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Intelligent Traffic Control System and Analysis of CO_2 Emission Using Vehicular Ad Hoc Network

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Abstract - *India is experiencing terrible road congestion problem in its cities. This paper presents an intelligent traffic control system using Vehicular Ad Hoc Network (VANETs). VANET provides wireless communication among vehicles, with the help of this V2V communication, we provides many features which will helps to reduce road congestion problems by controlling vehicles automatically and warn the driver about the collision before it happens and provides clear way to emergency vehicle. This paper also gives analysis of how much CO2 Emits with same set of vehicles with multiple topologies. It is predicted that using such environment would solve the problem of road traffic congestion to a great extent.*

***Key Words*: Ad hoc network, CO_2 emission, communication, Traffic Control, Vehicles, Vehicle Safety**

1. INTRODUCTION

Now days, the absolute volume of road traffic affects the safety and efficiency of traffic situations. Around million people are killed each year in road accidents.

Road traffic safety has been a stimulating problem in traffic management. One probable way is to deliver the traffic information to the vehicles so that they can use them to analyze the traffic environment. It can be accomplished by exchanging the information of traffic situation among vehicles. All the vehicles are traveling in environment, hence a mobile network is needed which can be self-organized and proficient of operating without infrastructure support. With the evolvement of microelectronics, it becomes possible to add node and network device into single unit and wireless interconnection, i.e. an ad- hoc network. Additionally this network is evolved as mobile ad hoc network. Mobile Ad-hoc network is a wireless networks consisting of a collection of portable nodes with no static infrastructure, where some intermediate nodes should participate in forwarding data packets. MANET is composed of groups of self-organized wireless stations without a need to utilize any preinstalled infrastructure Vehicular ad-hoc networks (VANETs) are a sensational and growing field of study. There are many possibilities of using ad-hoc communication between vehicles for information distribution, safety, or even entertainment. These likelihoods, driven in the United States by the Department of Transportation Intellidrive initiative, have launched many different lines of research.

Due to the budget of vehicles and equipment, nearly all of this research has been done using simulation. However, the current collection of simulators widely available either wholly splits the vehicle and network stages of the simulation or overgeneralizes either the vehicle or networking simulation. The German Aerospace Center (DLR) ongoing the development of the open source traffic simulation suite SUMO back in 2001. Since then SUMO has progressed into a full featured suite of traffic modeling utilities including a road network capable to read different source formats, demand generation and routing utilities from various input sources (origin destination matrices, traffic counts, etc.), a high performance simulation usable for single junctions as well as whole cities including a "remote control" interface (TraCI) to adapt the simulation online. SUMO is not only a traffic simulation, but rather a suite of applications which help to prepare and to perform the simulation of traffic. As the traffic simulation "sumo" needs the representation of road networks and traffic demand to simulate in an own format, both have to be imported or generated using different sources[10].

2. LITERATURE SURVEY

As per the survey we came to know that traffic congestion is a main problem in cities of developing countries like India. Evolution in urban population and the middle class sector contribute ominously to the rising number of vehicles in the cities [1]. Congestion on roads eventually results in slow moving traffic, which escalate the time of travel, thus stands out as one of the key issues in metropolitan cities. In [3] an intelligent traffic control system to pass emergency vehicles smoothly is developed. Each individual vehicle is equipped with distinct radio frequency identification (RFID) tag (placed at a strategic location), which makes it difficult to remove or destroy. They use RFID reader, NSK EDK-125–TTL, and PIC16F877A system on chip to read the RFID tags attached to the vehicle. They use ZigBee modules on CC2500 and PIC16F-877A system on chip for wireless communications between the ambulance and traffic controller.

In [2] a vehicle driving system in a model analytical control structure that efficiently improves traffic flow. The vehicle driving system regulates safe inter vehicle distance under the bounded driving turning condition by predicting the preceding traffic. It also focuses on improving the effect of braking on the vehicles that follow. Traffic is a perilous issue of transportation system in most of the cities of various countries. This is especially factual for countries like India and China, where the population is growing at higher rate. For example, Bangalore city, has observed an incredible growth in vehicle population in recent years. As a result, most of the roads and intersections are operating over the capacity (i.e.,v/c is more than 1) and average journey speeds on some of the key roads in the central areas are lower than 10 Km/h at the peak hour [3], In [4] we studied the use of RFID traffic control to avoid problems that usually arise with standard traffic control systems, specifically those related to image processing and beam interruption techniques are discussed. This RFID technique deals with multivehicle, multilane, multi road junction areas. It provides an efficient time management scheme, in which, a dynamic time schedule is worked out in real time for the passage of each traffic column.

[5] In this paper, we studied vehicle-to-vehicle (V2V) communication technology to implement computationally efficient decentralized algorithms for two-vehicle cooperative collision avoidance at intersections. Our algorithms employs a formal control theoretic methods to guarantee a collision-free (safe) system, whereas overrides are only applied when necessary to prevent a crash. This work is to provide an experimental validation of our method on two instrumented vehicles engaged in an intersection collision avoidance scenario in a test track. Vehicular Ad hoc Networks (VANETs) are the promising approach to provide safety and other applications to the drivers as well as passengers. It becomes a key component of the intelligent transport system. A lot of works have been done towards it but security in VANET got less attention. In this article, we have studied about the VANET and its technical and security challenges. We have also studied some major attacks and solutions that can be implemented against these attacks. They have compared the solution using different parameters [6].

At [7] present a predictive road traffic management system (PRTMS) based on the Vehicular Ad-hoc Network (VANET) architecture is available. The proposed PRTMS uses a novel communications scheme to estimate the future traffic intensities at different intersections based on a modified linear prediction algorithm. Based on the prediction, a central controller reduces the congestion level by rerouting the vehicles and adaptively changing the signaling cycles. An IEEE 802.11p based vehicle to infrastructure communications system is used to collect trip information and transmit control signals to enforce multi-junction traffic flow control. Simulations are conducted using an integrated OPNET model comprised of road infrastructure, vehicular mobility management and communications networking to jointly examine the performances of the proposed PRTMS and the VANET. [8] In this article they collect envisioned application from various sources and classify the unique network characteristics of vehicular networks. Based on this analysis they propose distinct communication patterns that form the basis of almost all VANET Applications. Communication patterns like Beaconing, Geobroadcast, UnicastRouting, Advanced Information Dissemination, Information Aggregation out of these communication patterns we are using geobroadcasting and information aggregation. In [9] this paper, they developed a client to make SUMO and NS3 work parallel by TraCI (Traffic Control Interface) in NS3. It helps NS3 get SUMO's information and sends instructions to change the states of vehicles and traffic lights. They present a realistic road traffic model with kinds of vehicles and intelligent traffic lights. The model is built in SUMO (Simulation of Urban Mobility). We use Open Street Map to generate a realistic map near the bund in Shanghai. The traffic flow is built according to a survey which makes us get meaningful and reliable statistics. A mechanism of changing the traffic lights dynamically is introduced to minimize traffic jams and give high priority to emergency vehicle.In 11] we studied about SUMO simulator i.e how to install it, basic needs to run simulators, also studied about how to build network. After this we decided to use SUMO simulators as platform.

3. PROPOSED METHODOLOGY

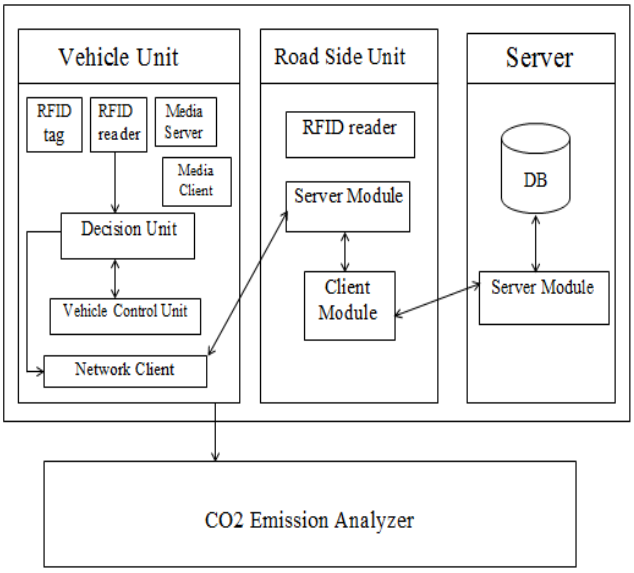

Fig1: System Architecture of Proposed Concept

The block diagram of the proposed methodology to be used is explained in Fig1 above.

Vehicle Unit

Vehicle Unit is a device usually mounted in a vehicle used for exchanging information with Road side units and other Vehicle units. It Consist of RFID Tag, RFID Reader Media Server Media Client, Decision Unit, Vehicle Control Unit, Network Client. RFID Reader is used to read RFID signals these signals send to the decision unit to take the decision according to that Vehicle will perform the action. This information will be shared with Road side unit through Network client. It also includes Media Server and Media Client for entertainment purpose e.g to watch youtube videos, Google Map e.t.c. The main function of Vehicle Units is wireless radio access, ad-hoc and geographical routing, network congestion control, reliable message transfer, data security and IP mobility.

Road Side Unit

The RSU is a wave device usually fixed along the road or in dedicated locations Such as at junctions, at Traffic signal, or near parking spaces dedicated for short range communication based on IEEE 802.11p radio technology , and can also be equipped with Infrastructure Network. Main function of RSU is as under

- Extend the Communication Range.
- Providing Safety application such as accident warning.
- Provide internet connectivity to Vehicle Units.

Server Unit

Server contains database (memory database) and Server Module. It will store RFID Tags of Each vehicle. This also helps to track the stolen vehicle. Server module fulfills the request coming through Client Module from road side unit.

CO_2 Emission Analyzer

Here we analyses how much CO_2 emits with same set of vehicles on different topologies which will help to reduce CO_2 emission and to build the alternate route.

We proposed to develop the following intelligent vehicle safety applications

1) V2V Communication

Provide Information about vehicle which is in communication range. Transmitted messages common to all vehicles include each vehicle GPS position, vehicle speed, path history, Acceleration and vehicle control information like brake status, steering, vehicle angle.

2) V2V Interoperability

When crash is predicted the vehicle will provide warning to driver. Driver remains in control all the time and vehicle will not automatically break or steer.

3) Emergency Speed Control

Automatic speed control when hard breaking vehicle detected.

4) Unsighted Spot Vehicle

When driver attempt to change lane with the vehicle which is still in his unsighted spot at that time the unsighted spot warning safety will lets the driver know that there is vehicle that may not be visible positioned. And make him aware about the presence of the vehicle

5) Lane Change Warning

When driver intends to change lanes into zone that will soon be occupied by a faster moving vehicle traveling in the same direction, using this v2v communication our vehicle will predict that and gives the warning message to driver i.e NOT Safe to change the Lane.

6) Forward Collision Warning

It will warn driver if he is approaching too quickly , and is in the potential rear end crash with stopped or slower moving vehicle ahead.

7) Do Not Overtake

You are moving behind slow speed vehicle and you want to overtake that vehicle, same time faster passing vehicle come in zone immediately warning message gives to driver i.e It is UNSAFE to pass.

8) Intersection Movement Assist

Warning is provided to driver if it is unsafe to enter into the intersection. Here Left Turn Assist Application also provided.

4. CONCLUSION

This proposed methodology is aimed to acquire intelligent control over traffic and as vehicle having automotive control over it by emergency speed control, warn before lane change, forward collision warning etc. it will diminish the roadside accident; provide the clearance so that emergency vehicle can go smoothly. Emergency vehicles like ambulance, fire trucks, need to reach their destinations at the earliest. If they spend a lot of time in traffic jams, precious lives of many people may be in danger and analyze how much CO_2 emit on from particular road condition and vehicle as well.

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