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INTELLIGENT TRAFFIC MONITORING SYSTEM USING MACHINE LEARNING

[1]Dr.Sateesh Nagavarapu, [2]Dr.K.R.N.Kiran Kumar,[3]N. Pavan,
[4]girija Prasad Dondapati,[3]deepareddy Madireddy
[1]Associate Professor, [2]Professor,[3]Assistant Professor,[4,5] Student
[1,2,3,4,5] Computer Science & Engineering
[1,2,3,4,5] Malla Reddy Institute of Technology, Maisammaguda, Hyderabad-500100

Abstract

Almost one of significant challenges in metropolitan cities is traffic, which has complete people's lives incredibly hard. Obviously, this leads to non-productive behaviour. It will make drivers and passengers more stressed and frustrated. The major effect of a holdup is unsafe driving, which may result in traffic accidents and casualties. Traffic bottlenecks can also be detrimental to one's mental health. The Python-based Traffic Observation System's goal is to manage routes, vehicles, traffic, diversion, and traffic laws. It keeps track of all information about routes, lengths, and traffic laws. Because the system is entirely based on image processing, only the administrator has access to it. The system's goal is to reduce manual labour in route, vehicle, length, and traffic management. It keeps track of all the fine print pertaining to traffic, diversion, and traffic laws. The major motivation is to control traffic congestion and anticipate routes in- order to build a smooth and cost-effective transportation system.

***Keywords**:*TMS, Image processing Feature Extraction**.**

I.INTRODUCTION

Image processing on a laptop computer refers to the machine-driven approach of manipulating, analysing, and interpreting photographs using algorithms and codes. Image processing is currently effectively employed in a variety of applications, including photography, remote sensing, robotics, medical diagnostics, and so on. Many image processing algorithms must be used or developed in order to process the photographs we submit to social media sites such as snap chat, whatsapp and Twitter, which we have gotten accustomed to utilising in our regular lifestyle and where we upload hundreds of photos regularly. Folks employ several Python libraries to perform conventional image processing, beginning with the extraction of image data and transforming it with methodologies using libraries and frameworks to per-process, improve, re-establish, portray (with descriptors), section, categorise, and identify and identify (objects) in order to more effectively analyse, comprehend, and interpret the data[1]. Several Python libraries are available for deep learning-based image processing, which has gained popularity recently [5]. Areas related to health and biology, such as X-rays and CT scans, object identification, fingerprint authentication, face recognition, and soon are all examples of image processing applications [6].

With the support of real-time traffic cam feed, this system is equipped with image processing and real-time automation algorithms that can monitor any moving item. Object classification and training are very important for object detection accuracy. Congestion control and traffic management are two unique features of the system that help to minimise overcrowding on the roadways.

II.STUDY OF LITERATURE

Static-image-based vehicle detection & type recognition is immediately useful for a wide range of traffic surveillance system tasks. The method of automatic vehicle detection & recognition would be presented in this study. To start, we apply Haar-like features & Adaboost techniques for features extraction & classification construction to find the car in the input image. This picture is subjected to external interference, as the vehicle's positioning was randomly determined, prompting the employment of the Gabor wavelet transform as well as a local binary pattern operators to extract characteristics at many scales & so in different directions. At last, the image is segmented into smaller areas, from which histogram sequence were retrieved & emphasised to depict the vehicle's attributes. A low-dimensional solution is found using principal component analysis-PCA.

IOT is a technology that connects billions of real-world & digital things, each of which has a unique identifier, to the internet. This is altering the world. This integration results in the generation of enormous volumes of data, which, with the storage and data analysis tools that are available now, might not be manageable. Even while cloud computing provides services that can help address this problem at an infrastructure level, The effectiveness of it for time-sensitive applications like fuel ,gas monitoring and vehicle tracking is still up for dispute. It is possible that sending enormous amounts of data to the cloud in order to store & process them could result in the clouds becoming overloaded as well as the networks capacity becoming saturated.

Cloud computing architecture and integrated fog computing are presented in our research to address the restrictions of real-time analysis, network congestion, & latency that are associated with utilising fundamental clouds service for traffic surveillance. The sample of an intelligent traffic monitoring system was developed using the method that was described (STMS). The suggested monitoring system is intended for use in the maintenance of traffic lights as well as the monitoring of congestion. It is also capable of identifying situations in the flow of traffic which call for rapid help even when there is congestion. With the help of globally disparate detectors, a very small processor on a component acts as a fog node in this architecture, collecting real-time data. This information is then sent to the cloud for storing and analysing. The findings demonstrate that the fog network is effective in enhancing the functionality of the clouds platforms by lowering the response time & boosting the bandwidth. These improvements were brought as an outcome of using the fog network. In addition, the proposed integrated fog & clouds architecture has an interface with Tweeter, which allows it to deliver notifications regarding traffic congestion in the form of Tweet message to people who have registered to receive them.

The goal of this section is to analyse different issues that arise in the manufacture of new intelligent traffic data physical fusion networks, including clouds-based control systems approach, fresh intelligent traffic organize set of connections as the analysis item, & the physical design of the intelligent travel data fusion clouds con. These issues include weak real-time scheduling & control ability, complex object types, large amounts of data gathering, high demand for transmission & calculation, & high demand for transmission & calculation. Additionally, this article will also discuss complex object types. The plan calls for the utilisation of intelligent transportation networks virtualisation technologies in addition to smart transportation edge control technologies.

The central clouds control managerial server uses deep learning-DL and overrun learning machine intelligence analysis approach, including the forecast of traffic flow information for training, to predict urban road short-term traffic flow & congestion based on intelligent traffic flow data. This allows the server to forecast urban road short-term traffic flow as well as congestion. The simulated findings demonstrate that the proposed method is successful by making use of an intelligent optimization planning algorithms for real-time traffic flow control strategies. This is accomplished at the higher reaches of the atmosphere.

The fast expanding vehicle counts was an essential measure that is crucial for determining the cost-effective expansion of any nation. An increase in the number of vehicles has the consequence of making the traffic more congested. It leads to the waste of both energy & time, not to mention the contamination of the atmosphere. Due to their predetermined intervals for switching from a red phase to a green phase, conventional traffic signals put in municipalities appear to be insufficient to meet the requirements of an expanding municipality. Conventional traffic signals must be utilized to handle the demands of a growing metropolis. In spite of the efforts being made to mitigate & lessen the impact of the big problem, the majority of cities continue to struggle with it. In recent times, it has been evident that one of the key issues for engineers, planners, as well as politicians not only in all metropolitan settings, but worldwide it is traffic congestion. This issue is not unique to the United States.

In this approach, using the assistance of A Intelligent Transportation Systems-A-ITS, numerous attempts have been done to automate the traffic signals in accordance with the volume of the vehicles on the roadway. Certain academics have proposed the utilisation of a variety of different kinds of methods & computerised sensor framework to investigate traffic density & to address the problem of congestion in a manner that is appropriate to the nature of the traffic. Throughout this study, many sensor frameworks are discussed, as well as the article analyses the benefits & drawbacks of each framework in terms of cost, dependability, accuracy, efficiency, & maintenance overhead.

Road traffic accidents are 1 of the top cause of deaths & injuries around the world. These accidents not only results in the loss of valuable human life yet also have an effect on the resource that are available in economies around the world. Based on the World Health Organization-WHO road accidents were responsible for the deaths of more than 1.35 million people as well as the injuries of more than 50 million people every year around the globe. Moreover, as comparing to other developed countries with the similar proportion of people who own vehicles, the number of fatalities & accidents in Saudi Arabia is far greater. Road accidents are responsible for the deaths of between 7000 & 9000 individuals as well as the injury of over 39,000 others each year.

At the very minimum, one mishap takes place every minute in the Kingdom of Saudi Arabia. New laws, restrictions, & severe punishments for breaking them have been enacted by the Saudi Ministry of Interior in an effort to decrease the figure of deaths & injuries that are affected by highway travel accidents. In addition to that, they implemented a whole new traffic system known as the SAHER system. Still, because of the static nature as well as other restrictions of the systems, the drivers developed loopholes & methods to fool the systems to escape the fines as well as not being detected by the scheme. The most common traffic violations are going too fast, braking too quickly, and being distracted while driving. In this article, they present our ideas for an intelligent traffic monitoring system that makes use of Unmanned Aerial Vehicles (UAVs) and 5G technologies. The traffic monitoring systems covers the existing shortcomings of the SAHER system implemented in KSA. It has been noticed that the amount of accidents & deaths could be reduced if the existing restrictions & loopholes of the SAHER systems are closed. According to the information that is currently viewable, it is anticipated that once those violations have been remedied, the amount of accidents that occur every year would reduce to 299,317, which would results in 4,868 deaths & 33,199 injuries for one year. Furthermore, it is anticipated that within the next 5 years, the amount of fatalities & injuries would decrease to 3,745 & 16,600, respectively. Our hope is that this approach will further cut down on the number of incidents, as well as the amount of deaths & injuries it causes.

The combination of AI- Artificial Intelligence & IOT-Internet of Things, also known as Artificial Intelligence automatic Internet of Things-IoT, is allowed to produce a large quantity of information produced by a large number of gadgets & handle complex problems in social infrastructures. This capability is designated by the acronym AIoT. In this paper, we suggest to implement AIoT techniques for traffic light control that is a crucial element for intelligent transportation device, in order to enhance the effectiveness of the road system in a smart city. This comes as both AI and IoT technologies are maturing into their respective stages of development. To be more specific, a variety of sensors like security cameras offer real-time data to an intelligent traffic light control system so that it may monitor the conditions of both motorised & non-motorized traffic.

In this article, users suggest a solution for intelligent traffic light control by making use of distributed multi-agent Q learning. The above solution takes into account the traffic information at the neighbouring intersections in addition to the local motorised & non-motorized traffic. Its goal of this solution is to improve the overall performance of the traffic control system as a complete idea. Through the application of the multi-agent Q learning algorithm that we have presented, our system intends to maximise the efficiency of both motorised & non-motorized traffic. In moreover, we took into consideration a large number of rules & constraints that apply to the control of traffic lights in the real world. We integrated these rules & constraints into the learning algorithm, which will make it easier to implement the proposed solution in actual operational scenarios.

We carried out numerical simulations for a real-world map using traffic data taken from the real world. According to the findings of the simulations, the suggested system functions better than existing solutions in terms of the lengths of queues for vehicles & pedestrians, the amount of time spent waiting at junctions, as well as several other important performing indicators.

This article explores the development of intelligent traffic management systems through the utilisation of the Internet of Things-IoT. It functions as middleware atop the IoT underlying infrastructure & advances the idea of a smart city by making features like intelligent parking, intelligent emergency assistance, intelligent traffic signal regulation, and many more possible. A useful way for web items to communicate with each other, in addition to with congested roads sensing, applications, controllers, and other requires to maintain, is provided by the Internet of Things. Therefore, the application of IoT in the smart traffic management system is not confined to the reduction of traffic congestion, improvement of air quality, as well as optimization of traffic flow; rather, it is expanded to the constant monitoring of old people as well as ensures their protection & safety. Internet - of - things monitors the flow of traffic, manages the functioning of the traffic system, & stores the correct choice for the future information display. This is accomplished by acquiring different sources of traffic data for the purpose of data analysis. In spite of the fact that it utilises a sophisticated machine learning-ML approach in conjunction with a data-driven approach, this technique is not without its implementing restrictions. On the other hand, this research offers a valuable insight into the implementation of Internet of Things in the smart traffic control systems from the point of view of the study that has already been conducted.

Delicate registration techniques were tolerating of imprecision, relying on assumption, focuses on vulnerabilities as well as in light of inadequate truth. The current real issue with crowded actions in smart cities is unavoidably confusing, making it difficult to develop creative analogy joysticks frameworks. Increased risk of accidents, increased fuel consumption, unsanitary conditions due to contamination, and degraded general public health in typical city conditions are all caused by the growing number of vehicles at motion centres in active urban communities. These factors lead to unexpected delays in journeys.

Some astute urban societies are currently implementing better activity control frameworks that operate under the tenet of robotizing movement in order to avoid the aforementioned issues. Using current tests done with online mobility data and properly applying it to some activity streams constitutes its key test. Using clustering expertise as a sensitive registering procedure with perceptive interaction between autonomous sensors & motions of building seeds are an excellent, an up to date actions presidency framework called SCICS (Soft Computing based Intelligent Communication System) had also been suggested in just this exploratory article. It makes use of a more advanced course reversal technology with nano-machines that perform reasoning. In a Vehicular Ad-hoc Network (VANET) setup, cooperative nanorobot communication between sensing devices takes place. Re-enactment outcomes done utilising NS2 test system suggests empowering benefits in terms of superior performance to controlling problem.

Due to rapid advancements in software, hardware and communication technologies, Internet-connected sensory devices that offer observations and data measurements of the real world have becoming increasingly common. There will likely be between 25 and 50 billion Internet-enabled gadgets in use by 2020. As these figures rise and technologies advance, more information will be made public. Connectivity and interaction among the real & virtual worlds are made possible by the Internet of Things IoT technologies of Internet-connected gadgets.

The Internet of Things generates big data that is not only larger in amount, but also more dynamic in terms of time & location dependence, multimodal, and of varied data quality. The development of smart Internet of Things applications relies on the intelligent processing and analysis of this large data. Through the lens of smart cities as the primary application, this paper compares and contrasts many machine learning-ML approaches that address the difficulties posed by Internet of Things data. The main contribution of this research is a taxonomy of machine learning-ML algorithms that classifies the many methods used to process data and derive insights. We will also talk about how machine learning-ML may be used to analyse data from the Internet of Things, as well as its advantages and disadvantages. It is demonstrated how a Support Vector Machine-SVM could be put to use analysing traffic data from the smart city of Aarhus.

III.PROPOSED METHODOLOGY

The steps below outline the critical processes in the image processing pipeline [3]:

1. The image must be taken and saved on a device (such as a High Definition camera) before it can be used.
2. Once the image is in memory, it must be saved to a picture file by serializing a data structure (for example, numpy ndarray) into a file.

3. Manipulation, augmentation, and restoration: To do the following, we must execute preprocessing algorithms:
4. Segmentation: To extract the items of interest, the picture must be split.
5. As a result, the pictures has to be represented in different format, such as one of the following alternatives:
6. Interpretation of images: This representation is utilized to better comprehend the image:

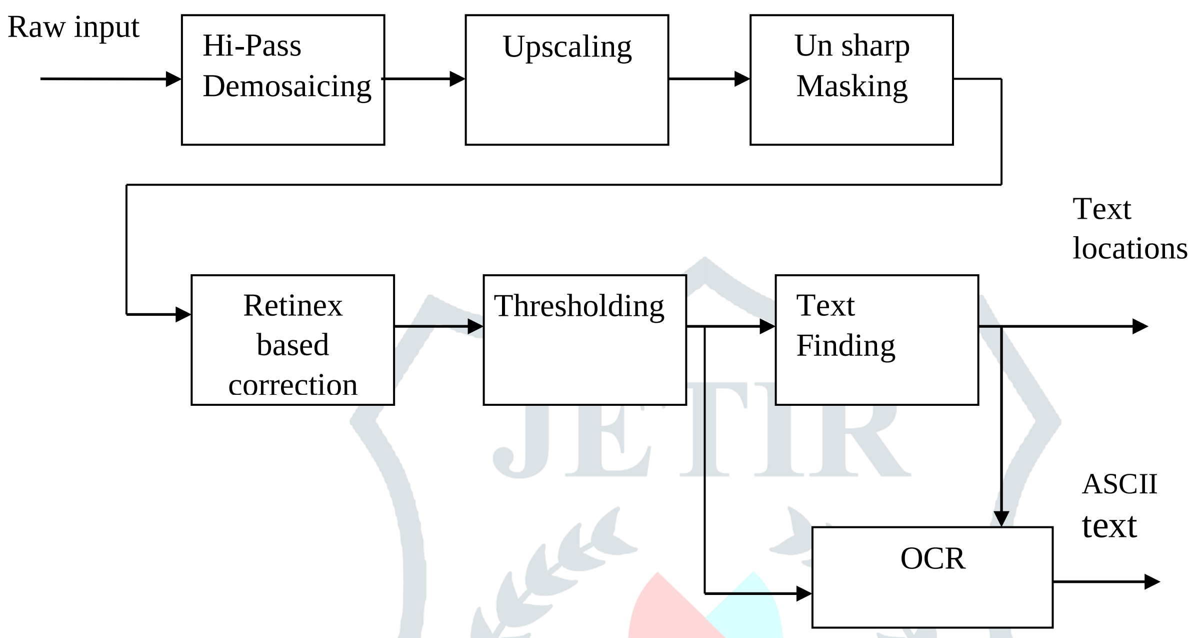

Figure 1: Image processing pipeline

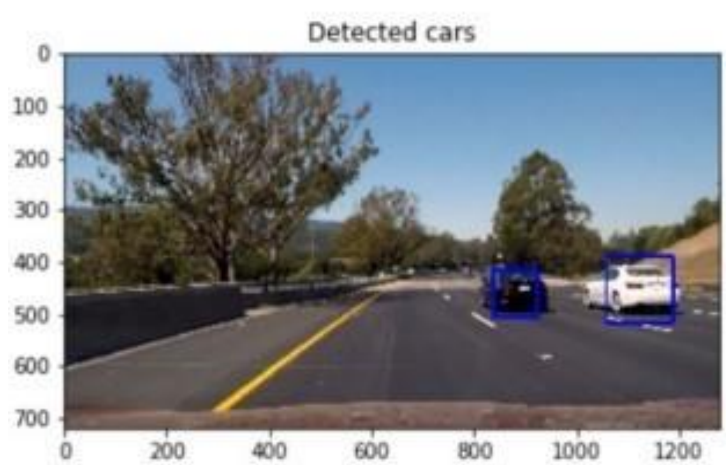

Figure 2: Detected cars

The graphic below depicts the many stages of image processing:

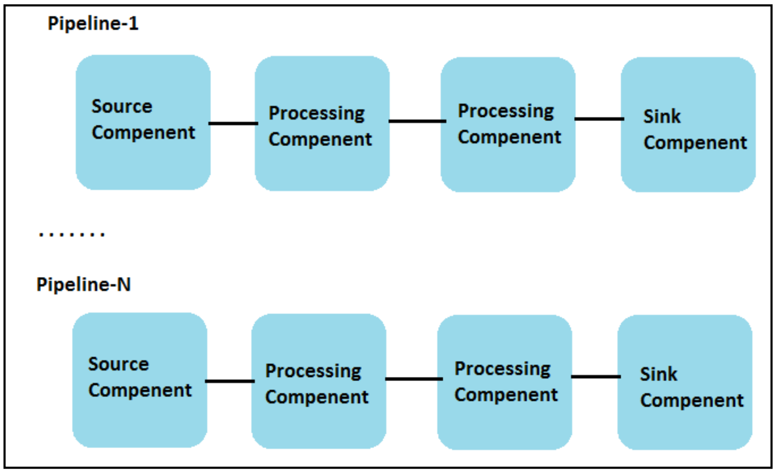

Figure 3: image processing pipeline

Feature extraction

Identifying elements that unmistakably depict a car is required in instruct to correctly locate one on the image. Color-based matching (template matching) is employed here. Using these methods has the advantage of being straightforward when it comes to forming object forms. We'll use Histogram of Oriented Gradients to build our capability set and improve our accuracy rate (HOG). We will use Histogram of Oriented Gradients in instruct to have a broad range of capabilities and increase our accuracy rate (HOG). Conniving the HOG feature requires the Scikit-image python package. The YCrCb colour house and all of its channels were utilised as inputs for the extraction of HOG choices. However, YCrCb offered Pine Tree State the best accurate coaching prediction model when using multiple colour regions.

Model training

Models are required to determine whether vehicles are compatible with our feature set. A linear support vector machine will be used in this particular scenario. An automobile classification model that is trained to recognise automobiles and non-automobiles is possible. Pulse counters are used instead of HOG options since they are scaled to zero mean and unit variance. There are two separate sets of data: the training set and the testing set. Eighty percent of the data are in the training set, whereas only twenty percent are in the testing set. After shuffling the photos before to beginning the training session, the randomly generated images are then utilised. The SVM linear model is used to extract the HOG features in YCrCb colour space. The SVM linear model has a 98.06 % accuracy rate [4].

Eliminating false positives

For the sake of increasing the accuracy of the output, many hits are made on the same region of interest. A heat map-like method is applied here. Once this threshold has been established, a certain number of hits from the heat map must be satisfied before a given vehicle can be considered a detected one. In this case, a threshold of two is used.

Here is a breakdown of the stages involved in spotting a vehicle on the road:

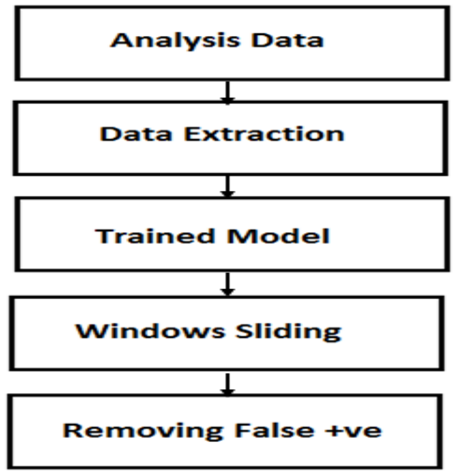

Figure 4: Proposed Methodology

Data Analysis

Analytical frameworks for data are those that use the processor to process and then display the results according to a specified algorithmic programme. Similar to enduring frameworks, it will gradually collect data but cannot demand any constant supply, i.e. it should obey the directions provided to it. Plans to explain congestion as far as typical wait times and lengths of lines at a solitary confluence and provide an effective stream in global rush hour gridlock management at diverse crossing places with the agreement of continuous information. As a result, the information acquired is utilised in a variety of ways to determine the client's disposition. Such approaches to making use of data fall under the following two categories. Data replication and chaining method. An opposite intersection receives the information obtained at a first junction, which illuminates problems and enables steps to be required. In the event that many cars, including emergency vehicles, are involved, the equivalent can be used.

Real Time Image Processing At the place where two pathways intersect, a camera system is installed, and traffic is continuously recorded by the camera. As soon as a recording is made, it sends the video to the PC, where Open CV programming can be used to extract one edge per second from the video. USB will be used to connect the computer to the camera.

IV.RESULT AND DISCUSSION

In order to create a highly accurate system appropriate for developing nations, the work was submitted to a review of current field research. Project goals are to first determine the length of the cars on the road so traffic may move smoothly without congestion, and then to establish priority-based signalling that will assist prioritise emergency vehicles such as ambulances. Enables the implementation of much more sophisticated algorithms in the future because of its straightforward coding.. Connecting the sensors to the controller at the junction is the first step. Once the cameras are in place and the right planning is done, the system will make our traffic system more high-tech and our cities more intelligent.

ACCURACY

The Metrics used to Evaluate Accuracy of Algorithm is:

➢ Classification when we use the phrase "accuracy," we're generally referring to a high degree of precision. The accuracy of the predictions as a percentage of the total input samples is known as the prediction accuracy ratio (ERR).

$$\text{Accuracy} = \frac{Nunmber\ of\ correct\ predictions}{Total\ number\ of\ predictions\ made}$$

The genuine drawback emerges, when the estimation of misclassification of the minor class tests are extremely high. On the off chance that we will in general arrangement with an uncommon however deadly ailment, the estimation of neglecting to analyze the disease of a victim is a long ways past the benefit of making a solid individual more tests.

➢ Confusion Matrix offers us a lattice (matrix) as yield and depicts the whole execution of the model.

How about we accept we have a parallel arrangement issue. We have a few examples having a place with 2 classes: YES or NO [8-10]. Additionally, we have our own classifier which predicts a class for a given information test. On testing our model on 200 examples, we will in general get the ensuing outcome [11-12].

N=200	Predicted: NO	Predicted: YES	
Actual NO	58	14	72
Actual YES	8	120	128
	66	134	

Figure 10: Confusion matrix

There are 4 important terms:

i. TP: In those instances when we predicted a yes and the actual yield was also a yes, we were correct.
ii. TN: In the situations where we expected NO and the actual yield was NO, we were correct.
iii. FP: The circumstances where we expected a YES, but the actual yield was a NO.
iv. FN: The particular yield was YES in the circumstances when we expected NO anyway.

Accuracy for the confusion matrix is the result of average of the values lying across the "main diagonal" i.e.

$$\text{Accuracy} = \frac{Total\ Positives + False\ Ngeatives}{Total\ number\ of\ samples}$$

$$\text{Therefore, Accuracy} = \frac{100+84}{200} X100 = 92\ \%$$

V.CONCLUSION

Using OpenCV, a traffic evaluation approach is presented in this study. This is accomplished by the use of images captured by street-side cameras.. The number of automobiles in each photograph has been verified. To guarantee that the vehicle's usual waiting time before a traffic sign will be smaller than current traffic management frameworks, this framework uses techniques and computations that promise to be more effective than those used in the past. Among the new method's benefits are the ability to use OpenCV instead of traditional sensors, as well as the simplicity, ease of setup, and reasonably high accuracy and speed. Because OpenCV programming was used to implement this method, the creation costs were kept low while speed and accuracy were increased. In rural areas, where there are fewer automobiles and hence less traffic problems, this structure is practically unimaginable. The current system relies on a single camera to monitor traffic at a point of intersection. With the integration of a distinct camera with High Dynamic Range for each street at the convergence, the framework's competency may be further improved. At daytime, vehicles such as semi-trucks and other large commercial vehicles might be obstructed from passing because of the vehicle's geometrical condition. There are improvements that can be made to the crisis mode, such as putting a GPS tracker in an emergency car, so that a base station can continuously watch the rescue vehicle area and clear the roadway as needed.

Using computational robotization to predict and regulate the thickness of traffic, this emerging technology has enormous measurements in the area of observation. It also reduces and eventually eliminates the traffic calamity. As a result, traffic signal coordination, personnel management, and overall traffic flow control need more expertise. Ticket the board systems may also be integrated to identify tags on vehicles and drivers who are breaking traffic regulations.

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