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RESEARCH ARTICLE

Minimizing Delay by Controlling Signal in VANET

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Abstract - In traditional Traffic Signal Control System, many times, because of heavy traffic, accidents, heavy rain or any reasons, there may be chances of blockage on roads. So, people may get late due to heavy traffic. In Metro cities, people feel inconvenience about spending their valuable time waiting at signal. It leads to the need of developing a dynamic system which will provide a user with a facility of all alerts about such problems so that people will get aware and change their ways to avoid their inconvenience. Our web application will provide a user alerts about such a problem by using VANET. VANET is an emerging technology to efficiently handle the traffic management. The analysis on the basis of minimum time and distance required is also provided to users of the system. With the above facilities, it needs to optimize delay faced by vehicles at traffic signal with an efficient algorithm to manage traffic. Our project provides such algorithm and name of the algorithm is OAF which is divided into two parts i.e. Platooning algorithm and OJF algorithm.

Keywords: VANET, MANET, OJF, OAF, Platoon

I. INTRODUCTION

During the last years, the total number of vehicles around the world is growing rapidly. Therefore the focus of government, manufactures and researchers is shifting towards improving the on road safety rather than improving the quality of the roads. The development in the wireless technologies emerged a new type of networks, such as Vehicular Ad Hoc Networks (VANETs), which provides communication between vehicles themselves and between vehicles and infrastructure.

In daily life, people often faces problem of traffic jam at intersection, they have to wait for long time to get rid of heavy traffic. Sometimes, due to mishap on roads, the roads become unavailable and driver may face a trouble to come back and change route, find alternative path. Our web application is solution for all such problems. Traffic jam at lanes will be serviced through delay minimization [5] algorithm. Alerts about accidents, blockage on roads are provided to user, so that user will be updated as soon as possible before the problem becomes more severe.

Our web application will provide a user with analysis of intermediate paths when source and destination is given as input to reach at their destination. Updates about problem regarding unavailability of roads are provided to user on Mobile device. Our delay minimization algorithm will reduce waiting time at the intersection along with the reduction in queue length.

II. RELATED WORK

VANET is a technology in which vehicles on roads creates a network and communicates with each other to share information[9]. Exhaustive research is being carried out in the field of VANET. The aim of VANET research is to develop a vehicular communication system to enable ‘quick’ and ‘cost-efficient’ transmission of data for the benefit of passenger’s safety and comfort [1].

Vehicular Ad hoc Networks is the subclass of Mobile Ad Hoc Networks (MANETs). VANET are self-organizing networks [2]. It has no fixed network infrastructure. Higher node mobility, speed and rapid pattern movement are the main characteristics of VANET. This also causes rapid changes in network topology. VANET is a specific type of MANET, in which each vehicle corresponds to nodes. VANET serves as communicator and coordinator to vehicle drivers in order to avoid any critical situation in roadside communication e.g. road side accidents, traffic jams, speed control, free passage of emergency vehicles and unseen obstacles etc. Apart from safety applications VANET also provide comfort applications to the road users.

III. EXISTING SYSTEM

In urban areas traffic signal controls are the main mechanism to control vehicular flow at the intersections. However, traditional systems fail to set the timing pattern according to the time variability[7]. An alternative solution to such systems is to develop systems which will adjust the timing patterns according to the traffic demand.

Intelligent traffic signal control has been extensively studied in the literature. There are another algorithms alternative to the algorithm which we are going to implement. The algorithm which we are implementing provides a good solution to minimize delay at intersection.

1. Vehicle-actuated methods
2. Webster’s method [5]

A. Vehicle-actuated methods

In this method, initialize the traffic signal controller to the initial phase and initially set the extension time for the phase to 0. Next, we search for a vehicle that is closest to the stop line by examining the location field of all the vehicles. And compute the approximate traveling time to the stop line using the Compute_Traveling_Time () function as follows. The packet broadcast by the closest vehicle contains its position and speed data. These data are extracted, and since the position data consist of a Cartesian coordinates, we can compute the Euclidean distance of the vehicle from the stop line. Given the distance of a vehicle from the stop line, we can use the current speed information to compute the traveling time to the stop line. This traveling time is an approximation of the actual traveling time. If the vehicle closest to the stop line indicates a speed of 0, Compute_Traveling_Time () returns a traveling time of 2 s . We set variable gap to be equal to the traveling time returned by Compute_Traveling_Time ().

B. Webster’s Method

Webster’s algorithm is the most quoted method of determining a delay minimizing cycle time or evaluating delay for a cyclic fixed signal control scheme. In the Webster’s algorithm, simulation tools are used to generate random vehicle arrival times to the intersection at a given average arrival rate. Arrivals to the stop line are added to a queue estimate and dispersed during the effective green time at a constant departure rate called the saturation flow rate. Delay is calculated as the integral of the queue over the cycle, and an average value is obtained by dividing the delay by the volume. Webster used the result of simulation analysis to deduce a model of average delay per vehicle as a function of the cycle time, green split, saturation flow rate, and arrival rate. Under heavy vehicular traffic load, the OAF algorithm performs the same as the vehicle-actuated traffic method but still produces lower delays, as when compared with Webster’s method.

IV. PROPOSED SYSTEM

In our system, we are registering user for Log in and only registered users can have access to our system. User names, address, email id, and phone number all the information is stored in the database. We will give user name and password on the basis of input data entered by user. After Log in the user can have access to all functionalities of our system. Source and Destination is taken as input in order to provide all available paths to reach the destination. Network is created by configuring various mobile devices on Server, in order to send alerts. The route selected by user is informed to server. On the basis of alerts user can take appropriate actions. The Figure4.1 gives brief idea about our proposed system.

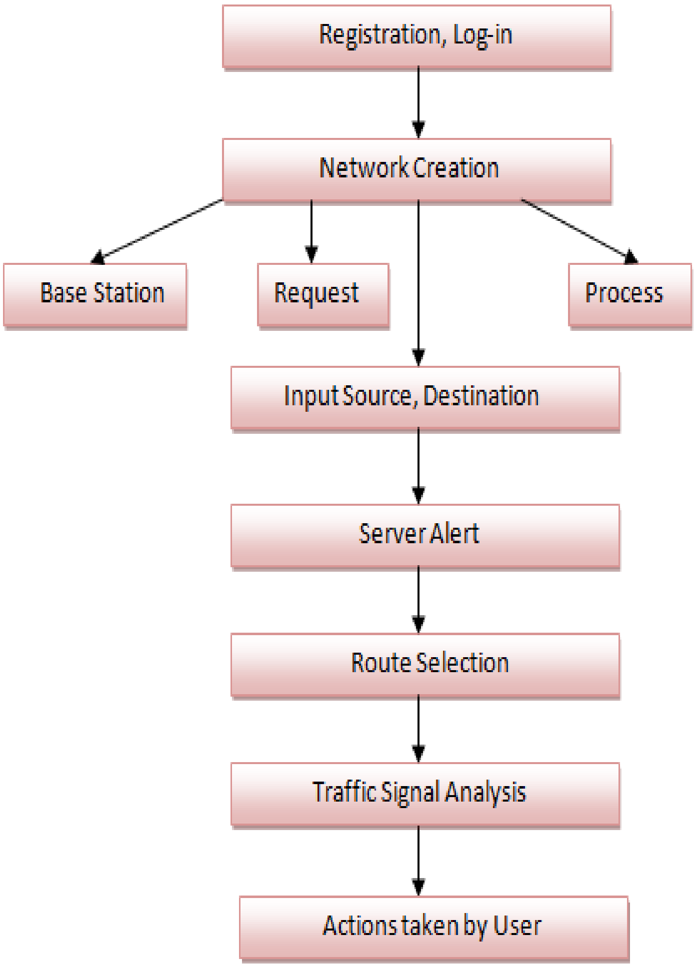

Figure4.1: System Architecture

System Description

Consider an isolated traffic intersection shown in Figure4.2. It is a typical four-leg intersection with eight traffic movement groups represented by the arrows. The numbered arrows show the directions of the various traffic movements. For this traffic intersection, we now describe the system architecture of the VANET-based traffic signal controller. In the single traffic intersection scenario, the traffic signal controller is connected to a wireless receiver that is placed at the intersection. The wireless receiver listens to information being broadcast from the vehicles.

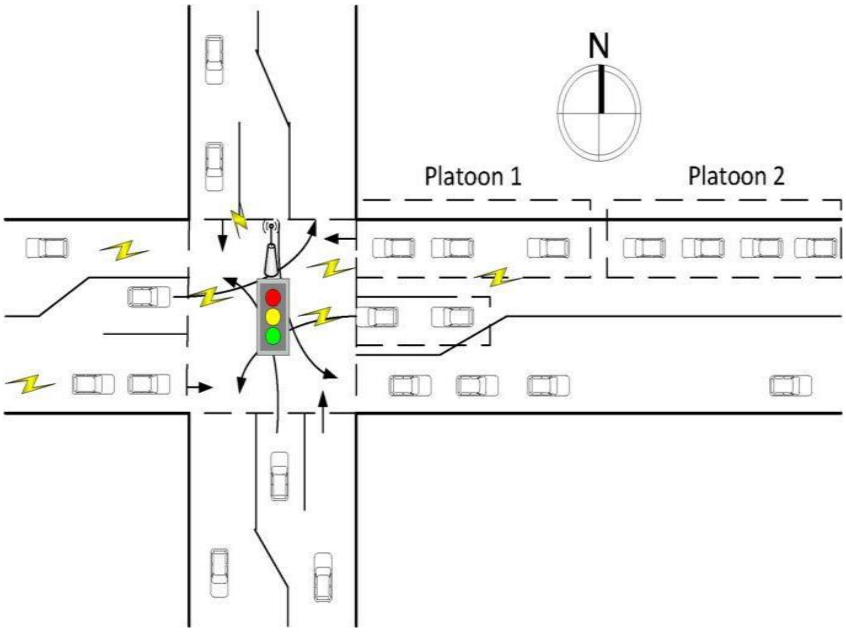

Figure4.2: VANET-based traffic signal control architecture.

A. Vehicle route construction

In this module, Route has many numbers of vehicles. Vehicles are connecting with other vehicles in all the route ways. Centralized server will maintain the vehicle details and status each and every vehicle movement required. Vehicles will give the request to centralize server and get the needed response from centralized server while moving one network to another one.

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B. Centralized Server Network Creation

A server is a collecting the vehicle details list i.e., running to serve the requests of every vehicles. Thus, the "Network/ Server" connect through the different network. Here the Centralized Server acts as the primary resource for the vehicles. Each vehicles information will be stored in the Server. Also the Server will maintain the route traffic information, So that the Vehicle/User can retrieve the information of the current area into wherever, where the traffic is occurred.

C. Delay Minimization

In this module, it uses both algorithms viz., Platooning and OJF. These algorithms are designed to minimize delay at traffic intersection.

D. Identify The Traffic And Accident

In this module, the server will identify the heavy traffic conditions or an accident is occurred by indicating the signal that was passed by the anyone of the Vehicle ID. So that the user can know that the traffic has been occurred in the specific path. Then the user will take an alternative route to reach their destination.

E. Alternate and best path identification

In this part, the user sends a request to the server regarding the source and destination information that they want to travel. The server will display the best path identification based on distance and time to reach the destination. By using this technique, the user can priory knows about the traffic in the specific location and takes alternate/best route to reach the destination.

Mathematical Model

Let S be a VANET system which will control traffic such that

$S = \{N, C, I, A, B, D, T \mid \varphi_s\}$

Where,

$N = \{n_0, n_1, n_2, n_3, \ldots, n_n \mid \varphi_n\}$

Represents the set of nodes
C = $\{c_0 \mid \varphi_c\}$
Represents central system
I = $\{i_0, i_1, i_2, i_3 \mid \varphi_i\}$
Represents signal
A = $\{a_0, a_1, a_2, a_3, \ldots, a_n \mid \varphi_a\}$
Represents traffic alert
B = $\{b_0 \mid \varphi_b\}$
Represents source
D = $\{d_0 \mid \varphi_d\}$
Represents destination
T = $\{t_0, t_1, t_2, t_3 \mid \varphi_t\}$
Represents time

The sequential algorithm will execute the function, registration 1 time to get the required result. The Function may contain the registration commands or relevant algorithms as per efficiency issues. Login will execute number of times. Network will be created one time. Signal data analysis, Server Alert, actions, route selection will execute number of times.

The following conditions are checked and decisions are made on the basis of this condition.
If n <maximum traffic limit then it will send alert
If n >time then increase the timer
If n >time then decrease the timer

State Representation:

Here we have given module name and its corresponding state name.
Registration: S0
Login: S1
Network Creation: S2
Select Source, Destination: S3
Route Selection: S4
Signal Data Analysis: S5
Server Alert: S6
Actions: S7

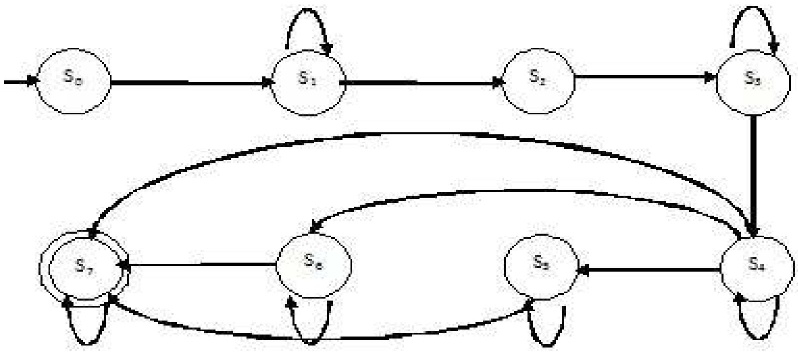

Figure4.3: State Representation

Figure 4.3 gives Representation and flow of states shown in Figure 4.1 which provide brief overview of our system.

V. ALGORITHM

Our system is divided into two main parts:

- Delay Minimization Algorithm for avoiding delays at traffic signal intersection.
- Providing analysis of routes on the basis of time and distance and providing alerts to the user

In Part I, we are using the following algorithms:

A. Platooning Algorithm:

For each approach k do
Configuration = IntegerPartitions(n)
for each platoon configuration i in Configuration do
for each platoon j in i do
Platoon_Green_Time[j] =Estimate_Green_Time(j);
Add Platoon_Green_Time[j] to the list
Config_Green_Time[i, k];
Min Diff = $\text{Min}_{i \epsilon k, k=\{1,\ldots,4\}}$ {max{Config _Green_Time[i, k]}-
Min{Config_Green_Time[i, k]} ;
Final_Platoon_Configuration=
Arg $\min_{i \epsilon k, k=\{1,\ldots,4\}}$ {max {Config_Green_Time[i, k]}-
Min{Config_Green_Time[i, k]}};

B. OJF Algorithm

Let a_i^r, $a_j^{r'}$, a_k^l *and* $a_m^{l'}$ be the earliest arrival times on each of the vertices of G';
While *r, r', l, l'* have jobs waiting, **do**
Let a_s^t be the earliest arrival time among a_i^r, $a_j^{r'}$, a_k^l *and* $a_m^{l'}$
Let S be the side of G on which vertex s lies;
For each vertex s' on side S in G', **do**
Schedule the job with the earliest arrival $a_t^{s'}$;

C. Analysis of Routes

In this, we are handling databases by linking source and destination through sequence of sub paths. Sub paths are linked to each stop with the help of sequence stored in the databases. Along with Sub paths, Distance, time and traffic conditions records are also stored in the database for respective entries. After specifying selected path by user, user will get alerted by current traffic conditions on that road by alerts on his mobile.

VI. RESULTS AND CONCLUSION

In this system, We are using VANET for reducing traffic problems. Vehicular Ad-hoc Networks has very vast application including collection and aggregation of real time information for individual vehicles to optimize signal control at traffic intersections. This system is intended to provide alerts to user with analysis of routes. We are using platooning algorithm and oldest job first algorithm to optimize delay at intersections. Due to accidents on roads, the roads become unavailable and driver may face a trouble to come back and by changing route, he has to find alternative path. Thus we are studying how a VANET can be used to aid in traffic signal control, including a new job-scheduling based online algorithm, the OJF algorithm.

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