Case Study on Various Traffic Control Systems

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Abstract--- Vehicular Ad Hoc Networks is a self-organizing, distributed communication network formed by highly Mobile Vehicles. This type of networks is developed as part of Intelligent Transportation Systems (ITS) to bring significant improvement to the transportation systems. One of the main goal of ITS, is to increase safety on road and reduce traffic congestion. This paper represents a review on various traffic system & working of vehicular adhoc network. After the review of traffic system and VANET it gives a survey on various techniques used in traffic system.

I. Introduction

During the last decades, the total number of vehicles around the world growing enormously. Especially in India traffic is growing four times faster than the population. Road safety has become a main issue for governments and car manufacturers in the last twenty years.

The development of new vehicular technologies has shifted companies, researchers and institutions to focus their efforts on improving road safety. The evolution in wireless technologies has allowed researchers to design communication systems where vehicles directly take part in the network. Thus networks such as VANETs are created to facilitate communication between vehicles themselves and between vehicles and road side unit. Vehicular ad hoc network (VANET) is a technology which uses moving cars as nodes in a network to create a mobile network [2].

New concepts like smart cities and living labs has emerged in the last years where vehicular networks play an important role. VANETs are getting attention due to the various important applications related to traffic controlling and road safety. Smart cities full of traffic would like to minimize their transportation problems due to the increasing population that results in congested roads. VANET helps to solve this issue by improving vehicles' mobility and also helps at having more safe and sophisticated cities. At the beginning of the development of vehicular technologies, the more focus was on building efficient and more safe roads. But nowadays huge development of wireless technologies and their application in vehicles, it becomes possible to use Intelligent Transportation System (ITS) that will change our way to drive and help emergency critical services.

VANET environment is consist of the vehicles(mobile nodes) in the route which are moving every time, RSU(Road side units),OBU's(onboard unit communication Links etc. On-Board Units (OBU's): It is a mobile device which is connected to the mobile node (vehicles) and used to transmit or receive data in adhoc network. RSU(Road side units): It is a fixed device placed anywhere within the range of adhoc network. Its function is to extend the communication range of adhoc network. It provides connection to OBU's and forwards data. Communication Link: In adhoc network there is a wireless link used to transfer data from one node to another node or from one unit to another unit.

II. Literature Review

An adaptive traffic light system is designed based on short-range wireless communication between vehicles. The system uses a GPS and Wireless communication system, based on a controller. Wireless node is placed at the intersection, which finds the optimized value for the different traffic lights phases..[4][5]

Intelligent traffic light control system is design which is based on traffic flow is and uses camera, video capture module, software based on DSP , traffic light controller module and various group of traffic light. Camera used in this system captures real-time images of the various intersections, main software processes this images captures by camera module, and finally the processed digital video signals will is transmitted to the main DSP module, this processed signal is used to calculate traffic flow. The main DSP module uses this video signals instantaneously controls traffic light through the data sent by traffic light controller module according to the flow of traffic at the intersection, and hence increases the no. of capacity of vehicles crossing through the intersection. The installation of system and its use are not necessary to contact lanes entity every time, easy to maintain. This system gives very correct detection of traffic flow and controlling traffic light will improve the intersection nodes crossing capacity, But as it uses hardware devices like camera and will increases the complexity as if the camera is not working properly and not capturing videos properly then the generated result will not give proper signal to the traffic controller module and this may create a problem and also the digital signal may take more time to process.[6,7]

An Intelligent transportation system (ITS) is the system which is widely used. ITS uses real-time forecasting of data. ITS uses various data forecasting model for forecasting data to their user. This real time data is a key for ITS system. This data need to be gather in every short term condition of traffic at different lanes or intersection .For the collecting this real time data forecasting models is used This forecasting models provides the ability to collect or gather this short term real data, and also supports proactive traffic transportation management and travel information services. This ability to gather and continuous update predictions of traffic flows and link times for several minutes into the future using real-time data is a major requirement for providing dynamic traffic control on traffic. There are various traffic – flow forecasting model has been developed in past few years that are listed below :state space model, neural network model kalman filter model time series model, Nonparametric model[8].

A. Time series model

Numerous of data in traffic system is in the form of a time series which is a collection of observations made sequentially, so this time series analysis model is a great tool for traffic flow prediction. A variety of application on digital computer enables us to consider the much more general such as an Auto Regressive model(ARM), Moving Average model(MAM), an Autoregressive Integrated Moving Average (ARIMA).In all these above model ARIMA models is the most general class of Model that are widely used for forecasting a time series data forecasting.

B. Neural network

Since the traffic flow data may have stochastic nature and the strongly nonlinear characteristics for short term prediction, hence most of the techniques of artificial intelligence can be used and considered as alternatives for the traditional statistic model. The neural network (NN) has been commonly used. Neural networks have been applied in a number of areas of transport including driver behaviour, vehicle classification and traffic forecasting .Mathematical theorems have proved that a three-layer feed-forward NN with sinusoidal units in the hidden layer. Can give approximate real-valued. Researchers have claimed that NN models are superior to traditional statistical models in forecasting future events. But sometimes it is not true.

C. Traffic System:

Basically Traffic control systems is classified as
1. Static Traffic system
2. Dynamic Traffic systems

1) *Static systems:* It consists of traditional pre-timed system. This kind of systems can provide efficient operation with the assumption that the signal timings reflect current traffic conditions. During off-peak times, traffic on major roadways often stop when there is little or no traffic on the cross streets. During peak hours the cycle timings don't adjust to the traffic flow thus creating traffic jams at the intersections

2) *Dynamic Systems:* This type of systems overcomes the problem of static traffic System. They are also called adaptive control system. These are similar to traffic signals based on responsive technique in which the real time data is used. This system uses an online computer in reducing the waiting time at the intersections. This adaptive control system is based on learning algorithms is proposed. This learning method with road-user based function to determine optimal decisions for each traffic light. This decision is based on a cumulative vote of all vehicles waiting at intersection where each car votes using its estimated gain of setting its light green. This way of co learning allows the driver to choose the route with lowest expected waiting time. This algorithm helps this algorithm helps in reducing the waiting time at the intersections [8] [9]

III. CONCLUSION

In this paper the various traffic control system, intelligent transport system is been discussed. Various traffic systems have various problems. To handle these problems a new system should be designed which should be adaptive in nature and handle the current traffic system.

REFERENCES

[1] European Network of Living Labs (ENoLL), http://www.openlivinglabs.eu/.
[2] Marc Emmelmann, Bernd Bochow, C. Christopher Kellum, "Vehicular networking: Automotive applications and beyond," John Wiley and Sons, 2010.
[3] Ferrari, G., Busanelli, S., Lotti, N., Kaplan, Y., "Cross-Network Information Dissemination in VANETs," 11th International Conference on ITS Telecommunications, pp. 351-356, 2011.
[4] Binbin Zhou, Jiannong Cao, Xiaoqin Zeng and Hejun Wu "Adaptive Traffic Light Control in Wireless Sensor Network based Intelligent Transportation System" , 2010,IEEE.
[5] Victor Gradinescu, Cristian Gorgorin,Raluca Diaconescu "adaptive traffic lights using car-to-car communication".
[6] WuHejun & Miao Changyun "Design of intelligent traffic light control system based on traffic flow",, 201O International Conference on Computer and Communication Technologies in Agriculture Engineering.
[7] Beijing, China Dongguan "A Survey of Urban Traffic Coordination Controls in Intelligent Transportation Systems", IEEE 2012.
[8] Josiane Nzouonta, Neeraj Rajgure, Guiling (Grace) Wang, Member, IEEE, And Cristian Borcea, Member, IEEE, "vanet Routing On City Roads Using Real-Time Vehicular Traffic Information "IEEE Transactions On Vehicular Technology, VOL. 58, NO. 7, SEPTEMBER 2009.
[9] Ovidiu TOMESCU1, Ilona Madalina MOISE2, Alina Elena STANCIU3,Iulian BĂȚROȘ4 "Adaptive traffic light control system using ad Hoc vehicular communications network", U.P.B. Sci. Bull., Series D, Vol. 74, Iss. 2, 2012 ISSN 1454- 2358.

