TRAFFIC PREDICTION FOR INTELLIGENT TRANSPORTATION SYSTEM USING MACHINE LEARNING

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***Abstract*—The traffic management system is considered one of the main dimensions of a smart city. With the rapid growth of population and urban mobility in metropolitan cities, traffic jams are often seen on the roads. In this project, an intelligent traffic management system using Yolo algorithm and machine learning process is proposed to deal with road traffic management problems and help authorities in proper planning. As a key part of machine learning, Adaptive Traffic Signal Control (ATSC) plays a key role in reducing traffic congestion by adapting to a real-time traffic control system. Additionally, these systems are integrated with machine learning and the yolo algorithm. Here, we propose machine learning with yolo algorithm for better vehicle tracking detection using training dataset. We used the yolo algorithm for better approaches using machine learning to manage the traffic crowd more effectively, which is an essential part of machine learning. Specifically, the yolo algorithm is the best method for machine learning and is easy to implement. The main objective of the objective is to avoid the traffic jam. The live detection of the camera will count the number of cars on the road, if we assume that the number of vehicles will increase and users can use another way to avoid traffic on the roads and can save their time, the data of this system is stored using machine learning is processed. This takes synthetic data about intersections using the yolo algorithm and for a real-world map with a real-world crowd that is received by an individual who can check what the state of the particular area of traffic they want to go.**

Keywords—Machine Learning, YOLO Algorithm, Vehicle Crowd Detection and Live Camera Surveillance.

I. INTRODUCTION

A city is a complex system that consists of many interdependent subsystems, with the transportation system being one of its important subsystems. The study says; is the cornerstone of the world economy. Moreover, it is also 7 as one of the main dimensions of a smart city. With the rapid growth of the world's population, the number of vehicles on the roads is consequently increasing, and the level of traffic congestion is also increasing in the same way Traffic jams are not only a waste of time but in some cases it is witnessed that many accidents occur in traffic areas and most of them occur in metropolitan cities. On the other hand, it not only has a bad impact on the ecosystem but also on the efficiency of industries. It is therefore established that active traffic management is a must. In most countries, traffic is controlled using fixed time signals, while in large cities of some developed countries, traffic is controlled by a centrally controlled system. The machine learning paradigm has been introduced into traffic management systems for vehicle control. To the best of our knowledge, it is found that until now the current traffic management systems are centralized. In addition, it focuses less on traffic flow fluctuations. Therefore, the proposed system controls traffic on local and

centralized servers using the concepts of the yolo algorithm. The representation of traffic data in statistical form can also be useful to authorities for real-time control and management of vehicle traffic.

II. OBJECTIVE

- Traffic management has its main goal to control the movement of vehicles as efficiently and safely as possible with machine learning using yolo algorithm.
- We can manage the traffic crowd and avoid road accidents by avoiding places where there is traffic denisity is high.
- The purpose of this project is to apply combined machine learning approach to provide an intelligent traffic signal control solution for multiple vehicle intersections.

III. LITERATURE REVIEW

Video surveillance and monitoring can be used for traffic control purposes. Surveillance cameras provide useful information such as traffic density and vehicle information to help build an intelligent transportation system. Manually monitoring and analyzing traffic is a tedious process. It is necessary to detect traffic density on roads, especially in metropolitan cities for traffic signal control and effective traffic control. Automated analysis of traffic surveillance videos eliminates the need for human intervention, which is not accurate. Existing vehicle detection systems include loop, radar, infrared and microwave sensors. These existing methods are expensive and also difficult to install and implement. Video processing techniques for vehicle detection are gaining importance in the transportation system. [1] Computer vision techniques have been used in various public sectors such as roads and other public transport systems. The task of analyzing traffic videos for useful insights is one of the main applications of computer vision. It can be used in traffic management systems to effectively manage peak traffic and make appropriate decisions. [2] Vehicle or traffic density is calculated. This data can be crucial in many surveys and plays a key role in the management of car traffic. This is one of the best modern methods that the country is trying to implement in the transportation system. [3] We will discuss unique vehicle identification and tracking in a selected area of interest with the most accurate results. Vehicle detection and counting plays an important part in many systems that help manage and manage traffic in cities. The main goal is to detect and count cars with maximum accuracy and be able to do so on roads, highways and in small lanes, etc. Our method uses foreground objects to detect cars, e.g. haar cascades, which receives input as a video or image and processes it as, to provide the exact number of vehicles visible on it. [4] In modern life, we have to face many problems, one of them is traffic jams, which are becoming more dangerous day by day. As a result of increasing vehicle traffic, many problems have arisen, such as traffic accidents, traffic jams, etc. There are many ways we can track, identify a car on the road, for example, by installing specific ID tags on them, using Image Processing, detecting their movement etc. [5].

IV. EXISTING SYSTEM

[1] Since the system is centralized, it may slow down due to network issues.The algorithm was used to set the red light time span for a specific lane of the intersection, which is determined by the traffic density on the road, which is the result of a complex of vehicle detections.

[2] It should always use complex methods and also has a lot of hardware devices combined with it.Many sensor devices are used in the implementation of this process, although the number of vehicles still cannot be correctly detected by the number of sensors, this is due to the incorrect detection of the vehicle sensors, even if the vehicles are far away, they cannot detect the exact number of vehicles.

[3] Their only availability of using hardware with software that requires a large number of hardware devices and cost results in a huge amount, sometimes due to sensor malfunction the vehicle detection will not be correct.

A. Disadvantages

1. An algorithm is used which is very complex and not easy to use because this algorithm takes a lot of time to show the output.
2. Unreliable use and implementation costs of this process will require high costs.

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V. THE PROPOSED SYSTEM

1.Camera surveillance that will record live video detection for vehicle detection, through the segmentation process, all vehicle edges will be in the market for a better vehicle for detection.

2.After the segmentation process is completed, a Gaussian filter is run for image clarity, this method is implemented for accurate vehicle identification.

3.The number of vehicles on a particular road will be detected by the camera which is done by machine learning.

4. The dataset is trained for the yolo algorithm to detect the number of vehicles in traffic. If the number of vehicles increases, the application will send a notification system to the user.

5. To avoid traffic on the roads and can use roads that are free of traffic. Here we implement machine learning with yolo algorithm to make machine learning the best.

6. Through this project we can save a lot of time just by checking whether the roads are clean or not. If the paths are not clear, we can use another path.

A.Advantages

1. Training a dataset using the yolo algorithm will not be too complex when training a dataset of changes.
2. The algorithm will be easy to understand and easy to implement.

VI. ARCHITECTURE DESIGN

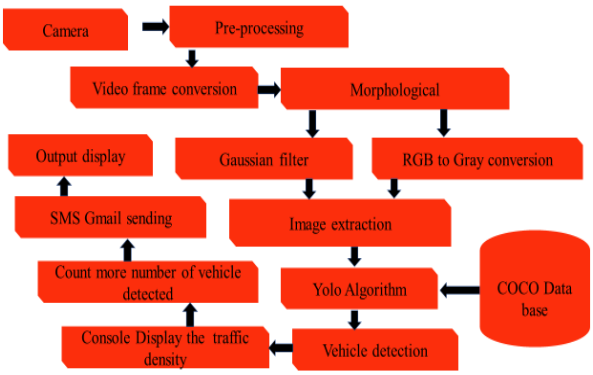

Fig .1. Architecture design

VII. MODULE

There are 5 modules

- Input module
- Conversion module
- Database module
- Vehicle detection module
- Warning module

Input module: A live video camera will convert 25 frames per second to one frame per second to extract a clean image for image pre-processing. In image preprocessing, some feature in the images will be enhanced for clarity, then bounding a set of image processing operations that process images based on shapes to produce an image of the same size.

•*Conversion module:* When extracting the same image size, errors in the image will be removed using a Gaussian filter. This filter will reduce the noise and blur area in the image. The image will be converted from RGB to gray level conversion. This conversion eliminates the complexity of the calculation and also simplifies the algorithm. This gray conversion to suppress information about the intensity of each light pixel. This makes the algorithm easier to understand. Finally, a pre-image is extracted in a much better quality.

•*Database module:* The database is trained for vehicle detection in the transport system. We train the database to understand it, to identify and understand the shape and structure of the vehicle. This database can understand what the vehicle looks like. The trained database is implemented using the yolo algorithm. The Yolo algorithm is implemented with a trained database for detecting vehicles in a traffic crowd. The Yolo algorithm is used here to quickly identify a large number of vehicles in a traffic crowd. This yolo algorithm will classify all vehicle features for accurate vehicle detection.

•*Vehicle detection module:* In this module the vehicle is identified in the contour mapping, in this application the traffic density is also

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identified with the number of vehicles in traffic which is displayed in the console window. This module identifies the number of vehicles in traffic using the yolo algorithm.

•*Alert module:* After detecting the number of vehicles in the transport system, an email will be sent to the user via the SMTP protocol about the number of vehicles in traffic. When the user knows the current traffic status, he can change his way if more traffic is detected.

VIII. SYSTEM FUNCTION

1. Image Preprocessing

Introduction to Image Segmentation The purpose of image segmentation is to divide an image into meaningful regions with a specific application in mind. Segmentation is based on measurements taken from the image and can be gray level, color, texture, depth or motion. Image segmentation is the task of dividing the image based on the objects present and their semantic importance. This makes it much easier to analyze a given image because instead of getting the approximate location from a rectangular box. Another important topic in computer vision is image segmentation. They identified proximity, similarity, common fate, common area, parallelism, symmetry, continuity, and closure as factors that make people group certain visual elements together. Image segmentation is a method in which a digital image is divided into different subgroups called image segments, which helps to reduce the complexity of the image and simplify further image processing or Analysis.

Fig no.2. Image preprocessing

2.Morphological Operation

Morphological transformation is a technique that is based on the shape of the image. Usually applied to a digital image. Two important morphological operations are erosion and dilation. Operation with these methods helps data analysis for future visualization of potholes in a specific area.

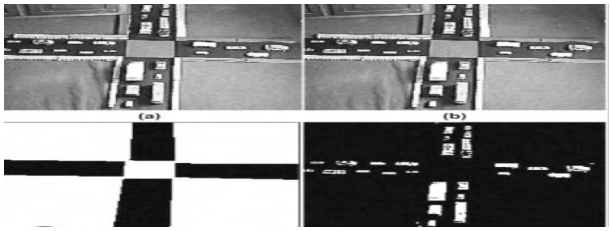

Fig no.*3.* Morphological Transformation

The image taken from the camera is smoothed using Gaussian blur and using a certain threshold. Basic morphological operations such as opening and closing transformations are used to remove noise from the image. The desired area is then extracted. Edge detection methodology is used to detect potholes from the image.

3. *YOLO Algorithm*

YOLO is an algorithm that used neural networks to provide real-time object detection. This algorithm the popular for speed and accuracy. It has been used various applications to detected traffic signals, people, parking meters and animals. This article introduces the reader to the YOLO object detection algorithm and explains how it works. It also highlights some of its real-life applications.. Object detection consists of different approaches such as fast R-CNN, Retina-Net and Single-Shot MultiBox Detector (SSD). Although these approaches have solved the data limitation and modeling problems in object detection, they are unable to detect objects in a single run of the algorithm. The YOLO algorithm has gained popularity due to its superior performance over the above object detection techniques.YOLO stands for 'You Only Look Once'. It is an algorithm that detects and recognizes different objects in an image (in real time). Object detection in YOLO is performs as a regression problem and provides that class probabilities of the detected images.

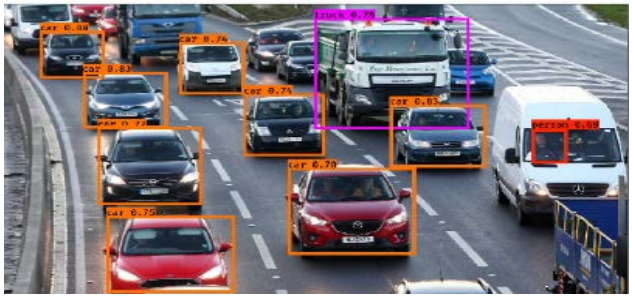

Fig no*.4.* YOLO Frame work detection

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4.Database Management

Database management systems (DBMS) are software systems used to store, retrieve, and query data. A DBMS serves as the interface between the end user and the database and allows users to create, read, update, and delete data in the database.A DBMS manages incoming data, organizes it, and provides ways for users or other programs to modify or extract the data.

- Hierarchical database systems.
- Network database systems.
- Object-oriented database systems.

A database management system (DBMS) is a software tool that allows users to easily manage a database. It allows used to access and interact with the underlying data in the database. These actions can be range from simply querying data to defined database schemas that fundamentally affect structure of the database.

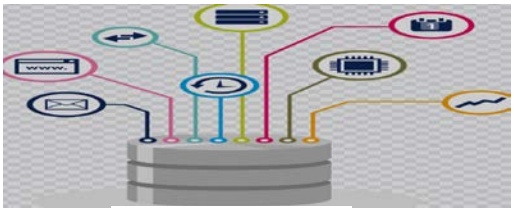

Fig no.*5.* Database

5. Gaussion Filter

In electronics and signal processing, a Gaussian filter is a filter whose impulse response is a Gaussian function (or an approximation of it, since a true Gaussian would have an infinite impulse response). It is considered an ideal filter in the time domain, just as sinc is an ideal filter in the frequency domain. Applying a Gaussian Blur filter before edge detection aims to reduce the noise level in the image, which improves the result of the following edge detection algorithm. This approach is commonly referred to as Laplacian or Gaussian filtering or LoG filtering.

A Gaussian filter is much better at separating frequencies. The best filter for this task is the Windowed Sinc filter. Gaussian filters weight pixels as a bell curve around the center pixel. This means that more distant pixels have less weight.The Gaussian filter is a spatial filter that works on the principle of convolution of the input image with a kernel. This process performs a weighted average of the current pixel's neighborhood in such a way that distant pixels receive lower ones.

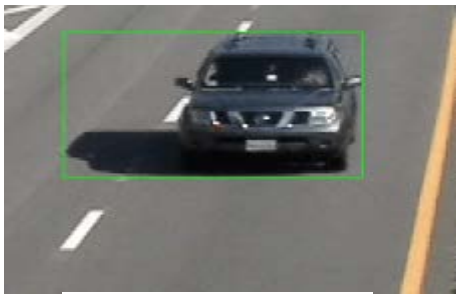

Fig no.*6.* Gaussian filter

6. Video Frame Conversion

A frame is one image in a sequence of images generally, one second of video consists of 24 or 30 frames per second, also known as FPS.A frame is a combination of image and image time when the view is exposed. The animation consists of an excerpt from the frames in a row. Frames are inserted into the view as they are re-evaluated by other frames. All images are presented on the display for a certain time, we can consider animations as images that are to be displayed in a short interval for a certain time in a row.

A frame context is an image that has pixels on the screen to be displayed. One monolithic function in the animation engine can create pixels from each frame. The film projector works as a monolithic one and transports all the frames for the required frames. Connect all images into one space to create a single animation.

7. RGB to GRAY Conversion

The RGB color model is an additive color model in which the red, green, and blue primary colors of light are added in different ways to reproduce a wide range of colors. The name of the model comes from the initials of three colors, red, green and blue. The main purpose of the RGB color model is to capture, represent and display images in electronic systems such as televisions and computers, although it is also used in conventional photography. Before the electronic age, the RGB color model had a solid theory behind it based on human color perception. RGB is a device-dependent color model: different devices detect or reproduce a given RGB value differently, because the color elements (such as phosphors or dyes) and their response to individual levels of red, green, and blue differ

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between manufacturers, or even within the same devices vary over time. So an RGB value does not define the same color between devices without some kind of color management.

Fig no.*7.* RGB to GRAY level conversion

8. SMTP Protocol

E-mail is becoming one of the most valuable services on the Internet today. Most Internet systems use SMTP as a method of transferring mail from one user to another. SMTP is a push protocol and is used to send mail, while POP (Postal Protocol) or IMAP (Internet Message Access Protocol) is used to retrieve these messages at the recipient's end.

A. SMTP BASICS:

SMTP is an application layer protocol. A client that wants to send mail opens a TCP connection to an SMTP server and then sends mail over that connection. The SMTP server always in the listening mode. When the SMTP process listens for the TCP connection from any client, it initiates a connection on this port (25). After successfully establishing a TCP connection, the client process immediately sends the mail.

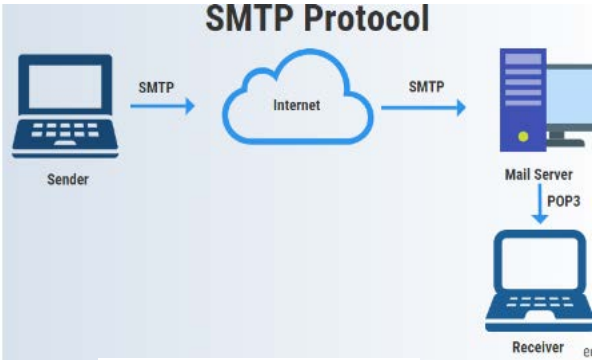

Fig no.*8.* SMPT protocol

B. *Working of SMTP*

Composition of Mail: A user sends an e-mail by composing an electronic mail message using a Mail User Agent (MUA). Mail User Agent is a program which is used to send and receive mail. The message contains two parts: body and header. The body is the main part of the message while the header includes information such as the sender and recipient address. The header also includes descriptive information such as the subject of the message. In this case, the message body is like a letter and header is like an envelope that contains the recipient's address.

Submission of Mail: After composing an email, the mail client then submits the completed e-mail to the SMTP server by using SMTP on TCP port 25.

Delivery of Mail: E-mail addresses contain two parts: username of the recipient and domain name. If the domain name of the recipient's email address is different from the sender's domain name, then MSA will send the mail to the Mail Transfer Agent (MTA). To relay the email, the MTA will find the target domain. It checks the MX record from Domain Name System to obtain the target domain. The MX record contains the domain name and IP address of the recipient's domain. Once the record is located, MTA connects to the exchange server to relay the message.

Receipt and Processing of Mail: Once the incoming message is received, the exchange server delivers it to the incoming server (Mail Delivery Agent) which stores the e-mail where it waits for the user to retrieve it.

Access and Retrieval of Mail: The stored email in MDA can be retrieved by using MUA (Mail User Agent). MUA can be accessed by using login and password.

XI .RESULTS

A. Evaluation of Vehicle Detection Module

The vehicle detection module was tested with a variety of test images containing varying amounts of vehicles, and the accuracy of detection was found to be in the range of 75-80%. Some test results are shown above in Fig. 3. This is satisfactory, but not optimum. The primary reason for low accuracy is the lack of a proper dataset. To improve upon this, real-life footage from traffic cameras can be used to train the model, so that accuracy of the system can be improved.

B. Evaluation of the proposed adaptive system

To measure how the proposed adaptive system compares to the existing static system, 15 simulations of both the systems were run for a period of 5 minutes each, with varying traffic distributions across the 4 directions. Performance was measured in terms of the number of vehicles that were able to pass the intersection per unit of time. In other words, the

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idle time of the signal i.e. the time when the signal is green but no car passes the intersection is compared. This has an impact on the waiting time of vehicles and queue lengths of the other signals. The distribution [a,b,c,d] means that the probability of vehicle being in lane 1, lane 2, lane 3, and lane 4 is a/d, (ba)/d, (c-b)/d, and (d-c)/d, respectively. For example, in simulation 1, the distribution is [300,600,800,1000] which means probabilities of 0.3, 0.3, 0.2, and 0.2. The results obtained were tabulated in the form of number of vehicles passed lane-wise.

XII. CONCLUSION

In this project, the design and development of a vehicle detection classification system will be a challenging task in this field. The system designates the object as specific to the vehicle. The YOLO algorithm is used to identify an object as a vehicle and count the number of passing vehicles on a particular road using traffic videos as input. The detection rate of this system is affected by the value of the scale factor, with a different value of the scale factor giving different detection rates. When obtaining a high detection rate, the scale factor value providing the best classifier performance should be determined. In the future, it provides agile and robust.

XIII. FUTURE SCOPE

The project can be further expanded to include the following functionalities to enhance traffic management and bring down congestion:

1) Identification of vehicles violating traffic rules: The vehicles running red lights can be identified in an image or a video stream by defining a violation line and capturing the number plate of the image if that line is crossed when the signal is red. Lane changing can also be identified similarly. These can be achieved by background subtraction or image processing techniques.

2) Accident or breakdown detection: Intersections also tend to experience severe crashes due to the fact that several types of injurious crashes, such as angle and left-turn collisions, commonly occur there. Therefore, accurate and prompt detection of accidents at intersections offers tremendous benefits of saving properties and lives and minimizing congestion and delay. This can be achieved by identifying the vehicles that remain stationary for a long time in an inappropriate position such as in the middle of the road, so that parked vehicles are not included in this.

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