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Traffic Congestion Related to Adaptive Timer

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ABSTRACT

Traffic congestion will become one of the most important problems as the city population and vehicles enlarge. Traffic jams cause supplementary delays and pressure for drivers and increase fuel utilization and air pollution. It seems to be everywhere, but megacity is the hardest hit. And due to its ever-increasing nature, there is a need to calculate real-time road traffic bulk for better signal control and successful traffic management. The traffic controller is one of the key features affecting traffic flow. Therefore, traffic is in charge of needs to be optimized to well again meet this growing demand. Our proposed structure aims to use live images from cameras at intersections to compute traffic density using image processing and AI. It also focuses on algorithms for switching traffic lights based on means of transportation density to improve congestion. This allows populace to move more quickly and reduce pollution.

Keywords: Traffic control, Traffic light system, Traffic management, intelligent transport systems, Smart surveillance, Machine Learning, Computer Vision.

1. INTRODUCTION

With the increasing number of vehicles in urban areas, numerous road networks are facing the problem of concentrated road competence and corresponding service levels. Many traffic-related problems are caused by traffic control systems at intersections that use fixed signal timers. They repeat the same phase sequence and their interval is unchanged. The increasing demand for road capacity has also greater than before the need for new traffic control solutions found in the intelligent traffic classification area. In recent years, video surveillance and close watch systems have been commonly used in traffic management for safety, ramp measurement, and providing real-time in sequence and updates to travelers. Traffic density estimation and vehicle classification may also be proficient using a video surveillance system, which is used to be in charge of traffic light timers our proposed arrangement aims to design a central processing unit vision-based traffic light controller that can become accustomed to the current traffic circumstances. Using live images from CCTV cameras at intersections, the calculates traffic density in real-time by detecting the number of vehicles at traffic lights and adjusting green light times accordingly. Use YOLO to be converted into aware of the numeral of vehicles and set timers for traffic lights in the opposite direction according to the vehicle density. This optimizes green light times, clears traffic much supplementary on the encourage of the moment than static systems, reduces redundant delays, congestion, and latency, and reduces fuel expenditure and pollution.

II. OBJECTIVE

The objective is to proposition an intellectual traffic signal control system algorithm with the use of sensing devices and image processing systems. The captured images were to be processed in real-time using an representation processing toolkit such as YOLO and an collection of parameters have to be calculated to investigate approximately the compactness of vehicle traffic in all four directions. The controller has to bring on the subject of the built-up algorithm on the traffic signal be in command of to vary its period.

III. LITERATURE SURVEY

Reference [2] proposes a explanation using video processing. The video from the live feed is processed before being sent to the servers where a C++-based algorithm is used to generate the results. Hard code and self-motivated coded methodologies are compared, in which the dynamic algorithm give you an idea about an improvement of 35%.

Reference [3] proposes an Arduino-UNO-based classification that aims to reduce traffic congestion and waiting time. This structure acquires images through the camera and then processes the representation in MATLAB, where the image is transformed to a entrance image by removing dissemination and hues, and traffic concentration is calculated. Arduino and MATLAB are associated using USB and reproduction packages, which are preinstalled. Depending on traffic calculation and traffic density, the Arduino sets the duration of the green light for each lane. But this method has more than a few flaws. The cars often overlap, and it is difficult to get a proper count up of how many vehicles are on the road. Moreover, different objects interfered with the recognition as they too were transformed to black and white and there was no way of making dissimilarity between customary objects like billboards, poles, and trees with vehicles.

Reference [4] proposes a fuzzy logic-controlled interchange light that can be adapted to the current traffic situations. This system makes use of two unclear controllers with 3 inputs and one amount produced for most important and secondary driveways. An imitation was done using VISSIM and MATLAB and for low traffic density, it improved traffic conditions.

Reference [5] proposes a smart traffic light structure using ANN and a fuzzy controller. This method makes use of images captured from cameras installed at the traffic site. The image is first converted to a grayscale image before supplementary normalization. Then, segmentation is performed using the sliding windowpane technique to count up the cars irrespective of size and ANN is run through the segmented image, the amount produced of which is second-hand in the fuzzy controller to set timers for red and green lights using crisp amount produced. Results had an standard error of 2% with an implementation time of 1.5 seconds.

Reference [6] uses a support vector piece of equipment algorithm and image handing out techniques. From live video, images in diminutive frames are captured and the algorithm is applied. Picture processing is done using OpenCV and the images are converted to grayscale images before SVM is applied. This structure not only detects traffic concentration but also detects red light violations.

IV. HARDWARE AND SOFTWARE REQUIREMENTS

Table 1. Hardware Requirements

SR. No.	Hardware	Description
1.	Processor	Intel Core i7 @ 2.70 GHz
2.	Memory	8.00 GB
3.	Hard Disk Space	256 GB
4	Device	HP Pavilion
		CCTV: C – Mount Camera
5.	Others	ANPR/LPR
		Camera
		Cloud – Azure, Google Cloud, AWS

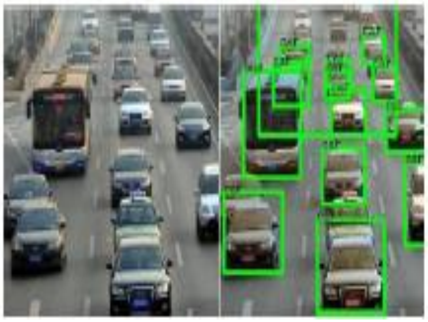
Table 2. Software Requirements

Sr. No.	Software	Description
1.	Operating System	Microsoft Windows 10
2.	Database server	MySQL
3.	Programming IDE	Jupyter Notebook, Google Collab
4.	Technology and Framework	Python, GoogleColab, YOLO v2

V. METHODOLOGY

1. Vehicle Detection Module

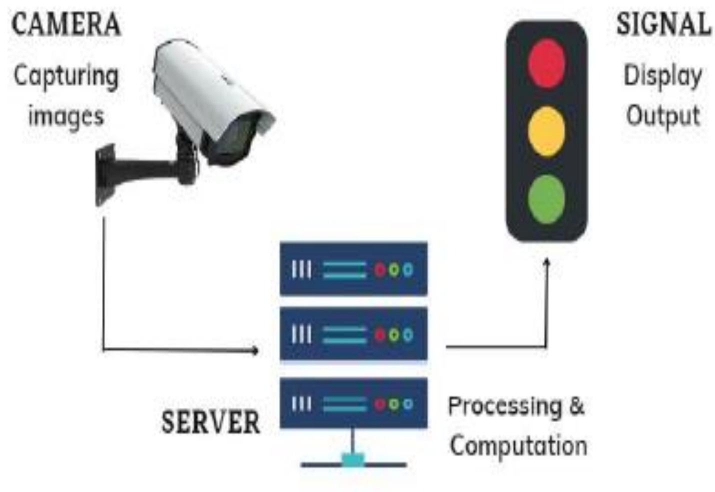
The proposed system uses YOLO (which appears only once) for vehicle detection. This will give you the accurateness and processing time you need. A custom YOLO model was trained for vehicle detection. They can be acquainted with various class vehicles such as cars, bicycles, heavy vehicles (buses and trucks), and rickshaws. YOLO is a clever convolution neural network (CNN) that performs real-time object recognition. The algorithm applies a single neural network to the comprehensive image, partitions the picture into regions, and predicts bounding boxes and probabilities for each area. These bounding boxes are weighted by the predicted probability. YOLO is popular in view of the actuality that it can do in real time at the same time as achieving high accuracy. The algorithm looks at the image "just once" in the sense that it requires only one forward propagation pass, from beginning to end the neural network to make a prediction. After maximum suppressions (which ensures that the object recognition algorithm finds each object only once), we output the detected objects along with their bounding boxes. In YOLO, a single CNN predicts multiple bounding boxes and their class probabilities simultaneously.



2. Signal Switching Module

The algorithm receives input information about vehicles detected by the detection component, as described in the previous section. This is in JSON format, where the label of the detected object is the key and the assurance and coordinates are the values. Next, parse this input to work out the total number of vehicles in each class. The signal's green time is then calculated and assigned, and the other signal's red times are in the swing of things accordingly. The algorithm can be scaled up or down to any digit of signals at the connection. The following factors were considered at the same time as developing the algorithm:

1. The processing time of the algorithm to analyze traffic density and then the green light duration – this decides at what time the image needs to be acquired.
2. The number of lanes.
3. Total count of vehicles of every one class like cars, trucks, motorcycles, etc.
4. Traffic concentration calculated using the greater than factors.
5. Time added due to lag each vehicle suffers during start-up and the non-linear increase in lag suffered by the vehicles which are at the reverse.
6. The average speed of every one class of vehicle when the green light starts i.e. the average time compulsory to cross the signal by each class of vehicle.
7. The minimum and maximum time limit for the green light extent - to prevent starvation.



3. Simulation Module

The signal's green time is then calculated and assigned, and the other signal's red times are adjusted accordingly. The algorithm can be scaled up or down to any integer of signals at the connection. A simulation was developed from scratch using Pygame to reproduce real traffic. It helps you visualize your arrangement and compare it with an existing static system. Contains four-way intersections with four traffic lights. Each traffic light has a timer that indicates the time outstanding before the traffic light switches from green to yellow, yellow to red, or red to -green. The number of vehicle that crossed the connection is also displayed next to each traffic light. Vehicles such as cars, bicycles, buses, trucks and rickshaws come from directions. To make the reproduction more realistic, some vehicles in the rightmost lane are about to turn and cross their intersection. Whether the vehicle turns is also determined by the unsystematic numbers when the vehicle is generated. Also included is a timer that indicates the over and done time since the simulation started.

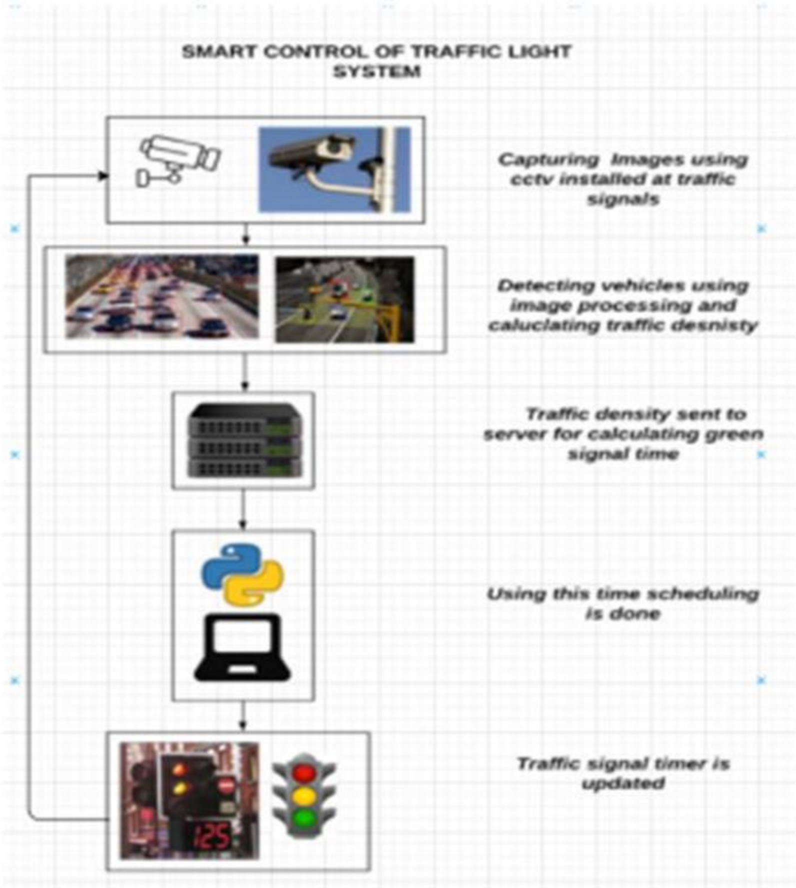


Fig. 1. Proposed System Model

VI. CONCLUSION

Finally, the proposed structure adaptively adjusts the timing of the green light according to the traffic compactness of the light, resulting in a longer green light in the high-traffic direction compared to the low-traffic direction. Allow time to be allocated. This reduces undesirable delays, reduces congestion and waiting times, and reduces fuel consumption and pollution.

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