Vehicle Traffic Management Using CNN Algorithm

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Abstract - The goal is to build a traffic light system that changes based on how many people are in the area. When there is a lot of traffic at an intersection, the signal time automatically changes. Many major cities around the world have a lot of traffic, which makes it hard to get to work every day. Traditional traffic signal systems are based on the idea that each side of the intersection has a set amount of time. They can't be changed to account for more traffic. People can't change the times of the intersections that have been set up for them. There may be more traffic on one intersection, which could make it more difficult for the typical green period to end. After processing and translating the traffic signal object detection into a simulator, a threshold is set and a contour is drawn many cars are in the area. After , we can figure out which side has the most cars based on the signals sent to each side. Paper provides a solution based on camera feed at crossing for each lane process the data through and allocates the "green" time according to its traffic flow density using YOLO v3 and also takes care of starvation issue that might arise of the solution. As a result ,the flow of traffic on each lane is automatically optimized and the congestion that used to happen unnecessarily is eliminated earlier and results show significant benefits in reducing traffic waiting time

***Key Words*: CNN, Classification , Deep learning, ,Traffic Analysis , traffic signal, deep learning, Congestion detection ,Traffic scheduling,Machine Learning etc.**

1.INTRODUCTION

Traffic control and management are essential issues in a number of regions, particularly those with expanding populations and large cities. Traffic lights utilize time division multiplexing to alleviate congestion at intersections. In various countries, fixed-cycle controllers are employed at all signalized intersections. The sole disadvantage of using a traffic light is the delay in reaching your destination (stop time or waiting time). Thedelay at an intersection is a performance indicator of a traffic signal controller's efficiency. The phases, sequence, and timing of traffic signals all contribute to the efficiency of traffic movement across an intersection. The adaptive signal controller is in charge phases, sequence, and timing. When it comes to reducing traffic congestion,the timing and sequence of traffic signals must be optimized. Traffic signal time management is tough and blind due to unpredictability and a plethora of otherfactors. this project is to develop a real-time adaptive of traffic signals.

The current traffic control system works based on time to switch the traffic lights. But many researches are conducted to change the current traffic light system into automatic and adaptive system to solve the problems with the traffic congestion. Some researchers used hardware installation such as sensors and Radio Frequency Identification [8] to detect the crowdedness of vehicles, but this is expensive and difficult to implement. Some researchers are also working to solve the problem with the help of image processing using image subtraction method to calculate the density of vehicles [1] - [4]. They have used a fixed image that cannot be changed, as a reference image in image subtraction method. But this method is not efficient in the night-time, because the light condition in the night-time is not same as in daytime. The decision making for switching the traffic light works based on the calculated density. Anurag [1] used an algorithm to determine the approximate density of vehicles on the road with four lanes. Using this algorithm the dynamic system [1] improves 35% over the hard coded system. Ashwini [2] used a motion detection algorithm to estimate the count of vehicles on the road; the estimated count will then used to control the traffic signal.

Although the importance of traffic lights which give safety to the users on roads, the traffic jam causes great loose in time and energy (fuel) for some people, while others crossing road or roundabout have no traffic jam. The main objective of this paper is to design and implement a suitable algorithm and its simulation for an intelligent traffic signal simulator. The system developed is able to sense the presence or absence of vehicles within a certain range by setting the appropriate duration for the traffic signals to react accordingly. By employing mathematical functions to calculate the appropriate timing for the green signal to illuminate, the system can help to solve the problem of traffic congestion. The reason depends on resent fixed programming time. So, our target in this paper is to make this time unfixed according to the size of traffic jam, When there is a traffic jam in any road the green light which means permeation gives full time to the user of the road. If there is no traffic jam, the green light does not give full time, but it gives programming time. The new timing scheme that was implemented promises an improvement in the current traffic light system and this system is feasible, affordable and ready to be implemented especially during peak hours[35].

The proposed system is to develop a smart traffic light switching with the techniques of image processing that can switch the traffic signals in different ways for day-time and night-time. In the day-time the system measures the density of the vehicles on the road and in the night-time the system counts the number of vehicles on the road using the vehicle's headlight, based on these measurements the traffic light will be switched. Apart from that the proposed system will improve the functionalities of the previous works, such that it can detect the traffic violations such as a red light violation, stop line and lane violations. Each of the lights will have their own additional features, such that the red light detects a stop line and red light violations, and the green light will also detect the lane violation. In the proposed system some filtering techniques, image enhancement and segmentation will be used to remove a noise and improve the quality of the captured image so that the accuracy and efficiency of the system will be improved accordingly[11].

1. LITERATURE SURVEY

Vehicle Classification techniques Comparison by Machine learning on roadside sensors shows that The dataset of 3074 samples is processed for vehicle classification by using different algorithms of machine learning. Various classification techniques are used such as SVM, neural networks and logical regression. Logical regression shows the results had high performance when comparing with other methods of machine learning with the classification rate is 93.4% The main difficulty in this method is the usage of datasets, as it was focused mainly on single class which is very difficult to search while classification[13].

Comparison of vehicle type: Various Schemes of Classification shows that Vehicles are classified into four different classes car, bus, van and motorcycle. Two types of methods used here, SVM and random forest which is a feature. The accuracy of SVM is 96.26% more robust than RF Due to similar image size and shape of car, bus and van, miscalculation occurs[14].
vehicle detection and classification in real time video streams Distributed method of real time vehicle detection and classification system is proposed by Kul et al. [17]. Other techniques used here are vehicle classification, feature extraction, detection of foreground and background subtraction. In broad daylight the results are promising with an accuracy of 89.4% In night and bad conditions of weather they didn't perform any work. [16] Z. Dong, Y. Wu, M. Pei, and Y. Jia Semi-supervised Convolutional Neural Network is used for vehicle classification [15].

Semi-supervised Convolutional Neural Network is used while the classification of vehicles. The dataset consists of 9850 high resolution images are used. The dataset holds only front views of vehicles. In daylight 96.1% accuracy is registered and in Night 89.4% Misclassification occurs due to incorrect labels in the BIT dataset[18].

Feature-Based Tracking The proposed method is feature based tracking method which uses feature descriptor of SIFT for tracking. It forms a rich representation of object classes. The proposed approach provides better performance. When the view is changed the system is ineffective and occlusion also not tested[19].

Color and Pattern Based Tracking The color and pattern of vehicle image series of traffic video surveillance are used for tracking. It consists of segmentation of foreground and background, vehicle flow, shade removal, vehicle velocity, vehicle count, vehicle location to track objects. This system is proved to work in different climatic conditions and is insensitive to lighting conditions The system needs to be tested under extreme weather conditions and occlusion problems also need to be checked[21].

2. PROPOSED SYSTEM

In this system we are taking input as an image. As we know that we are performing image processing operation on system, so that we are using four modules of image processing like preprocessing, segmentation, feature extraction and classification where we use our CNN algorithm. So first we have passed input as an image then in preprocessing RGB conversion and then Binary conversion is done then.

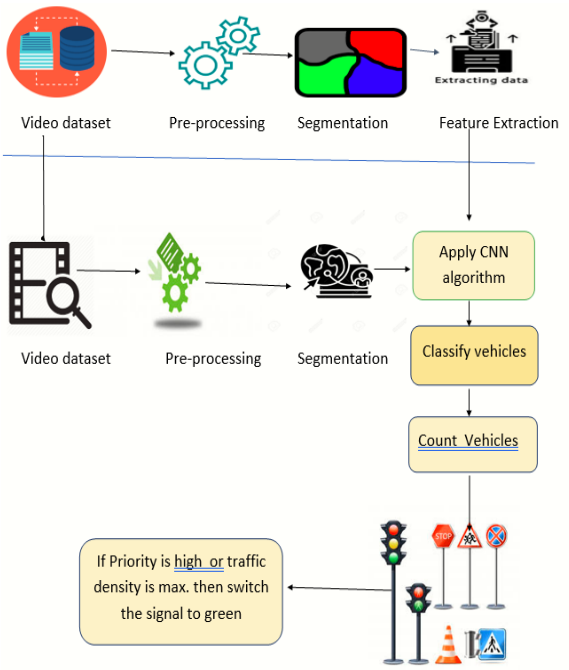

Fig-1. System Architecture

After that in the segmentation part the image is divided into the small pixels then after segmentation in the extraction part system extract the geometry based feature of traffic sign. then in classification where we use our CNN algorithm to classify and prediction[8] ,we pass this geometry based features of traffic sign to the classification to for classification and prediction , then on that basis it detect the traffic sign al then convert it into the voice alert.

3. DESIGN AND METHODOLOGY

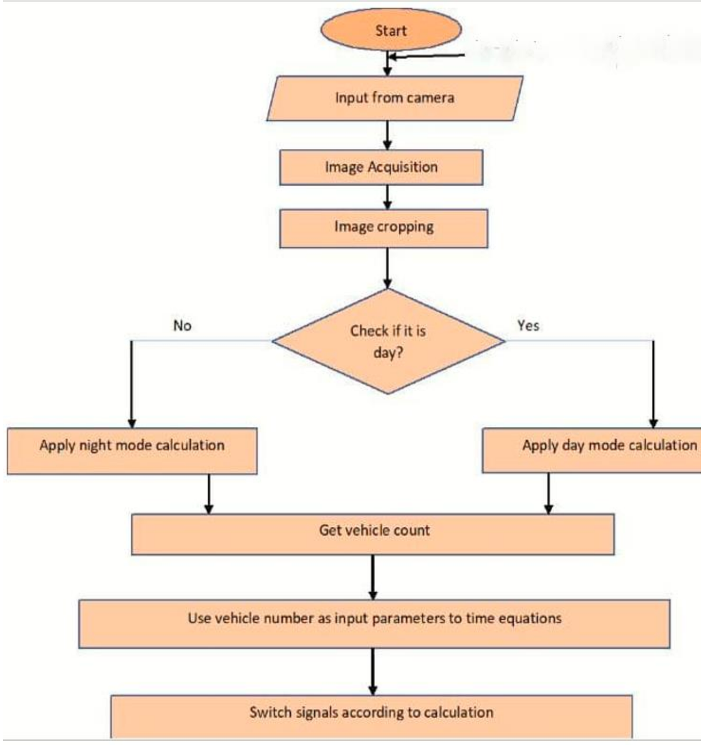

Fig-2 Workflow of proposed system

The system will use image extraction method to calculate the amount pixels occupied by vehicles on the road. The proposed system uses two different methods i.e. in day-time and night-time. At day time, Density of vehicles will be calculated , because the rate of vehicles are more visible in the daytime than in the night time. So it is effective to use density count instead of vehicle count in day-time. Counting the number of vehicles in the daytime may lead to a false or ambiguous result because two very close vehicles may be counted as a one vehicle.

The proposed algorithm checks the time, if it is a day or night in order to switch the system signal accordingly. The decision module receives density count (number of vehicles) in green signal and red signals (2) (3). Based on these values, the decision module will calculate the amount of the green signal time (TDi and TNi) and decide which side of the road will be switch to a green signal.

5.ALGORITHMS

5.1CNN (CONVOLUTION NEURAL NETWORK)

Computer vision and pattern recognition benefit greatly from the use of fully convolutional networks. CNNs are frequently employed in image analysis tasks such asimage recognition, object recognition, and image segmentation.
Deep neural networks consist of four layers. In traditional neural networks, each input neuron hidden unit. Each input neuron Layer is only linked to other inputneuron units. Only a few of CNN communicate with layerbe low it. It's reducing the three-dimensionality the CNN's hidden layer, activation and maximum pooling.A one-dimensional array is created by flattening data before moving is generated by flattening Connected Tiers are the last few nodes that are all linked together completely. Fully linked layers receive as input smoothed output from prior pooling or pooling layers. Sothat's how it works, as it were.

CNN implementation steps :

- Step 1: Convolution Operation(Filter image)
- Step 1(b): ReLU Layer
- Step 2: Pooling (used max pooling function)
- Step 3: Flattening (Covert Matrix into 1DArray)
- Step 4: Full Connection.
- Step 4(b): Dense()
- Step 4(c): Optimizer()
- Step 4(d) : compile()

5.2 CASCADE ALGORITHM

- Step 1 :In order to detect the features of a vehicle we need to import the **haarcascade_car.xml.** Use the **VideoCapture** of cv2 and store the value in **cap**Reading (cap.read()) from a VideoCapture returns a tuple (ret, frame). With the first item you check whether the reading was successful, and if it was then you proceed to use the returned frame.
- Step 2: Now that we have the tuple of (ret, frame) , we will convert the BGR channel image to gray channel. Reasons being the same, we are converting the image to gray scale and using the classifier function **detectMultiScale** to extract the x-coordinate, y-coordinate, width (w) and height(h), and gray scale is used for better performance throughput.
- Step 3:Based on the extracted features/dimensions of the cars, we will loop through them and draw a rectangle around each frame of the image.

5.3 VEHICLE DENSITY COUNT

The following are steps to calculate the density of vehicles.

- Image acquisition: The proposed system will start by capturing a live real time video ,input video or images using a video camera.
- Initially, the images capture by system will be empty roads with no vehicles and it will be used as a reference image RI. The system will capture a continuous sequence image frames from the live video or from given video/image per one second, which is used as a current image (CI). For both cropped for both reference and current images Only the interested target area of the road will be, to eliminate the unnecessary parts.
- To separate the foreground objects (vehicles) from the background the Background subtraction will be applied in each sequence of image frames, then the result image (I) will be obtained .Processing of subtracted image will be done by converting from RGB (Red Green Blue) to Grayscale for further processing.
- In each step of the image acquisition process ,a noise may be there so Image filtering techniques will be applied to remove noises, here median filtering will be used to remove pepper noises and salt and will produce a filtered image.

- In the filtered generated result, image there may be some non vehicles detected as foreground .In order to improve quality of result image the non vehicles object need to be remove.. So that thresholding that will be applied to differentiate the objects (white) and non object (black). Dilation morphological technique will also be used to fill the holes inside vehicle objects; For examining and expanding the shapes of the image and to extend the border and regions of the objects dilation is used .
- This results the final black and white image (Ibw) . It is further is used for calculation of density count. Here if the pixel value [pv] is not a zero, which will be considered as an object or vehicle . But if pv is zero, which is considered as a background (non object) that needs to be eliminated. Ibw = 1 if pv ≥ 1 0 else (1) .
- Finally the density of vehicles on the road will be calculated (not number of vehicles). The value of vehicle density determines the amount for which portion of the road is occupied by vehicles [4]. $D = n$ i=1 Ibw m j=1 (2) Here n is number of rows and m is number of columns. Only the white pixel values in all rows and columns will be added to density (D).

5.4 HOW THE SIGNAL WILL BE SWITCHED

- The density /count for the vehicles from sides of the road is determined and will be used as a input parameter to switch the signals.
- Green signal Time is calculated using density or count of vehicles in one road per the total density (vehicle count) in all sides of the intersection road.
- The proposed method uses the formula in [4] to calculate the green signal time, It will produce three outputs from the input parameters given ; weighted time (WD, WN) and traffic cycle (Tc). Total amount of time for one complete cycle of the traffic lights is given by Tc.
- WDi is a weight factor at a particular road in the intersection road will calculated as: WDi = Di n j=1 Dj (4)
- WNi is a weight factor at a particular road in the intersection road and will as: WNi = Ci n j=1 Cj (5) Where WDi is a weight factor of ith road in day-time, WNi is a weight factor of ith road at night-time, density calculated in day-time is D, vehicle count calculated in night-time is C, and the total number of road in the intersection is N.
- The time (TDi) of green light at ith road in the day-time is calculated by: TDi = Tc × WDi (6)
- The time (TNi) for green light that will be assigned to ith road in the night-time is calculated by: TNi = Tc × WNi (7)
- Finally, this received value will be sent to signal controller and it will switch the signals accordingly based on the decision phase module. The maximum green light provided to a lane must be 60 Sec and minimum is 15 sec.

6.RESULT

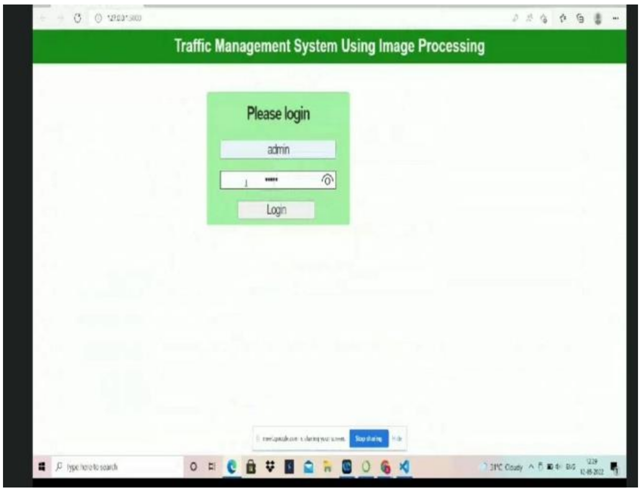

Fig-3

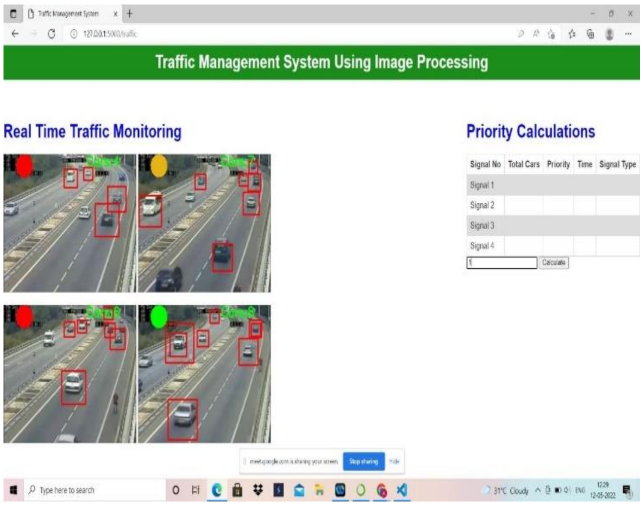

Fig-4

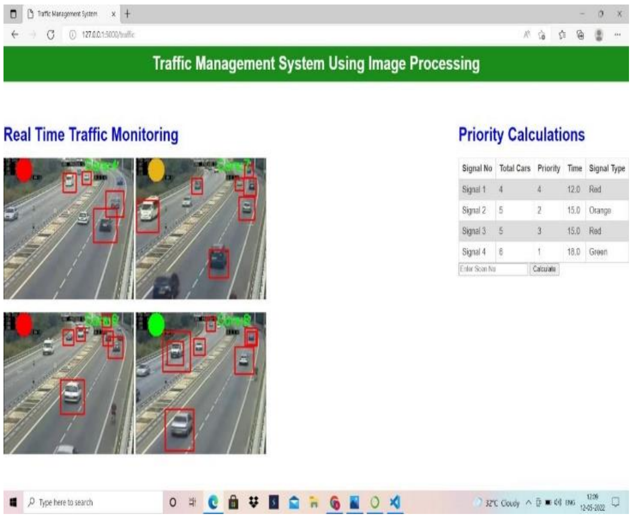

Fig-5

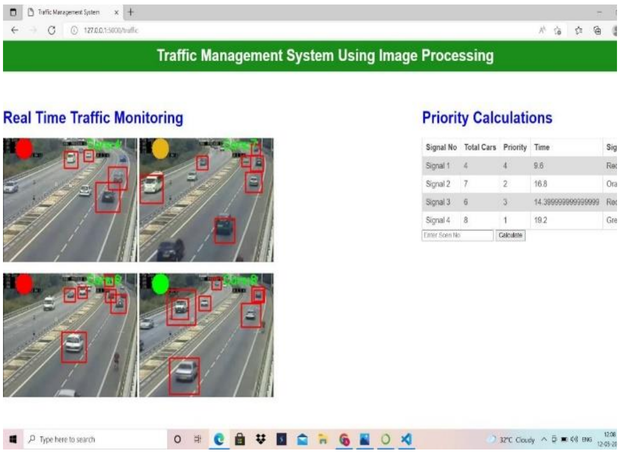

Fig-6

7.CONCLUSION

In order to record real-time traffic condition notifications, we may integrate our system with an app that analyses official traffic signals. As a result, in the worst-case situation, our system will be able to signal traffic-related events at the same time the console's results are displayed on the websites. In terms of feature coverage, we are also investigating the integration of our system into a more extensive traffic monitoring infrastructure. This infrastructure could include improved physical sensors as well as social sensors like social media streams. Social sensors, in particular, have the potential to provide low-cost comprehensive coverage of the road network, especially in areas where traditional traffic sensors are sparse (e.g., urban and suburban areas).The proposed strategy limits traffic delay which helps to reduce traffic congestions, environmental effects. The constraint of this work is, the proposed technique relies upon the vision framework introduced at convergence focuses that have variable video properties. In a future work, try to install the proposed method .

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