Preprocessing, feature engineering, model architecture design, training, validation, and data gathering are all included in this. Using the YOLO model, it detects the vehicles in the provided image and counts the number of vehicles.

II. BACKGROUND AND RELATED WORKS

Recent years have seen a substantial increase in interest in Intelligent Traffic Systems for Urban Conditions employing Real-Time Vehicle Tracking using deep learning because of its ability to segment images and detect objects. Below is a synopsis of relevant literature and background information in this area:

1. Background:

Urban regions have particular traffic problems because of their congested roads, constrained capacity, and intricate traffic patterns. Intelligent traffic systems (ITS) designed for urban environments have been developed to address these issues. These systems optimize traffic flow, improve safety, and lessen congestion in metropolitan areas by combining cutting-edge data analysis and decision-making algorithms with real-time vehicle tracking technologies.

2. Related Works:

- Deep Traffic: An influential study that examines the use of deep learning for traffic prediction is called Deep Traffic. Convolutional neural networks (CNNs) were used by researchers to simulate traffic flow patterns using historical traffic data gathered from road sensors. When compared to conventional techniques, the model performed better, accurately predicting traffic patterns and capturing complex spatial connections.

- Recurrent Neural Networks (RNNs) for Traffic Flow Prediction: A number of research have looked into the application of RNNs, particularly long short-term memory (LSTM) networks, for traffic flow prediction. RNNs are ideally suited for modeling time-series traffic data because they are excellent at capturing temporal dependencies in sequential data. RNN-based models are able to estimate traffic conditions with high accuracy by combining historical traffic flow data, weather information, and time of day data.

- Real-Time Traffic Prediction for Dynamic Routing: Applications involving dynamic routing in ITS require real-time traffic prediction. Dynamic route planning and adaptive traffic management based on real-time streaming data processing are made possible by deep learning models, such as online learning algorithms and recurrent neural networks with attention mechanisms.

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III. LITERATURE SURVEY

The Chun-Hsin Wu, Jan-Ming Ho, and D. T. Lee system is centered on the prediction of travel times using support vector regression. It is composed of One essential unit of measurement in transportation is travel time. Precise estimation of journey time is also essential for the creation of sophisticated traveler information systems and intelligent transportation systems. Using actual highway traffic data, we utilize support vector regression (SVR) for travel-time prediction and evaluate its performance against existing baseline travel-time prediction techniques. It is anticipated that support vector machines (SVR) will function effectively for time series analysis because of their increased capacity for generalization and ability to ensure global minima for given training data. Our findings demonstrate that the SVR predictor can greatly lower the relative mean errors and root-mean-squared errors of predicted journey times when compared to other baseline predictors. We show that SVR is applicable and works well for traffic data analysis, and we show that it is feasible to use in travel-time prediction.

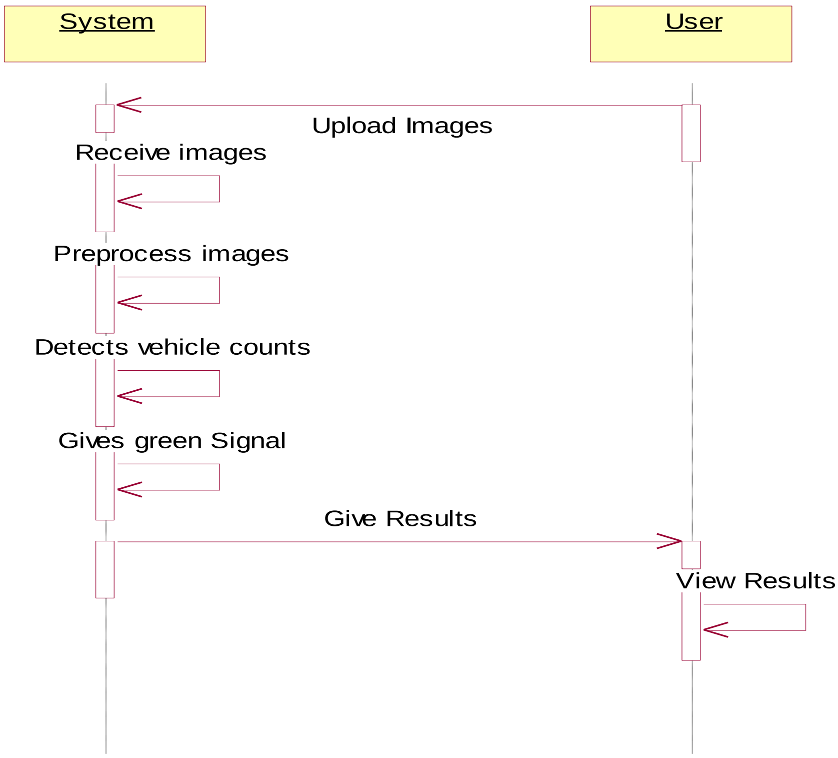
IV. METHODOLOGY

The system that is being proposed gathers images from the four lanes, processes them, and then releases the green signal to the highest vehicle count included image.

1. Data Acquisition: Gathering information from multiple sources, including sensors, traffic cameras, and satellite imaging, is the first stage. Images, videos, or sensor readings that capture the traffic scene may be included in this data.

2. Preprocessing: To maintain consistency across many sources and increase data quality, preprocessing techniques may include picture normalization, noise removal, and enhancement.

3. **Vehicle Detection**: Locating and identifying vehicles within a traffic scene is the process of vehicle detection. For this objective, deep learning-based object detection models like SSD (Single Shot MultiBox Detector), YOLO (You Only Look Once), and Faster R-CNN are frequently utilized. Annotated datasets with pictures of cars around them with labeled bounding boxes are used to train these models.



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RESULTS

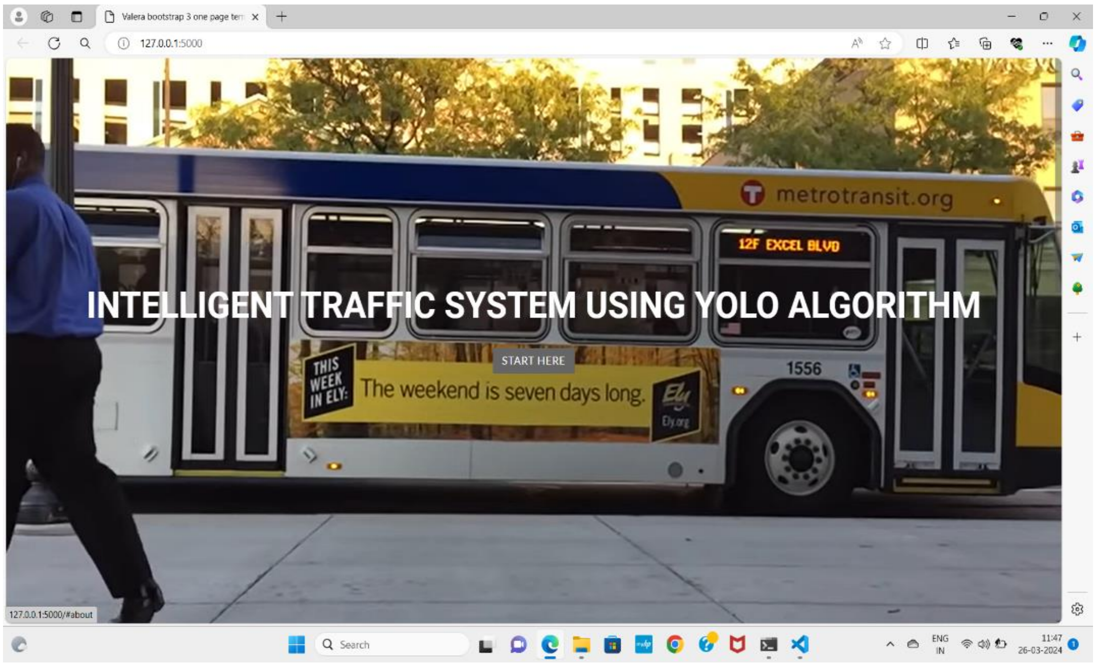

Fig: Home Screen

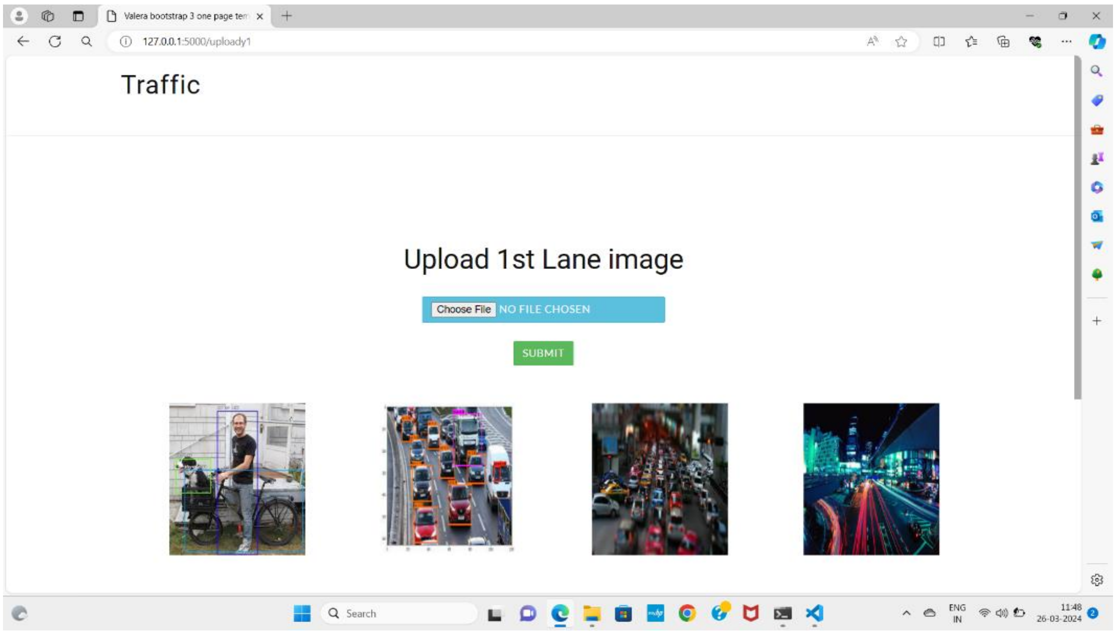

Fig: Uploading Lane Images

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Fig: Vehicle Detection

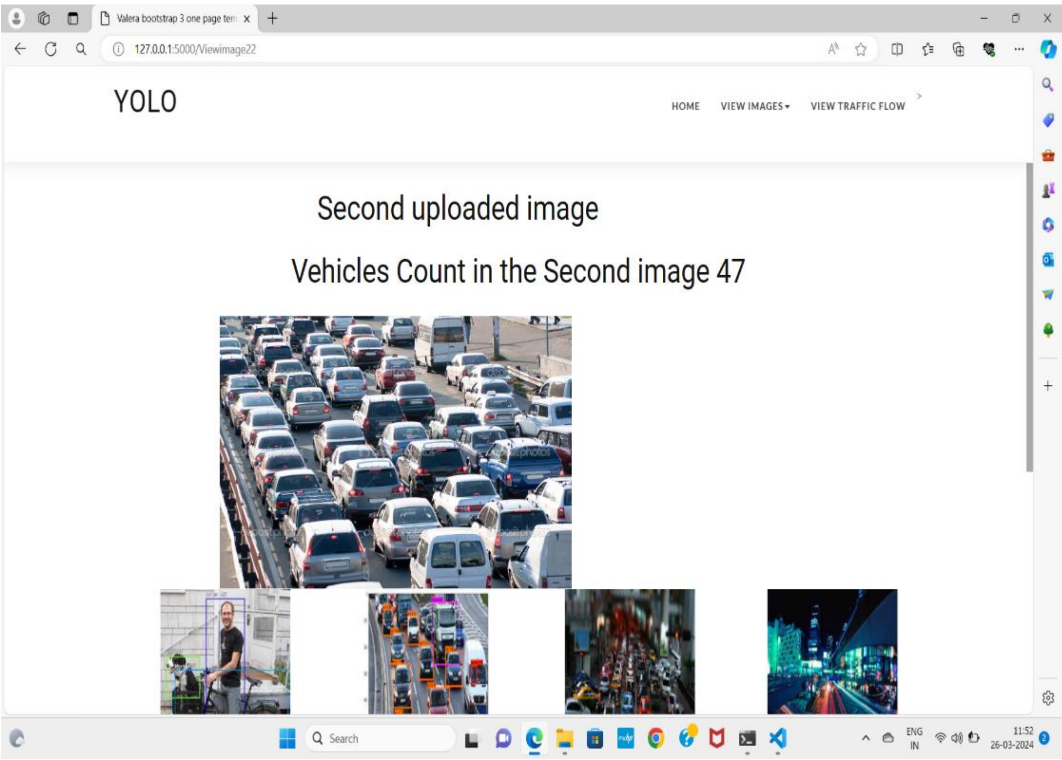

Fig: Highest vehicle count lane Image

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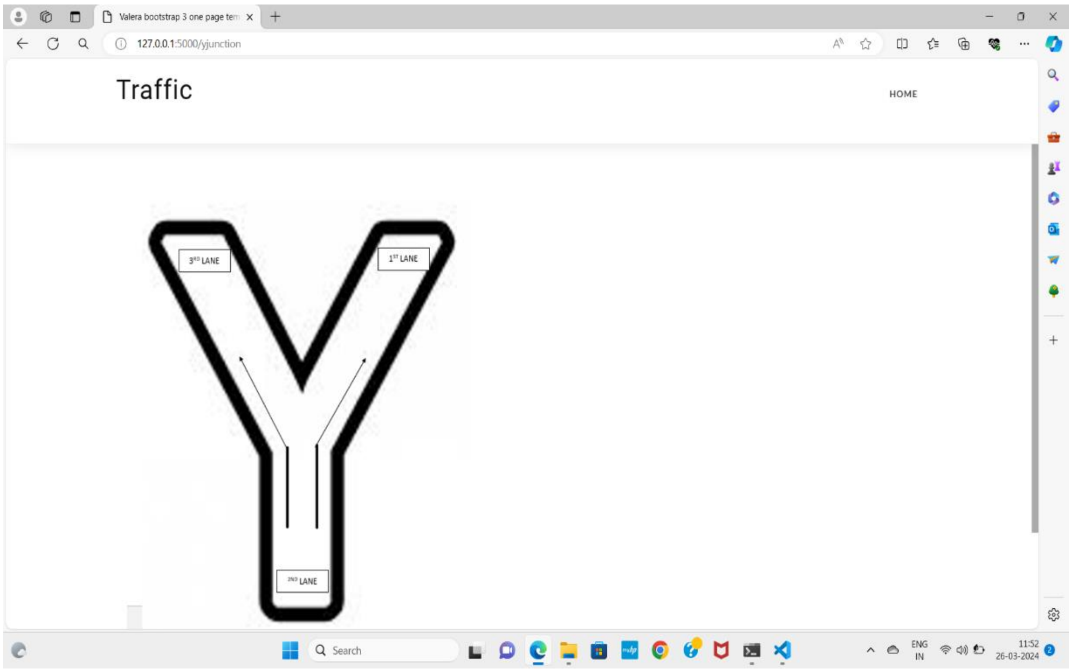

Fig: Releasing Green signal to highest vehicles count

CONCLUSION

We have successfully developed a system that manually regulates traffic signals in this application. This is created with Flask and Python programming in an approachable environment. In order to clear signals for the lanes with the greatest number of vehicles, the system is probably going to gather pictures from the user.

FUTURE SCOPE

In order to provide more complete predictive models, future improvements to the intelligent traffic system for urban circumstances utilizing deep learning may incorporate multi-modal data sources including weather, event schedules, and urban development plans. By using reinforcement learning techniques, the system may become more adaptive to changing traffic conditions and learn and improve traffic light regulation in real-time. Furthermore, investigating the combination of edge computing with deep learning may speed up local decision-making, enhancing responsiveness and general traffic flow control for more intelligent and effective transportation networks.

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BIOGRAPHIES

Bethapudi Haritha M. Tech, Asst. Professor,
Department of Computer Science & Engineering, BWEC, Andhra Pradesh,India.

Chirumalla Venkata Yamuna [B. Tech], Student,
Department of Computer Science & Engineering, BWEC, Andhra Pradesh, India.

Mallela Alfa Chandrika [B. Tech], Student,
Department of Computer Science & Engineering, BWEC, Andhra Pradesh, India.

Annam Chandi Priya, [B. Tech], Student, Department of Computer Science & Engineering, BWEC, Andhra Pradesh, India.