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TRAFFIC MANAGEMENT USING MACHINE LEARNING

Prof. Jadhav Supriya C[1]
Savitribai Phule Pune University, JSPM's JSCOE, Handewadi Road, Hadapsar, Pune-28, India

Sahil Dhumal[2]
Savitribai Phule Pune University, JSPM's JSCOE, Handewadi Road, Hadapsar, Pune-28, India

Swanand Hirve[3]
Savitribai Phule Pune University, JSPM's JSCOE, Handewadi Road, Hadapsar, Pune-28, India

Suraj Durande[4]
Savitribai Phule Pune University, JSPM's JSCOE, Handewadi Road, Hadapsar, Pune-28, India

Suraj Bhalekari[5]
Savitribai Phule Pune University, JSPM's JSCOE, Handewadi Road, Hadapsar, Pune-28, India

Abstract The project aims to create a new traffic signal system that uses density to dynamically adjust the timing of signals at an intersection. This system will automatically adapt to changes in traffic density at the junction in order to alleviate the problem of congestion which affects many cities and causes difficulties for commuters. Unlike traditional traffic signal systems, which use a fixed time allocation for each side of the junction, this system will adjust the timing based on the density of vehicles at the intersection. Using object detection, the system will process and simulate the traffic data, and then use this information to determine the number of vehicles present at the intersection. Based on this data, the system will adjust the signals for the side of the intersection with the highest density of vehicles.

Keywords: Traffic Management using ML, Traffic, Machine Learning, YOLO, image, object detection, vehicle, traffic signal systems, Classification, traffic solutions

I. Introduction

Our proposed system incorporates a feature that allows it to analyze official traffic news websites in real-time in order to capture and respond to traffic condition notifications quickly. By doing so, our system will be able to detect traffic-related events and alert users in a timely manner. Furthermore, we are researching ways to integrate our system into a more comprehensive traffic detection infrastructure. This infrastructure will consist of various advanced physical sensors and social sensors such as social media streams, to gather a wide range of data from different sources. Social sensors can provide a cost-effective and extensive coverage of the road network, especially in areas where traditional traffic sensors may be lacking.

The system employs image processing techniques such as pattern and object recognition for different applications. One such application is the detection of mobile targets in a specific environment. Vehicle detection on roads is an example of this, and it is used for traffic analysis, monitoring, and control. Therefore, an essential step in traffic controlling is the detection and classification of vehicles using traffic measuring techniques. Image processing-based techniques are among the most widely used methods for achieving this objective. Many algorithms have been proposed for vehicle detection and classification, such as image segmentation, edge detection, background extraction, and estimation techniques, which are used to isolate the vehicles of interest. Similarly, vehicle detection can also be achieved using vehicle shadows, however, this approach can be challenging when shadows from other objects like overhead bridges overlap with the shadows of vehicles.

Classification of vehicles based on their size or shape plays an important role in traffic management and flow control [5]. Regardless of the algorithm or technique employed, camera positioning and quality are critical factors in the success of vehicle detection. High altitude aerial cameras are an example of camera positioning that is often used for its wide area coverage.

II. Literature Survey

1.Paper Name: Deep Reinforcement Learning for Traffic Light Control in Vehicular Networks Author: Xiaoyuan Liang, Xusheng Du: Study how to decide the traffic signals' duration based on the collected data from different sensors and vehicular networks. We propose a deep reinforcement learning model to control the traffic light. In the model, we quantify the complex traffic scenario as states by collecting data and dividing the whole intersection into small grids. The timing changes of a traffic light are the actions, which are modeled as a high-dimension Markov decision process.

2.Paper Name: Multi-Traffic Scene Perception Based on Supervised Learning. Author: LISHENG JIN1, MEI CHEN 1, YUYING JIANG2, AND HAIPENG XIA1: In this system present vision driver assistance systems are designed to perform under good-natured weather conditions. Classification is a methodology to identify the type of optical characteristics for vision enhancement algorithms to make them more efficient.

3.Paper Name: MIndoor vs. outdoor scene classification in digital photographs Author:Andrew Payne, Sameer Singh: This paper proposes a new technique for the classification of indoor and outdoor images based on edge analysis. Our technique is based on analysing edge straightness in images. We make an original proposal that indoor images have a greater proportion of edges that are straight compared to outdoor images, and use multi-resolution estimates on edge straightness to improve our results

4. Paper Name: Intel Light: A Reinforcement Learning Approach for Intelligent Traffic Light Control Author: Hua Wei, Guanjie Zheng, Huaxiu Yao, Zhenhui Li: In this paper, we propose a more effective deep reinforcement learning model for traffic light control. We test our method on a large-scale real traffic dataset obtained from surveillance cameras. We also show some interesting case studies of policies learned from the real data.

5.Paper Name:Text Detection and Recognition on Traffic Panels from Street-Level Imagery Using Visual Appearance Author:Alvaro Gonz ´ alez, Luis M. Bergasa. ´ Description:- Traffic sign detection and recognition has been thoroughly studied for a long time. However, traffic panel detection and recognition still remains a challenge in computer vision due to its different types and the huge variability of the information depicted in them. This paper presents a method to detect traffic panels in street-level images and to recognize the information contained on them, as an application to intelligent transportation systems (ITS).

III. Methodology

1. System Features

A. System Feature 1

1. Utilize traffic signals to effectively manage the flow of traffic.
2. Adjust the traffic signals according to the number of vehicles and manage the flow of traffic.

B. Hardware Interfaces

1. The capability to access and interpret data from cameras
2. The capability to transmit and receive data over a network
3. A touch screen interface for ease of use
4. A keypad as an alternative input method in case the touch screen is not available
5. A consistent power supply
6. The ability to connect to a network
7. The capability to receive input from users
8. The ability to authenticate users.

C. Software Interface

1. The software interfaces are designed to be compatible with the specific applications or systems used by the target user.

1. patient data and protecting it from other nodes in the network. The network is protected from malicious or misbehaving nodes.
2. **Reliability**: The system should provide efficient and reliable search results every time, allowing the user to rely on the system for accurate and timely information.

IV. Algorithm Description

A. *The YOLO algorithm:*

This task is important in real-world scenarios, and it is widely used in fields such as Computer Vision. The YOLO V3 algorithm is a state-of-the-art object detection method that utilizes an end-to-end neural network to predict bounding boxes and class probabilities simultaneously.

Step-1: Import the required libraries.
Step-2: Create a function for filtering the boxes based on their probabilities and threshold *Convolutional neural networks*
Step-3: Define a function to calculate the IoU between two boxes
Step-4: Define a function for Non-Max Suppression.
Step-5: Create a random volume of shape (19,19,5,85) and then predict the bounding boxes.
Step-6: Finally, we will define a function which will take the outputs of a CNN as input and return the suppressed boxes:
Step-7: Use the yolo_eval function to make predictions for a random volume
Step-8: Use a pretrained YOLO algorithm on new images and see how it works
Step-9: Define a function to predict the bounding boxes and save the images with these bounding boxes included.
Step-10: Read an image and make predictions using the predict function
Step-11: Plot the predictions

B. *Convolutional neural networks*

Convolutional neural networks are a specialized type of artificial neural networks that use a mathematical operation called convolution in place of general matrix multiplication in at least one of their layers.[13] They are specifically designed to process pixel data and are used in image recognition and processing.

C. *Design and Implementation Constraints*

1. Develop a system for real-time traffic analysis and detection.
2. Adjust signal timing based on the arrival of vehicles.
3. Eliminate the need for manual adjustments during periods of heavy traffic.
4. Implement a system that automatically adjusts signal timing based on the number of vehicles on each lane.

- Use a zero before decimal points: "0.25", not ".25". Use "cm3", not "cc". (*bullet list*)

V. Proposed System

i. System Architecture

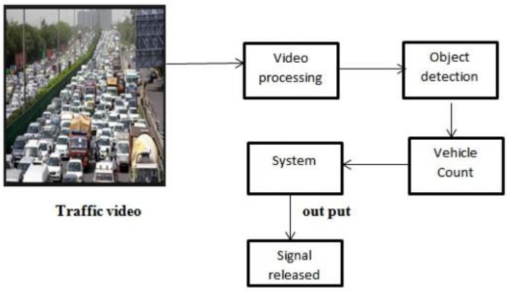

Fig. 1 System Architecture

The focus of this study is to create a customized Traffic Signal Management System. Fig.1 shows an overview of the architecture. This proposed system will be deployed as a Desktop application. The picture is recorded in real-time from a CCTV on Traffic Signal. First the video is taken from CCTV footage with live detections. Then the video is processed and object detection is done using CNN and Yolo Algorithm. The Yolo algorithm is used to extract object features from the CCTV video. The traffic signals updation countdown is done using the CNN algorithm and it is detected depending on the type of objects present (such as cars, buses, auto-rickshaw, trucks, bikes,etc).

According to the vehicles present in the video at a time it will detect and update the signal.

A. *Software Quality Attributes*

The system takes into account the following non-functional requirements to enhance its functionality and usability:

3. **Availability**: The system must be operational 24 hours a day.
4. **Usability**: The system is designed with ease of use in mind for developers and programmers, and includes detailed help for quick and efficient learning. Navigation of the system should be simple.
5. **Consistency**: The layout, screens, menus, colour scheme, and format should be consistent throughout the system.
6. **Performance**: The system should be fast and meet the user's requirements. It should provide expected outcomes quickly and with minimal resources, as efficiency is a priority. Speed is dependent on the response of the database and connection type.
7. **Extendibility**: The system should allow for future changes and upgrades.
8. **Reusability**: Files of any type can be used multiple times during transformation.
9. **Reliability**: Data must be protected from malicious attacks or unauthorized access.
10. **Security**: The system provides security to the randomly generated private key by encrypting

ii. SDLC

B. *The Waterfall model is a sequential software development process, where progress flows downward in a linear fashion through the following phases[5][6][7]:*

1.1. Requirement gathering and analysis: Identifying the necessary software and hardware requirements, database, and interfaces for the project.

1.2. System Design: Creating a user-friendly design for the system using UML diagrams and data flow diagrams to understand the system flow and module sequence.

1.3. Implementation: Developing and testing small units of the system, and integrating them into the final product.

1.4. Testing: Verifying that the project modules meet the expected outcomes and performance in assumed time.

1.5. Deployment: Releasing the product into the customer environment or market.

1.6. Maintenance: Fixing any issues that arise in the customer environment and releasing updates or new versions to enhance the product. Each phase must be completed and signed off before moving on to the next, hence the name "Waterfall Model." Phases do not overlap in this model.

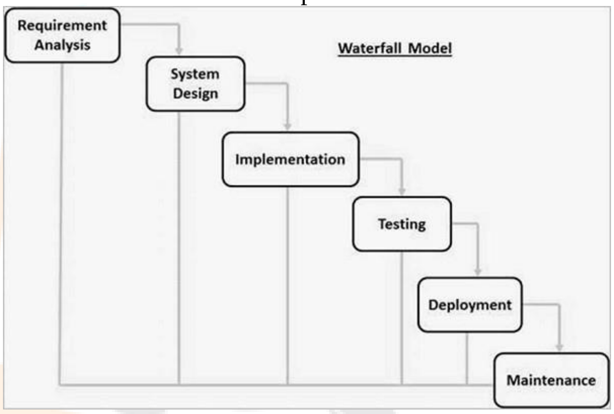

Fig. 2. Waterfall Model [5]

C. *TECHNICAL SPECIFICATION*

Advantages

1.1. Smart traffic management systems aid in identifying congested areas and, subsequently, alleviate traffic congestion.

1.2. Implementing such systems can also lead to decreased pollution levels and an increase in road safety.

Disadvantages

2.1. If deflection is not possible, the system may not be successful in slowing down traffic.

2.2. Implementing turning movements may cause an influx of traffic onto side roads.

Applications

3.1. Monitor and control a fleet of vehicles.

3.2. Obtain information on estimated arrival time.

VI. Expected Output

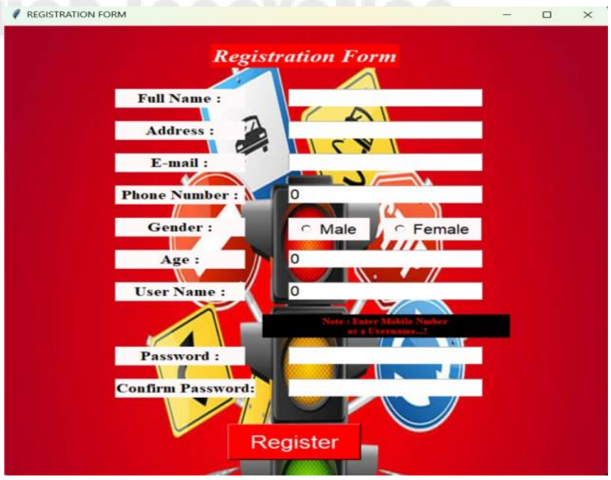

Fig. 3. Expected Output 1

The output using the python for traffic management is given in figure 3, 4, 5. This project first needs to take the registration from the user and then after that we have to login using this page after that the application for Traffic Management System will start, this program is executed in the Python language and it gives the implementation for machine learning using the YOLO algorithm.

Fig. 4. Expected Output 2

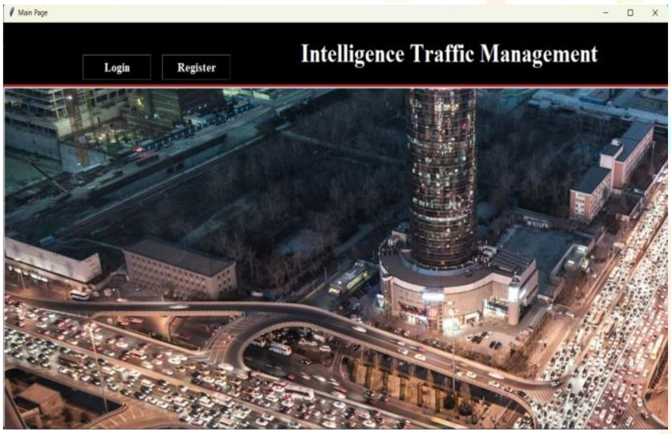

Fig. 5. Expected Output 3

This Program that runs on the Python Virtual Environment can be installed. The figure 8 shows the login and registration page after registering in the UI.

VII. Conclusion

Our system can be integrated with an application for analysing official traffic signals, allowing for real-time capture of traffic condition notifications. This means that our system can signal traffic-related events at the same time as they are displayed on the console of web sites. Additionally, we are exploring the possibility of integrating our system into a more comprehensive traffic detection infrastructure, which may include both advanced physical sensors and social sensors, such as social media streams. This can provide a low-cost, wide coverage of the road network, particularly in areas where traditional traffic sensors are not present.

VIII. Future Scope

Traffic management is an important aspect of logistics that involves the planning, control, and procurement of transportation services for moving vehicles and freight, such as airplanes, cars, trains, and ships.

IX. Acknowledgement

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X. Refernces

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