AUTOMATED TRAFFIC CONTROL SYSTEM

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ABSTRACT - *THE EXPONENTIALLY INCREASING TRAFFIC HAS BECOME A TROUBLESOME OBSTACLE IN MOST OF THE BUSY CITIES. THIS PROBLEM CAN BE SOLVED BY ELIMINATING THE FIXED STATIC TIMED SIGNALS AT BUSY JUNCTIONS AND THEREBY ADAPTING A VOLUME BASED AUTOMATED TRAFFIC CONTROL SIGNAL. THIS PAPER PROVIDES A PROTOTYPE FOR A MODEL WHICH CAN BE USED AS A SOLUTION FOR THE AVOVE PROBLEM. IF THE SENSITIVE THRESHOLD OF THE NUMBER OF CARS IS ACHIEVED, THEN THE PROPOSED BLUEPRINT COULD BE APPLIED AT JUNCTIONS THUS PREVENTING CONGESTION AND FACILITATING SMOOTH TRAFFIC FLOW WITHOUT ANY HASSLE.*

***Key Words*: traffic control, congestion, signal automation.**

I. INTRODUCTION

Vehicular traffic control has always been a matter of concern for administrations in many modern cities around the world. Several attempts have been made to design efficient automated systems to solve this problem. Most of the present systems use predetermined timing circuits to operate traffic signals, which are not very efficient because they do not operate according to the current volume of traffic at the crossing. To avoid this problem urban societies use hardware sensors like cameras, inductive loops and radars to monitor traffic status. These tools function well however, they have some limitations. One of these limitations is the high maintenance costs of these tools.

It is often seen in today's automated traffic control systems that vehicles have to wait at a road crossing even though there is little or no traffic in the other direction. There are other problems as well, such as ambulances getting caught up by a red traffic signal and wasting valuable time. Congestion is often translated into lost time, missed opportunities, lost worker productivity, delivery delay, and a general increased cost.

Google maps is a web mapping service developed by Google that provides satellite imagery and real time traffic conditions (Google Traffic) that works by analyzing the GPS-determined locations transmitted to Google by a large number of mobile phone users. By calculating the speed of users along a length of the road, Google is able to generate a live traffic map. Google processes the incoming raw data about mobile phone device locations, and then excludes anomalies such as postal vehicles which make frequent stops. When a threshold of users in a particular area is noted, the overlay along roads and highways on the Google map changes colour.

Load Balancing Network consists of devices that use statistical techniques to give computer systems the ability to "learn" (e.g., progressively improve performance on a specific task) from bandwidth traffic data, without being explicitly programmed.

Hence by combining the concepts of a load balancing network the real time data from Google Traffic an automated traffic control system can be developed which can dynamically control the traffic signals depending on the real-time traffic instead of the static values used presently which do not take in consideration the real time traffic density or can adjust to anomalies such as accidents, emergency services or rerouting of traffic.

It eliminates the need of a traffic police standing at the junction to control the traffic manually and relaying information to the next signal officer over radio. This automated system has more vision compared the human traffic police officer to route traffic and can be easily updated real time over a large span of area.

Google Traffic changes continuously with time based on the satellite imagery making it accurate and reliable information to determine the traffic density given at a particular time of the day, hence ensuring the traffic management automation is accurate and rational in deciding where to route the traffic.

A. Aims and Objectives

The principle aim of this project is to design and develop an autonomous traffic control system. Real time traffic information is important for avoiding traffic congestion spots.

The existing studies based on Internet Traffic Analysis Concepts that use machine learning to route the internet traffic have shown greater efficiency and better management when paralleled to the real time application to vehicle traffic management and automation[1].

The various objectives of the paper are- Automation of current traffic control signal and make the traffic signal timings dynamic instead of being a fixed static value for different routes; To ensure efficient routing of traffic to minimize congestion and time wasted by vehicles at the

respective traffic signal junctions; To provide better routing to emergency services like ambulance and fire brigade which usually cannot reach the destination at the right time due to vehicle congestion; To classify the routes based on colour scheme given by Google Traffic and determine the time period for every traffic signal to be green or red allowing or stopping traffic (respectively); To provide the option of manually re-routing traffic by administrator for emergency services or government use. And lastly the system determines whether manual rerouting is feasible and implements it if true.

B. Scope

The Project Scope pertains to the work necessary to deliver a product. The main goal of the project is to stop the unnecessary delays caused by the static traffic signals which are causing enormous amount of fuel and results in poor management of real time traffic.

In our project, we will be using satellite maps to know the traffic status on a road. The traffic signals on the roads will dynamically change instead of having a fixed timer, road junction signals that have less or no traffic will be will become red and the traffic signals on the roads with more traffic will be turned to green dynamically, depending on the present vehicle density of that route.

This automated system can also be used by administrators to control and redirect the traffic as needed if considered feasible by the system.

II. LITERATURE SURVEY

Traffic congestion is a main problem with foremost cities. In India the traffic lights are founded on timing system i.e. whether the vehicles are present or not the timing will remain constant which makes people to wait unnecessarily for longer time. The key characteristic of the traffic in cities particularly for developing the geographies is that even if the geographies are explicitly mentioned/marked on the roads it doesn't move through the lanes. The lanes with more traffic tolerate more waiting time.[2] The lanes with less traffic often gets the green signal. We here propose a density based traffic signal scheduling algorithm.

The system is designed to manage traffic signal timings based on the density of traffic on its corresponding road. The system represents the traffic strength of a road graphically using traffic judgments. By measuring the traffic lined up on a particular road the signal timings are adjusted to let that particular way clear out and then the next populated one. The entire system works according to an algorithm that allows for smooth and efficient traffic flow across all four ways. It also consists of an emergency override that allows traffic authorities to remotely let go a particular signal in case an ambulance or important vehicle arrives on that way .[3]

III. LITERATUREREVIEW AND METHODOLOGY

A. Domain Explaination

Data Extraction From Google Traffic API- Extracting data from the Google Traffic API is another module of this system which solely involves getting real traffic information for the Machine Learning module to train on and determine the time period for each traffic signal dynamically.

Google Traffic changes continuously with time based on the satellite imagery making it accurate and reliable information to determine the traffic density given at a particular time of the day, hence ensuring the traffic management automation is accurate and rational in deciding where to route the traffic.

Using satellite imagery for automation of traffic signals is a relatively new emerging research area. Most of the present systems use predetermined timing circuits to operate traffic signals, which are not very efficient because they do not operate according to the current volume of traffic at the crossing. To avoid this problem urban societies use hardware sensors like cameras, inductive loops and radars to monitor traffic status. These tools function well however, they have some limitations. One of these limitations is the high maintenance costs of these tools. [3]

On the other hand Google Traffic provides real time traffic status and is highly accurate to represent the current vehicle density on a particular route.

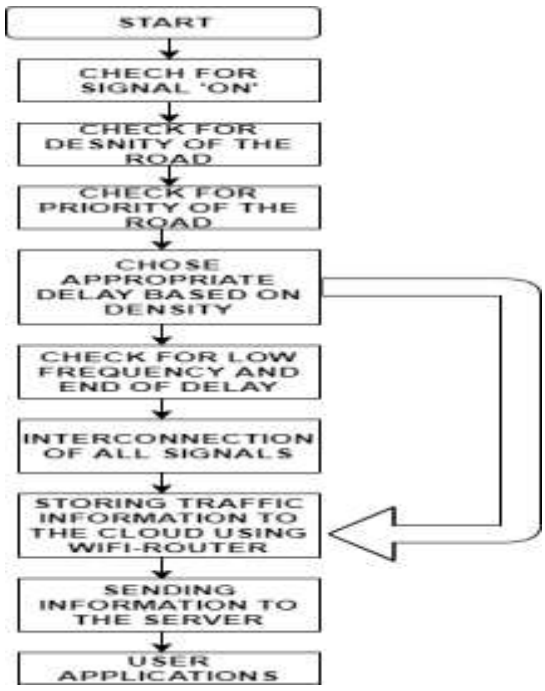

Fig. 1. Work Flow Diagram

B. Hardware and Software Requirements

Recommender hardware requirements involve a disc space(storage device) for minimum 200MB, an Android device and an internet connection with a minimum speed of 100kpbs. As for the software part is concerned, we would require a MySQL database system and an Android v5.0 or higher version.

C. Characteristics

Traffic intersections also have the potential for major traffic congestion, particularly if queues of vehicles can spill over to affect adjacent intersections. Intersections typically have lower flow capacity than roadways since the passage space must be shared over time with different directions of travel. In the extreme case of congestion, "gridlock" may occur with queues from one intersection preventing dispersion from the adjacent intersections. At low densities, issues of allocating green time to different directions or turning movements must be addressed for individual intersections. Also, coordination of green time to enable steady progression along a travel corridor arterial can be extremely beneficial.[2]

The mechanisms available for roadway traffic control are typically limited to indirect levers such as traffic signals, lane closures and speed limits. Individual drivers make all departure time, travel, route choice and destination decisions for vehicles. The result is a "user equilibrium" of travel in which individuals attempt to minimize their own travel cost. In making such decisions, drivers ignore the "external" congestion costs their decisions impose on other users, so the resulting traffic pattern does not represent an efficient or "system optimal" equilibrium travel pattern. Both the user and system equilibrium travel pattern can be identified from a mathematical optimization problem with nodal and roadway link continuity constraints. For the user equilibrium, the objective function consists of the integral of all travel time so that the first order Lagrangian conditions insure that travel between two points occurs on only the minimum time paths.

In addition to these technical problems in roadway traffic control, there are also financial and organizational barriers to modernization and improvement. Improvements in traffic control will result in savings to the traveling public and society at large, but there are no direct revenues returned to responsible local public agencies reflecting such quality improvements. At the municipal level, traffic control expenditures often must compete with other obligations such as police or transit service subsidy. As a result, improvements that may have substantial social net benefits may be foregone due to financial constraints or a lack of motivation.

D. Real Time Traffic Control for Emergency Service Vehicles

The fast response of the emergency services such as ambulances or fire fighters' cars has become a challenging situation nowadays. Because of many reasons like lack of infrastructure, increasing number of cars or even chaotic driving the time until the ambulance reaches to the patient place is reduced a lot. Sometimes the ambulance gets stuck in traffic and those minutes can cost humans life. The present project is proposing an improvement of emergency services with final effect in saving humans life. The ambulance path it will be cleared in advance by using high technology. Presently the clearance of the heavy traffic is done using the siren of the ambulance or police cars.

According to the recent survey there are thousands of people losing their lives due to the delay in the emergency services. Experts say that 3,000 more heart attack victims could be saved each year if 90 percent of the delay could be minimized. And in the present scenario the number of deaths are in lakhs and this number can be effectively reduced by providing timely and accurate ambulance service. By avoiding the unnecessary time delay near traffic jams during an emergency situation. [3] The shortest and the most efficient route that is asphalt constructed to the accident spot or the required location is displayed and the central server checks for the vehicles location and changes the traffic signal when the ambulance is approaching the traffic lights. The design and implementation of this technique is directly targeted for traffic management so that emergency service vehicles on road get a better way to reach their destination in shorter duration, efficiently and without any interference [1].

The traffic detection and pattern analysis model aim at detecting and calculating the traffic flux of vehicles and pedestrians at intersections in realtime. Our system can utilize one camera to capture all the traffic flows in one intersection instead of multiple cameras, which will reduce the infrastructure requirement and potential for easy deployment. We propose a new deep learning model based on YOLOv2 and adapt the model for the traffic detection scenarios. To reduce the network burdens and eliminate the deployment of network backbone at the intersections, we propose to process the traffic video data at the network edge without transmitting the big data back to the cloud. To improve the processing frame rate at the edge, we further propose deep object tracking algorithm leveraging adaptive Multimodal models and make it robust to object occlusions and varying lighting conditions. Based on the deep learning based detection and tracking, we can achieve pseudo-30FPS via adaptive key frame selection [2].

E. Traffic Automation Module

Early versions of Google Maps relied only on data from traffic sensors, most of which were installed by government transportation agencies or private companies that specialize in compiling traffic data. Using radar, active infrared or laser radar technology, the sensors are able to detect the size and speed of passing vehicles and then wirelessly transmit that information to a server. But here we are simply going classify congestion on road based on number of cars in that congestion. The application will identify type of congestion (Red, Orange and Blue) using a classification algorithm. In this basic classification Algorithm, we are going to classify congestions based on number of cars in that congestion.

Blue Congestion – 0 to 10 cars

Orange Congestion – 11 to 20 cars

Red Congestion – 21 and above

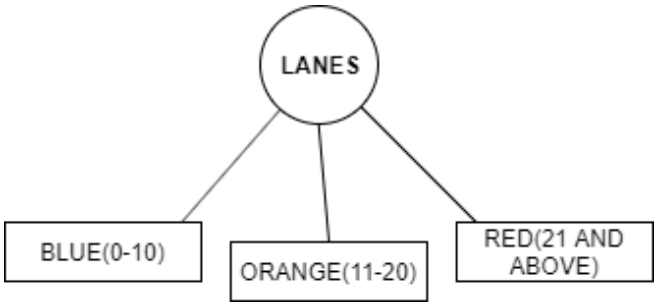

Fig. 2. Classification of lanes on basis of congestion

F. Basic Traffic Congestion Algorithm

Rule:

If (a>20)

Then do

B=a20

Break

C= B*5;

Cd= CCi;

Ci=Ci+Cd;

End

Example:

Let's say lane L1 (Red lane) has 35 cars and C1=30 sec

i.e. a=35.

Our goal is to convert that red lane into Orange.

Applying the Rule

B=35-20=15

So

C=15*5=75

Cd= C-C1=75-30=45

C1= C1+Cd= 30 +45;

As the number of cars reduced to 20, the lane will become orange by increasing the traffictimings by 45 secs.

IV. CONCLUSION

To reduce the congestion and unwanted time delay, an advanced system is required. One such advanced system is Automated Traffic Signal Control System Using Machine Learning. The sensors help in keeping count of vehicles entering roads and subsequently allot time delay thereby giving accurate priority to each road for time being. With this technique we have entered a new era of automated traffic signal control.

In this report, we have presented a traffic system using machine learning. The system is built using Android Studio, JAVA, RESTful API, MySQL, Google Map API and XML. It is capable of fetching the traffic status directly from Google maps analysing the data.

Thus, we can conclude that by using the proposed method we can save considerable amount of time and also we can prevent excessive traffic jams thus leading to smooth traffic jams. In practice presently in India we are following time-based control of traffic signals and we are experiencing heavy traffic jams all over which in turn consumes a lot of time and fuel. We hope this method will be adopted as soon as possible so that the limitation that we are experiencing with present method can be overcome.

V. REFERENCES

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