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Research paper

Efficient communication in VANET

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Abstract

Traffic safety is a major challenge in the automotive industry. As vehicular ad-hoc networks (VANET) plays a vital role in road safety. Day by day the number of vehicles increases, which lead to road traffic and many other problems so to solve this there must be an efficient communication between the vehicles. In this paper, we study the existing address configuration and propose a scheme for efficient communication in vehicular networks.

Keywords: *VANET; Address Configuration; Efficient Communication; Cognitive Radio.*

1. Introduction

With the increasing demand for vehicles, the road traffic is a very important issue which we have to solve. To this vehicular network must be connected to the internet. Each vehicle has its own internet protocol address version 6 (IPv6). The vehicular network is the combination of the moving vehicles which have a very high speed.These vehicles communicate with each other, but the range of communication is from 100 to 900 meters [1] and uses 802.11p standard and describes MAC and PHY specifications for wireless connectivity[2]. The Vehicular network system contains road side units which basically work as routers and connected to the on-board units. OBUs are the devices in every vehicle which have the communication capabilities.The OBUs and RSUs forms the ad-hoc domain [3]. The RSU is also connected to an infrastructure which in turns connected to the internet.

With the growth in the demand for vehicles, there is need of more addresses which is possible by using IPv6. It is the 128-bit address means we have 2^{128} addresses and the addresses are 7.9×10^{28} times more than IPv4 addresses. There are two types of configuration for IPv6 used in internetwork which are as follows:

1) Stateless
2) Stateful

In the Stateful configuration, DHCP is used which is dynamic host configuration protocol contained the pool of addresses. Every vehicle has OBUs. These OBUs are classified as normal OBU and leader OBU. The leader OBU is equipped with DHCP, which is responsible for assigning the IP address to normal OBUs.

In the stateless configuration, there is no need of any DHCP server, the devices are automatically assigned an address with duplicate address detection and make the uniqueness of the address .When vehicles are connected to the internet there are three problems occur:

1) Address configuration problem.
2) Efficient communication between the vehicles.
3) Mobility mechanism for the vehicles.

This paper focuses on the problem of communication between the vehicles.

2. Related work

In [4] Wang et al. propose a scheme which solves the problem of address configuration. This scheme uses both stateless configuration and the stateful configuration. Stateless configuration using DAD which increases the cost and delay, but in his proposed work the cost and the delay are reduced by stateful and the DAD is used in road -side instead of the network, reduces cost and delay.

S. Rehman [5], focuses on the state –of-the-art of the VANET and discuss the network architecture, signal modeling and propagation mechanism, mobility modeling, routing protocols and network security in detail.

M.Gramaglia [6], focus on IPv6 address auto-configuration, which is required for vehicles to connect to the internet. Vehicles for communicating each other are dependent on the availability of multi-hop to the fixed infrastructure, so under different circumstances analyze the probability of achieving this connectivity.

In [7], when a vehicle is moving fast on a highway, the handoff process occurs so to reduce this handoff and maintain the connection of vehicles to the internet is an important issue .This handoff may be reduced by the existing IP passing protocol, but if the number of the vehicles is low or the speed is changing then due to network fragmentation the handoff delay is increased and packet loss is also increased .To improve the existing IP passing protocol Y.S.CHEN et al. propose an IP passing protocol, which extends the time to release

the DHCP IP addresses and the new addresses for vehicles are quickly generated. This protocol reduces the handoff and maintains the internet connectivity.
X. Wang, [8] proposes an IPv6 address configuration scheme for a VANET (Vehicular Ad-hoc Network). This paper focuses on the architecture of VANET and based on that architecture proposed IPv6 address configuration scheme.

3. Cognitive radio

Cognitive radio is a form of wireless communication which intelligently detects the unused spectrum by sensing. We have two types of cognitive radio.
Fully cognitive radio
Spectrum sensing cognitive radio
In Fully cognitive radio user adapts all transmission parameters like bandwidth, coding,center frequency, etc., but it is not used for the practical purposes because it seems too complicated.
Spectrum sensing cognitive radio is a type in which user uses not all transmission parameters, but only focus on transmission frequency, bandwidth and time. The transceiver intelligently detects the spectrum if it there is no active user it is occupied by another user. This type of cognitive radio is often called Dynamic Source Access (DSA) [9].

4. Methodology

Firstly, we create a VANET scenario by initializing various nodes (these nodes are vehicles) and road -side domain which basically acts as a router between vehicles and the other networks. For an IP address configuration, we use stateful address configuration in which we have a DHCP server responsible for assigning the IPv6 address automatically to each node.
For the better communication, we use the MAC address of nodes instead of IP addresses which are moving and on the basis of the location of every vehicle is traced because the MAC address is unique for every vehicle we securely trace the location by using RSUs.
After that cognitive radio senses the spectrum, which is free to use. Cognitive radio has the capability to transmit data at high speed and for long distance transmission[10].
As for short range communication, VANET uses the 2.54 GHz frequency band, but by using this we increase the range of communicating VANET networks. The vehicles which are very close to each other they are using 2.54GHz frequency band, but the vehicles which are very far they are using DSA so that the emergency message will send for RSUs which in turn connected to the internet and leads to secure communication.

5. Simulation

In the simulation, we use NS2 software to find the Performance of proposed work.We use IEEE 802.11p for MAC layer protocol. The parameters on the basis of which we evaluate the performance are as follows:

1 .Delay
2. Packet delivery ratio
3. Throughput

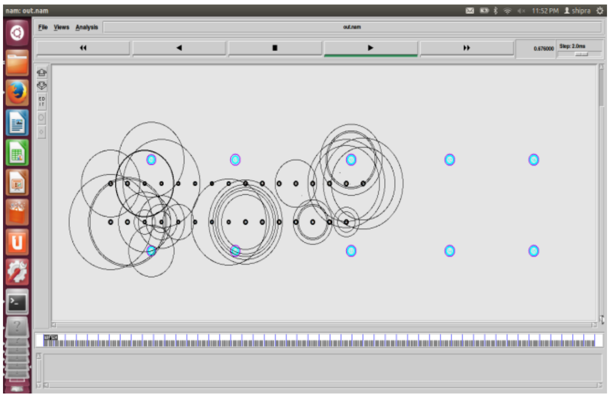

Fig. 1.1:

Fig 1.1 shows the VANET scenario. The RSUs (blue colored dot) are communicating with vehicles and contains the information about the number of nodes or vehicles, location of these vehicles by their MAC addresses and on the basis of its, vehicles can get information about their neighbour vehicles.

Delay: It can be defined as the time taken by packets to reach their destination. The x-axis shows the mobility of vehicles and y-axis shows the delay. Fig 2.1 shows the delay of proposed work (red color) is less than the delay of previous work (green color).

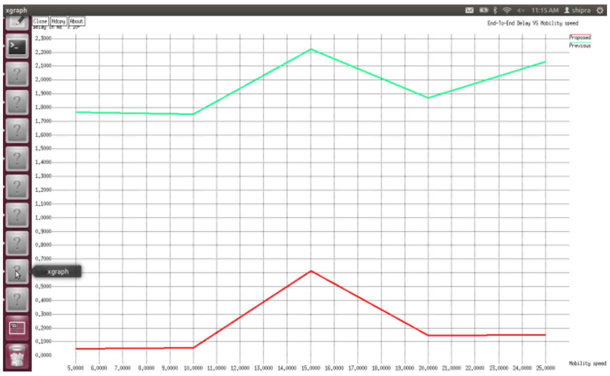

Fig. 2.1:

Fig. 2.2:

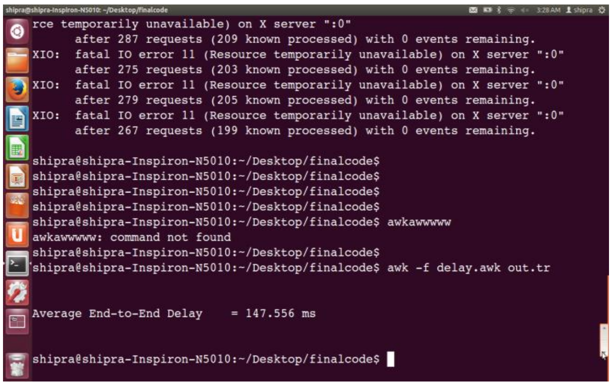

Fig. 2.3:

Fig 2.2 and Fig 2.3 shows the difference in the delay of previous work and proposed work which is very less as compared to the previous work.

Packet delivery ratio:It can be defined as the ratio of packets reaches to the destination to the number of packets sent over whole communication. In Fig 3.1 the x-axis shows the mobility of vehicles and y-axis shows the packet delivery ratio. The red colored line shows the packet delivery ratio of proposed work which is greater than the previous work (green colored).

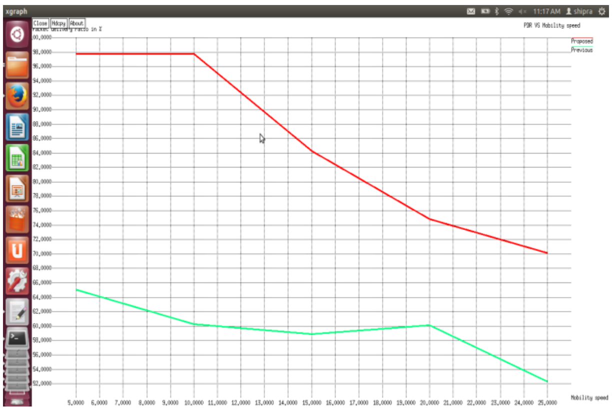

Fig. 3.1:

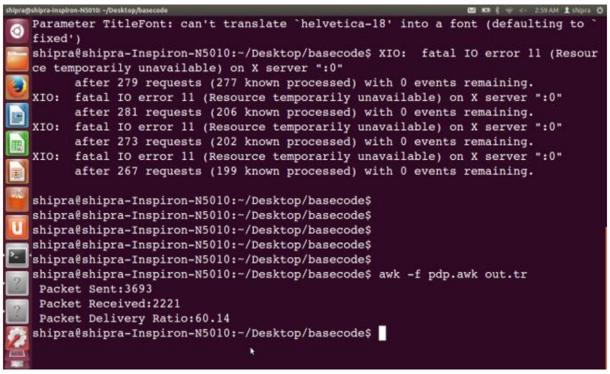

Fig. 3.2:

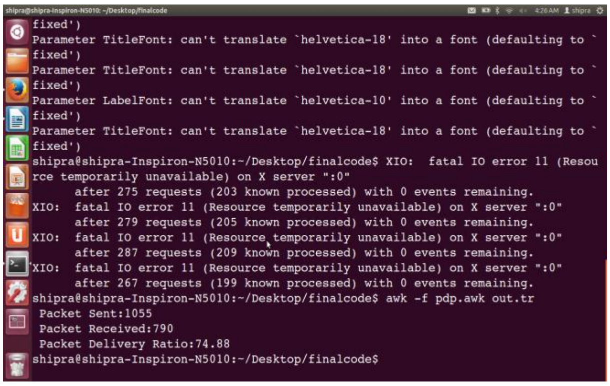

Fig. 3.3:

Fig 3.2 and 3.3 shows the difference in packet to the delivery ratio of the previous work and our proposed work packet to the delivery ratio.

Throughput: It shows the number of successful packets received per unit time. In Fig 4.1 the x-axis shows the mobility of vehicles and y-axis shows the throughput. The red colored line shows the throughput of proposed work which is greater than the previous work (green line).

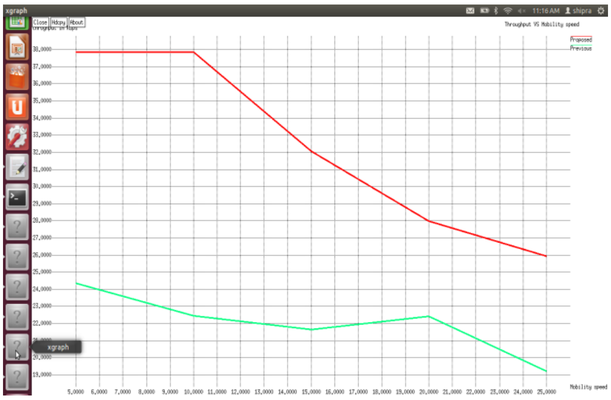

Fig. 4.1:

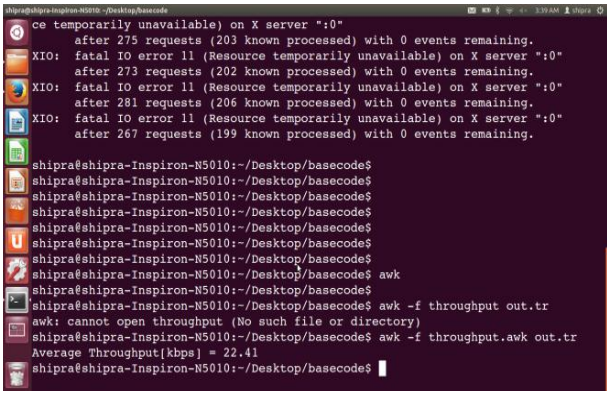

Fig. 4.2:

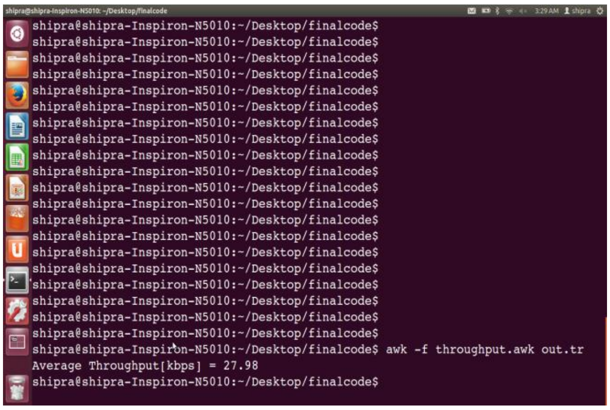

Fig. 4.3:

Fig. 4.2 and Fig. 4.3 shows the difference in throughput of the previous work and our proposed work.

6. Conclusion and Future scope

VANET is the extension of MANET but VANET has high movability than MANET and vehicles can use the 2.54 GHz band for communicating each other and it is for short range communication. In the proposed work we can efficiently communicate with the vehicles which are far from each other so that vehicles can securely move and there is no chance of any accident. On the basis of different parameters, we conclude that our results are better.

For the future work, we will focus on the third issue and enhance the efficiency of vehicular networks through intelligent transportation.

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