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REVIEW ARTICLE

A Review on Delay Optimization in Vehicular Ad Hoc Networks Using Ant Colony Optimization and WIMAX

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Abstract— This paper presents an approach for delay optimization in Vehicular ad hoc networks using Ant Colony Optimization and WIMAX technology. Several techniques have previously been proposed for optimizing the load and making routes more scalable to avoid collision for end to end communication between vehicles on highways to ensure that vehicles perform safety communication between each other. No technique can solve all types of problems, but some techniques are better than others for specific situations. This paper reviews ant colony optimization as well as WIMAX technology for optimizing load by making Collision Warning System Model in vehicle to vehicle to avoid collision in traffic full area by broadcasting the alert message between vehicles and finding the better result. This served as the major contribution of this paper.

Key Terms: - Vehicular Ad Hoc Networks; Ant Colony Optimization; WIMAX; Collision Avoidance

I. INTRODUCTION

Optimizing load and making routes more scalable between vehicles by broadcasting alert messages among vehicles by using Ant Colony Optimization and WIMAX technology presents a new challenge. The collision warning can be trans-formed in various ways.

VANET like MANET provides the objective of providing useful communication among an absolutely formed collection of vehicles that are geolocated. It requires reliable packet transmission but rapid topology changing and regular disconnection makes it difficult to design an efficient routing protocol. The main characteristic of VANET is high speed of network nodes. VANETs are classified by very high node mobility with limited degrees of freedom in mobility patterns. Thus VANET plays a very important role in the field of load optimization and collision avoidance. The load optimization and collision avoidance techniques for vehicular ad hoc networks can be grouped into two broad categories: Ant Colony Optimization and WIMAX.

Inter-Vehicular Ad Hoc Networks does not have a fixed network topology because wireless links are established and broken down due to certain factors such as velocity of vehicles, their mobility patterns and spatial density and these high dynamics can cause very short times for data transfer. So, Collision Avoidance is done in it by defining a critical “Inter-Vehicular Distance to be maintained between and any two vehicles on highways.

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Ant Colony Optimization

Ant Colony Optimization has the potential to optimize the existing AODV protocol to broadcast alert messages among vehicles using ant's behavior to optimize load and make routes more scalable. This technique is used for "hard" problems that can be reduced to finding optimal paths through graphs. Ants act like mobile nodes in MANETs and create paths dynamically. Ants communicate by modifying their local environment (laying pheromone). The level of pheromone in ACO indicates the quality and cost of path .Ant Colony Optimization is used in the field of robotics, operation research and telecommunications. ACO Meta heuristic is a multi-agent framework for combinatorial optimization. It finds its route in the experimental observation of a specific foraging behavior of some ant colonies to select the shortest path among few possible paths. It solves dynamic problems of adaptive routing in telecommunication networks. It defines complete state information to take optimized decisions to encode in pheromone variables memory of both decisions.

Worldwide Interoperability for Microwave Access (WIMAX)

WIMAX is an IP based, wireless broadband access technology to provide performance similar to 802.11/Wi-Fi networks with QoS of cellular networks. It is a wireless communications standard designed to provide 30 to 40 megabit per second data rates. It was created by WIMAX Forum to describe WIMAX as a standards-based technology providing the delivery of wireless broadband access as an alternative to cable and Digital Subscriber Line. WIMAX operates on both licensed and non-licensed frequencies, providing a modulated environment and possible economic model for wireless carriers. WIMAX is often iterated to have a spectral efficiency of 5 bps/Hz good in comparison to other broadband wireless technologies, especially 3G.

II. RELATED WORK

Robert Eigner (2008) and et al [1] Collision Avoidance in VANETs: An Application for ontological context models is an active research area for many years. A Huge variety of sensors is built into vehicles enabling them to obtain a view of their surroundings based on locally observed data. Data is broadcasted and information is collected in order to improve the own picture of the current situation with VANETs. This approach to context modelling and collision avoidance application is proposed to show the benefit from advantages of ontological models like distributed composition, partial validation, richness and quality of information. Two different scenarios with different context models show the advantages of ontologies with respect to extensibility of models which do not necessarily increase the execution times.

Neeraj Rajgure (2009) and et al. [2] VANET Routing on City Roads using Real-Time Vehicular Traffic Information. The proposed method is based on class of routing protocols called road-based using vehicular traffic routing (RBVT) routing in city based vehicular ad-hoc networks which supplies real time vehicular-traffic information to create road-based paths consisting of road intersections. Geographical forwarding is used to transfer packets between intersections on the path by reducing the sensitivity of paths to movements of individual nodes. So, the forwarding using a distributed receiver-based election of next hops based on multi criterion prioritization function to take non uniform radio propagation is optimized for dense networks with high contention.

In 2009, Samer Bali and et al [3] Investigation of Vehicle-to-Vehicle Communication in a Road Intersection. The vehicle-to-vehicle communication in a city road intersection using the simulation of ns-2 simulators has been investigated in this paper which focuses on sending information about the intersection from a node which may take several types of data such as voice, image, or video with different parameters such as number of vehicles, maximum speed of vehicles, and number of sent data packets which has better performance in terms of routing overhead and end-to-end delay.

Omar Cherkaoui (2011) and et al [4] Mobility-Aware Ant Colony Optimization Routing for Vehicular Ad hoc networks. This paper proposed that Vehicular Ad hoc Networks (VANETs) are a special type of Mobile Ad hoc Networks (MANETs), made by vehicles communicating among themselves, and by vehicles communicating to devices located in the margins of roads and highways. The main characteristic of a VANET is the high speed of network nodes that can go up to 200 km/h, and impacts directly on the ability the network have to deliver data. An ant-based routing can be successfully applied to both wired and wireless networks. This work proposes Ant Colony Optimization (ACO) procedures that take advantage of information available in vehicular networks such as the vehicles' position and speed in order to design an ant-based algorithm that performs well in the dynamics of such networks. The authors have also adapted the Dynamic MANET On-demand (DYMO) routing protocol to make use of the ACO procedures proposed in this paper, and the resulting bio inspired protocol, MAR-DYMO, had its performance evaluated in an urban scenario and compared against a few other routing protocols.

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Mario Gerla (2011) and et al. [5] RTMB/CTMB: A Collision Avoidance Scheme for VANET Broadcast. This paper proposed that a traditional directional broadcast protocol for VANETs always select redundant nodes and are not very efficient. So, Road based directional broadcast was proposed to solve this problem. The basic idea is to categorize vehicles based on road topology and select a relay for each road. So, we aim to add reliability to road-based directional broadcast protocol. A MAC layer collision avoidance scheme is proposed to reduce the chance of collision between sender and the selected relay nodes, while other nodes can receive data opportunistically. This scheme improves the delivery ratio than that of traditional broadcast protocols by limiting the number of selected relays and keeping efficiency at a comparable level.

R. K .Chauhan (2012) and et al [6] AODV Extension using Ant Colony Optimization for Scalable Routing in Vehicular Ad Hoc Networks. On demand set up, fault tolerance and unconstrained connectivity are the major advantages of mobile computing which continues to enjoy rapid growth in this paper. So, large improvement is made in the area of wireless ad hoc network. One of the most important research topic is inter vehicle communication i.e. realization of mobile ad hoc network in these days .VANETs have been drawing an increasing attention from both industry as well as research communities .It requires reliable packet transmission, but rapid topology changing and regular disconnection makes it difficult to design an efficient routing protocol. To broadcast the alert messages among vehicles to avoid accidents are sometimes a serious problem at some level. Therefore, this paper proposes a scheme that avoids the delay of communication that occurs due to regular disconnection in routing. Therefore, Meta heuristic search i.e. ant colony optimization is combined with AODV and route repair strategy is applied to ACO to avoid delay of communication.

Utpal Roy (2012) et al. [7] Modified AODV Routing Protocol Explored by Swarm Intelligence Technique in VANET communications. This paper proposed that Vehicular Ad Hoc Network (VANET) is highly demanded wireless ad hoc network which is based on IEEE 802.11 wireless standard that facilitates vehicle to vehicle and vehicle to roadside communications through air interface. Communicating techniques from one vehicle to another vehicle through different vehicles is called routing. Different routing protocols for communicating information in voice, message, data, etc. from one vehicle to another vehicle are applied. Also intelligent vehicular ad hoc networks (VANETs) use Wi-Fi IEEE 802.11 and WIMAX IEEE 802.16 for fastest communication between vehicles with dynamic mobility. So, Modified Ad Hoc on Demand Distance Vector (M-AODV) routing algorithm has been proposed in this paper and M-AODV routing protocols for ad hoc mobile networks are also improved by Swarm (Ant colonies) Intelligence technique in this paper. Modified AODV is used for both unicast and multicast routing.

Dinesh V. Jamthe (2012) and et al. [8] Collision Avoidance in IVAN to maintain Inter-Vehicular Distance on Highways. Inter-Vehicular Ad hoc Network (IVAN) does not have a fixed network topology but is highly dynamic. The topology of the network changes frequently because wireless links are established and broken down due to certain factors such as the velocity of the vehicles, their mobility patterns and their spatial density. These high dynamics also cause very short times for data transfer. This paper presents Inter Vehicular Collision Avoidance System on Highways to ensure that the vehicles perform safety communication with each other for which can alert the drivers before accidents. This can be done by defining a critical “Inter-Vehicular Distance” to be maintained between and any two vehicles on highways. By giving vehicular priorities and providing group communications, our proposed System results vehicular collision avoidance in Inter Vehicular Ad hoc Network.

Annu Mor (2013) and et al [9] A Study of Improved AODV Routing Protocol in VANET. This paper proposed that Vehicular Ad Hoc Network (VANET) is a sub class of mobile ad hoc networks. VANET is most important technology for intelligent transportation system that provides wireless communication among vehicles and vehicle to road side equipments, according to IEEE 802.11 p standard for end to end communication between vehicles to find a route based on link properties. One of the most important routing protocols used in ad hoc networks is AODV. This protocol is connectivity based reactive protocol that searches routes only when they are needed because bandwidth is limited and topology frequently changed. It always exchanges control packets between neighbour nodes for routing. In this paper, author present cross layer technique that find channel security at link layer to AODV routing protocol to improve the communication in vehicles for safety purpose. To reduce the packet delay in AODV, AODV_BD routing protocol is proposed that reduces the packet delay in AODV and make routes more scalable.

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III. **COMPARATIVE STUDY**

A. **Author(s)**	*B.* **Year**	*C.* **Paper Name**	*D.* **Technique**	*E.* **Results**
F. Annu Mor, et al.	*G.* 2013	*H.* A Study of Improved AODV Routing Protocol in VANET	*I.* Cross layer technique to find channel security at link layer and improve communication to AODV routing protocol.	*J.* Find a different strategy of efficiency improvement by reducing the packet delay between data packets.
K. Dinesh V.Jamthe, et al.	*L.* 2012	*M.* Collision Avoidance in IVAN to maintain Inter-Vehicular Distance on Highways *N.*	*O.* Inter-Vehicular Collision Avoidance Scheme on Highways.	*P.* Develops a reliable collision avoidance system which relies on GPS.
Q. Utpal Roy et al.	*R.* 2012	*S.* Modified AODV Routing Protocol Explored by Swarm Intelligence Technique in VANET Communications.	*T.* Wi-Fi IEEE 802.11 and WIMAX IEEE 802.16 for fastest communication between vehicles.	*U.* Discusses Vehicular ad hoc network principles with AODV and M-AODV.
V. R. K. Chauhan, et al	*W.* 2012	*X.* AODV Extension using Ant Colony Optimization for Scalable routing in Vehicular ad hoc networks.	*Y.* Collision Avoidance, Ant Colony Optimization, WIMAX.	*Z.* Extends Candidate AODV protocol with ant colony optimization with repair strategy.
AA. Mario Gerla, et al.	*BB.* 2011	*CC.* RTMB/CTMB: A Collision Avoidance Scheme for VANET Broadcast.	*DD.* Road-based directional broadcast, MAC layer Collision Avoidance Scheme.	*EE.* Proposes a collision avoidance scheme to add reliability to VANET broadcast by using network traffic.
FF. Omar Cherkaoui, et al.	*GG.* 2011	*HH.* Mobility-Aware Ant Colony Optimization Routing for Vehicular ad hoc networks.	*II.* Ant-based routing, Dynamic MANET On-demand (DYMO), MAR-DYMO.	*JJ.* Proposes ACO procedures and develops DYMO and MAR-DYMO procedures.
KK. Samer Bali, et al.	*LL.* 2009	*MM.* Investigation of Vehicle- to- Vehicle Communication in a Road Intersection.	*NN.* Vehicle-to-Vehicle communication using Simulation of Urban Mobility (SUMO) and ns-2 simulators.	*OO.* Investigates the vehicle-to-vehicle communication by using different parameters.
PP. Neeraj Rajgure, et al	*QQ.* 2009	*RR.* VANET Routing On City Roads Using Real-	*SS.* RBVT Routing, multi criterion	*TT.* Presents RBVT for city-based environments to use real time vehicular

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		Time Vehicular Traffic Information.	prioritization function, distributed receiver-based election of next hops.	traffic information.
UU. Robert Eigner, et al	*VV.* 2008	*WW.* Collision Avoidance in VANETs: An application for ontological context models.	*XX.* Context Modeling, Collision Avoidance.	*YY.* Uses ontological context model in VANETs to validate sensor readings.

IV. CONCLUSION

It is shown in the paper that there are several load optimization techniques with collision avoidance mechanisms and also the previous improved techniques which give us better results. The paper presents delay optimization in vehicular ad hoc networks using ant colony optimization and WIMAX. These techniques aim at reducing overhead, avoiding collision and increasing performance by using ns-2 simulator.

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