An Approach to Reduce Vehicular Traffic Data Dissemination Delay using VDDRA (Vehicular Destined Resolution Algorithm)

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ABSTRACT

Recent advances made in Vehicular Adhoc Network indicate its capability of improved passenger safety by efficiently handling vehicular traffic. It demonstrates capability to handle a large capacity of vehicles on roads ferrying within city limits mostly consisting of light weight vehicles. Albeit on national highways this load is not because of light vehicles but because of heavily loaded vehicles that ultimately creates a highly accident prone area, VANET (Vehicular Adhoc Network) still demonstrates it's powerless. VANET needs only sufficient bandwidth and updated yet reliable, traffic and current road situation data through various Adhoc points to work. This accumulation and transmission of data is a very complex task as the nodes are mobile in nature and communication network is also very much affected by environmental conditions. This paper comprehensively discusses various research challenges in this information transmission technique. An approach for improving the quality of data transmission at various nodes in the network is also presented.

KEY WORDS: ROUTING, DISSEMINATION, MOBILE NODES, ETC.

INTRODUCTION

With the advancements in computer and communication networks, study on VANET (Vehicular Adhoc Network) a technology for connecting daily life movements with the advance networks has also gained momentum. In conventional transportation technique i.e. roads, the commutation time is highly dependent on traffic conditions and road conditions that may or may not be favourable as well as predictable under certain circumstances. Thus, VANET could play a very important role in this as well, as it is a communication network

created with the help commuting vehicles wherein the vehicle can be of any type and size. As shown in figure (1) mobile node communication network can be developed using commuting vehicles and road infrastructure.

In this network one mobile node (moving/stable vehicle) can communicate with another mobile node (moving/stable) which is in its radio transmission range. Also the node can communicate with road side transmission infrastructures. This "VANET" demonstrates an ability to make a transport system an Intelligent Transport System (ITS). This intelligent system is widely dependent on acquired infrastructure and mobile nodes which can use a very large bandwidth of electromagnetic waves. These sensors are deployed at various intersections of roads/rails. Radio Frequency sensors can also be used to detect and transfer information by integrating them in cameras to detect the movement of vehicles. A mobile node will consist of various communication devices like cell phones to receive or transmit data. Hence a cellular network can be used to transmit traffic data to a particular user if required.

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Figure 1: Working of Vehicular Adhoc network

Figure 2: Hybrid VANET Structure

The main applications of VANET can be categorized as: Safety applications: pre-collision warning, electronic road signs, traffic light violation warning, online vehicle diagnosis and road condition detection, etc. Various other applications of VANETs are in Government oriented traffic managements systems, Congestion detection in high traffic regions, Traffic Route planning systems, National highway tolling systems, Public Transportation system, etc.

2. Recent Wi-Fi Technologies and VANET: VANET involves efficient use of wireless networks and hence by using an advanced Bluetooth technology one node/ communicating device can be connected to another device through vehicular functionality just like an audio system. An example is a driver who can connect to another vehicle driver whether stationary or moving. WAN, Wireless MAN, WiMAX standards have been introduced in IEEE standard 802.11 for fast and accurate transmission of data between vehicles usually cellular network. Future predicts advanced architecture of VANET that can become hybrid structures as shown in figure (2)

As shown in figure 2 this structure is capable of providing a very long distance communication using mobile networks such as WIMAX. Dedicated Short-Range Communication (DSRC) and wireless-fidelity (Wi-Fi) are capable of facilitating short range communication using vehicular network and has advantages of being less costly and dynamically connective.

3. Research Challenges in VANET: Implementing VANET presents a lot of challenges but prominent amongst them

are the complex issues that occur in VANET networks. A complex challenge in implementing VANET is restructuring of a network layer protocol so as to support VANET. The unique properties of vehicular network are to be explored to solve various other design challenges which in turn can also solve various ITS (Intelligent Transport System) problems.

3.1. Link Layer Challenges: The main issue to be dealt in this layer is of adapting to current vehicular environmental condition i.e. being dynamic while being responsiveness, reliable and scalable. Also MAC Management is inefficiently lengthy here. Appropriate Link layer protocol can improve drastically the data packet forwarding performance in VANET.

3.2. Application Layer Challenges: In application layer challenges lie in representing, discovering, storing and updating information in the complete network. Addressing and naming of data packet is a main issue in application layer. The naming and addressing strategy has a significant impact on other framework conventions, such as data revelation and routing. Because vehicles are exceptionally mobile, another challenge is to dynamically map vehicle IDs to position-based addresses. This issue is particularly important for applications incorporating hybrid design.

3.3. Dynamic Data Dissemination: VANET being a data-centric network, data transfer or data collection through it is a very challenging task as the network portability is completely dependent on the traffic on data network. Any error in data received or transferred by the source or destination is not desirable. Information dissemination can be classified into two levels.

3.3.1 Macroscopic Data Dissemination: This type of dissemination deals with the transmission of data from one mobile node to another mobile node within a specified geographical area. Here the source or destination can be single mobile node or a group of known/unknown mobile nodes. This type of data dissemination should reduce data transfer delay, reduce delivery overhead but enhance the future enquiry success rate. This type of data transmission presents a specific research challenge that of routing of data in network, storage of data to be transferred or received and data segregation .

3.3.2 Microscopic Data Dissemination: This type of dissemination deals with data delivery by one or more than one hop. The data dissemination is processed through Wi-Fi links. It also deals with local multiple-hop communication in which multi-hop works as a co-coordinator between local vehicles and the specified direction of data transfer. For this it uses vehicular traffic based algorithm to transfer the data packet to

the specified vehicle by following a specific path or direction.

4. Proposed Methodology (VDDRA): Figure (3) presents block diagram of proposed Vehicle Destined Data Resolution Algorithm (VDDRA) that can be used to reduce data dissemination delays and other problems.

In Macroscopic data dissemination method one node can transfer traffic data to one or a group of known or unknown nodes. A node in VANET can be a mobile node and may become out of reach while the data transfer is being done thereby causing unnecessary delay.

Table 1. Comparative Analysis of Already Existing Methods

Sr.No	Name of Method	Technique Used	Advantage	Disadvantage
1.	Traffic Dynamic Data Dissemination Protocol (TDDDP)	It works on Broadcast Data Suppression technique based on time slot scheme to disseminate data between mobile nodes & Buffer a & Carry forward mechanism for choosing appropriate mobile node to fill the gap interconnection between various disconnected mobile network.	1. Data Disseminations is very fast. 2. Always has a connected network for data transfer.	1. Extra storage space is required for data buffering before dissemination.
2.	Network Opportunistic Data Dissemination Method	Centric data dissemination method is used where a Cluster head node will broadcast data periodically and all the mobile nodes passing through the network range will receive the data.	1.This technique is most suitable for highly dynamic traffic network. 2. No Infrastructure is required.	1. Periodically data updation is required in cluster head node. 2. As all the nodes will receive and store data, extra data dissemination overhead management is required. 3.Efficient Periodic updating in highly traffic area is required otherwise collision of data may occurred a lot.
3.	Data Push Based Data Dissemination technique	Central Data Dissemination method is applied here. It works on 3 steps: 1.Collects the data from network in the center head system 2. Then a list of data items is created that is to be delivered in the network. 3.Then data consist of Header information (source id, source-location, data forwarding information, data packet generation time etc) is transmitted to the road side unit(RSU)	1. Central data management is very easy to handle. 2.False Data packet transmission is easy to detect. 3.Error detection and elimination is very easy.	1. Central management required extra management system. 2. If center head crashes over-all the network performance will get affected.

4.	Buffering and data pouring Data dissemination (BDPDD) Method	This technique is based on Relay and broadcasting station. It works on scheme called as Data Pouring (DP-Scheme) which selects the very high density traffic consisting road and then transmitting the data not only that roads but also on nearby cross roads.	<ol style="list-style-type: none"> 1. Rely station present in specific area has ability to update themselves by their own ,hence no extra overhead is there in center head. 2. Central data transmission is very easy to manage. 3.Data disseminated is stored in IBER (Station) hence data recovery during network failure is very easy. 	<ol style="list-style-type: none"> 1. Rely stations includes extra cost in network management. 2. Buffer is required to stored data delivered by center head.
5.	Data Dissemination based of Data Pulling method	This technique is used by only some specific users for getting some specific response form the mobile node. Data dissemination is managed by center head and all mobile nodes moving in the road with in a network range. Bacon message transmission scheme is used here known as token message transmission. All vehicle in the network must be fully equipped with digital devices, maps,traffic details.	<ol style="list-style-type: none"> 1. Advance digital devices give more reliability and capability to operate accurately in very high traffic density. 2. It has Good Performance capability. 3.Central data management gives easy management of network in high network density. 	<ol style="list-style-type: none"> 1. Use of advance digital devices add more network cost. 2. Beacon message transmission needs more memory to store data packets.

Figure 3: Block Diagram of Proposed Methodology

In our proposed methodology as shown in figure 4, a group of known/unknown nodes will disseminate traffic information to some destined mobile nodes moving in coverage area to initiate communication between them and then to the desired destined node/nodes. The basic requirement for this would only be a very high speed network and proper identity of nodes. Hence this proposed methodology may be applied to road side units whose identity are known or can be marked easily

as compared to moving vehicles wherein it needs to be incorporated which is a tedious task but possible.

CONCLUSION

Research advancements in Vehicular Adhoc network (VANET) gives more promising solutions to solve many problems related to traffic and accidents in current situation. Appropriate study and advancements in it could be the next promising area paving a path for futuristic ITS. Vehicular Adhoc network however has various data dissemination protocols with their advantage and disadvantages. Our proposed data dissemination method Vehicle Destined Data Resolution Algorithm (VDDRA) when implemented completely in future will overcome the disadvantage of data transmission delay and central data management cost. In our proposed system the data will be transmitted only when the mobile node will present in coverage area else data will not be disseminated in the network, thereby regularizing routing of traffic information as well as traffic congestion as well. Thus proposed VDDRA (Vehicle Destined Data Resolution

Algorithm) will reduce the traffic data dissemination between the various vehicular communication nodes.

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