ISSN:2231-0711

Kamaljeet Kaur et al | IJCSET(www.ijcset.net) | June 2016 | Vol 6, Issue 6, 223-227

Performance Evaluation of Bee Swarm Inspired Hybrid Routing Protocol Parameters for Applications in Vehicular Ad-Hoc Networks

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***Abstract*—Vehicular Ad-hoc Networks (VANET's) is entice substantially from the inquisition community and the automotive industry to enhance the design and development of the Intelligent Transportation System (ITS) Technology, who facilitate the vehicles to interact with each other and the road side units, which helps to elevate the safety measures in vehicles and transportation productivity. Lately one of the interesting and developing domains in VANET is to improve road safety by providing timely and accurate information to drivers and authorities. Towards the attainability of timely dissemination of messages, various routing protocols have been proposed. We present a Hybrid Bee Swarm Routing protocol for VANET's. Aforementioned routing protocol is unicast and a multi-path which assures road safety services by disseminates packets with minimum delays and high packet delivery. Finally to manifest the capability and the performance of the proposed routing protocol in VANET is evaluated in terms of packet delivery ratio, end-to-end delay and normalized overhead ratio.**

***Keywords*— Vehicular Ad-hoc Network, routing optimization, AODV routing protocol, Bio-inspired computing, Bee swarm Routing Protocol, Genetic Algorithm, Performance.**

I. INTRODUCTION

A vehicular Ad-hoc network (VANET) is a new emerging technology in ad hoc network that is becoming even more popular than the original ad hoc concept.[1]VANET is a emanated form of mobile ad-hoc network(MANET) which provide communication among neighbouring vehicles and between vehicles and nearby fixed point equipments. VANET is one of the influencing areas for the improvement of Intelligent Transportation system (ITS) in order to provide safety and comfort to the road users [2].Intelligent Transportation System technology provides various applications like as traffic monitoring, traffic control flow, secure road crossing and preventing from collisions. As a result of the development of Intelligent Transportation system, vehicles have become smart enough to adapt to the dynamic changes in road traffic.[3] VANET provide services to the vehicle drivers to communicate and to coordinate among themselves in order to avoid any kind of critical situation through vehicle-to-vehicle communication e.g. road side accidents, traffic jams, speed control, free passage of emergency vehicles and unseen obstacles etc. by the implementation of the intelligent transportation system. VANET also provide comfort applications to the road users. For example, weather information, mobile e-commerce, internet access and other multimedia.[2]

VANET structure is assembled on mobile connectivity between cars and automobile equipment that informs the drivers about the status of road and other necessary travel service information. Communication between vehicles or between vehicles and a Road Side Unit (RSU) is through a wireless medium called Wireless Access in Vehicular Environment (WAVE) which ensures a range of information to drivers/travellers enabling safety applications to improve road safety and driving. On Board Unit (OBU), Application Unit (AU), and Road Side Unit (RSU) are main Safety components..

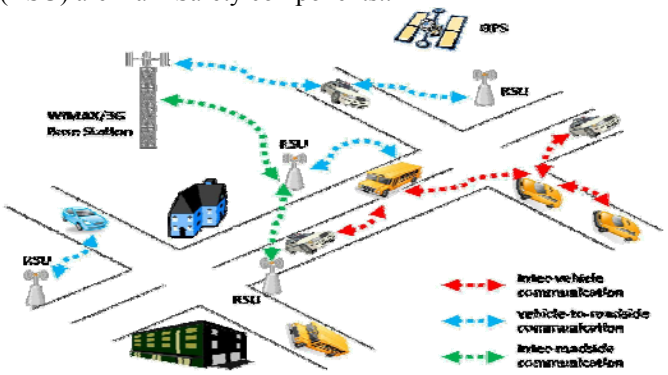

Figure:-1 Vehicular Ad-hoc Networks Architecture

RSU hosts an application which ensures services and OBU is a peer device using provided services. Application may reside in RSU or OBU, the device hosting the application is the provider and that which uses the application is user.[5] The various wireless communication in VANET, Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I). Vehicle-to-vehicle communication approach is most suited for short range vehicular networks. It provides accurate and real time security. It does not require any infrastructure. Vehicle-to-infrastructure gives solution to longer range

vehicular networks. It makes use of previous existing network infrastructure such as wireless access points. Hybrid Architecture combines both Vehicle-to-vehicle and vehicle-to-infrastructure. In this vehicle can communicate with the road side infrastructure either in single hop and multi-hop fashion, depending on the distance. Vehicular Networks are expected to employ varity of advance wireless technologies such as Dedicated Short Range Communication (DSRC) which is the enhanced version of the wifi, as well as WIMAX and cellular technology suitable for VANET environments.[11]

Vehicular Ad-hoc networks (VANET) have similarities to Mobile Ad-hoc Network (MANET) like random topology and short range communication. These two characteristics depict that messages could not be directly delivered to destination rather message shall be routed by intermediate nodes to given destination. So, routing protocols are very important in both VANET and MANET environments. [9] Certain possible research works have been explored widely in VANET routing protocols which is categories into two major components: topology-based and geographic routing protocols. The main objective of routing protocols is to achieve short communication time while using the minimum amount of networks. The data dissemination techniques should be designed efficiently to deliver the data to the intended receivers on time. It should deal with different types of network densities to eliminate the redundant rebroadcasted data, especially in very high network density scenarios. Based on this scenario many nature inspired algorithms were developed which consider biology and nature as a source of inspiration. It has also been shown that these algorithms can provide far better solutions in comparison to classical algorithms.[7] In this paper we introduced a Bee swarm routing algorithm which is a branch of nature inspired algorithms, as well as use genetic algorithm simultaneously in order to develop the proposed hybrid algorithm for the routing protocol that can efficiently handle the variations in the network parameters like changes in the number of vehicles nodes in the ad-hoc network, so as to keep its performance constant over network changes.

II. RELATED WORK

In VANET, a routing protocol governs the way to exchange data information in a network between two entities. The routing protocols of VANET are broadly classified into two main categories: Topology based routing protocol and Geography based routing protocol, they are as follows:

A. Topology Based Routing Protocol

Topology based routing protocol requires the association with other nodes that exists in the network to send the data packets from source to destination. This topology information defines the type of connection between the nodes, available resources and certain other conditions of the vehicular networks. Topology based routing protocol is further divide into two categories: Proactive routing and Reactive routing protocol. The Proactive routing protocols manage routing tables for all routing topologies. These protocols are also known as table driven protocols which records the routing information of each participating nodes. Proactive routing protocols update the information in the routing tables at the time nodes changing its positions. Reactive routing protocols are also known as On-Demand protocols, which were designed to overcome the network overhead. In these protocols routing information is only maintained when the source node wants to transmit the data to destination nodes.

B. Geography Based Routing Protocol

Geography Based Routing Protocols are also known as Position Based Routing Protocols in which the routing procedure is based on the positional information of the active nodes. In these protocols the source node transmit a packet to the geographic position of the destination node rather it to sending to the destination location. The substantial factor of these protocols is the robust property in which the packets are routed to the destination beyond the awareness of the network topology or route discovery.

III. METHODOLOGY

A Bee Swarm inspired hybrid routing algorithm objective is to combine the two routing protocols that is Bee swarm routing protocol and the genetic algorithm for improving the routing efficiency. Its basic mechanism is to implement the proposed algorithm overall on the same network which is further not divided into the sections. After the projection of this technique the performance of the new routing protocol seems to be optimized due to the fact that the Hybrid offspring has qualities of both original techniques. The descriptions of their different phases are as follows:

A. Bee Swarm Routing Protocol

The Bee Swarm Routing Protocol is a topological routing protocol, it is based on the unified behaviour of honey bee foragers and able to actively detect multiple paths between source and destination, also distributes traffic across them.[4] The optimization of routing protocol is based on the intelligent foraging behaviour of the honey bee swarm. The bees live in colony which consist three groups of bees : packers, scouts and foragers. Honey bees use different diverse processes for transmission like as dances which are performed by the scouts. There are two types of dances: First one is round dance, if food is close enough to the hive bees dance in circular motion, second type of dance is the waggle dance in which bee repeated a same move so as to appear like number eight. This dance implies the distance and direction. The basic information of waggle dance consists in two paths: I) Orientation of dance – which describes what angle to travel away from the sun. II) Duration of middle path of the dance - which describes the distance between the food source and hive. Waggle dancing

bees that have been in the hive for extended times adjust the angle of their dances to accommodate the changing direction of the sun. [7] This dances objective is to associate other bees (called foragers) by the transmission of distance, direction and quantity of found food with a visual, tactile and olfactory perception. [12]

B. Genetic Algorithm

Genetic Algorithm is a stochastic technique based on the principles of natural evolution and genetics. The inventor of the original genetic algorithm was john Holland, which aims to find an exact or approximate solution to optimization problems. GA combines the exploitation of past results with the exploration of new areas of research spaces. GA is based on following key terms: Initial population is created with a group of individuals that is the set of solutions available for particular problems. The individuals in the population are evaluated. Fitness function is to determine the compatibility of the solution with the problem. If the evaluated individuals well perform their tasks then the chances of being selected is higher otherwise not selected for further scrutiny. Genetic Operators applies to reach the final solution, the whole population is encoded into the binary set of strings. After initial population is randomly generated, the algorithm evolves three operators: Selection which equates to survival of the fittest, Crossover which representing mating between individuals, and Mutation which introduces random modifications. It is called heuristic search algorithm that implies these methods find out the optimal solution not on the basis of the predefined techniques, these solutions are obtained by those methods which are based on the observation and survival of the fittest theory.

C. Proposed Algorithm

In this proposed algorithm, we use a Bee Swarm Routing Protocol as well as Genetic algorithm simultaneously in order to develop the hybrid algorithm. In this algorithm, the individual refers to the nodes participating in the route from source to destination produced by Bee Swarm Routing Protocol. Population refers to the group of individuals that are selected as candidate for the routes from source to destination. Fitness Function refers to the criteria that are to be fulfilled by the candidate nodes to be selected for the routing process from source to destination. Applying fitness criteria to the system facilitates the efficient performance of the system as the defective or incapable candidate nodes will be eliminated in this selection process of the fittest candidate node. Then Genetic operations are performed on the basis of selection of these candidate nodes. This proposed routing protocol algorithm will provide reliable and efficient routes between the source node and destination node with better performance results as like as reduced delay, increased packet delivery ratio and normalized overhead ratio.

IV. SIMULATION SETUP

The simulation parameters define specific type of environmental real time situations that are used to check the feasibility of the protocol. Here we use the NS-2 simulator on the Ubuntu 14.04 Linux operating system to analyse the performance of the protocol. Here we perform the set of experiments for simulation area which is 500m x 500m square, simulated network consist 40,100 mobile nodes. All the results are taken by varying the number of nodes in the network. The simulation parameters that are used by the simulator are given in following table.

TABLE I
SIMULATION SETUP

S.No.	Parameters	Values
1	Channel	Wireless
2	Propagation Model	Two ray Propagation
3	Network Interface	Wireless physical
4	Queue	Drop tail/Priority queue
5	Mac Type	Mac 802_11
6	Interface Queue Length	50
7	Antenna Type	Omni-Antenna
8	Number of Nodes	40,100
9	Protocols	AODV, Bee Swarm Routing Protocol, Proposed Algorithm

V. SIMULATIONS RESULTS AND ANALYSIS

In this paper, we represent our research model testing results, which is shown in Bar graph and the network scenario of network nodes. The proposed work is simulated and tested for 40,100 nodes to evaluate the performance parameters. Here we analysed some performance metrics such as Packet Delivery Ratio, End-to-End delay, Normalized Overhead Ratio.

A. *Network Scenario*- Network scenario for 40,100 nodes at some time instant are shown below:

For 40 Nodes

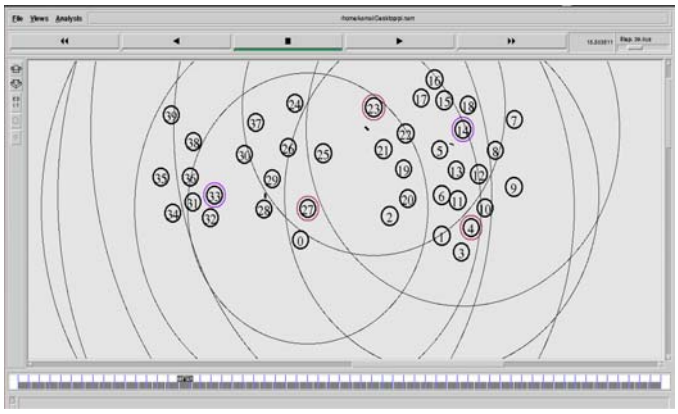

Fig. 2 Network scenario for 40 nodes of the vehicular network with random distribution.

For 100 Nodes

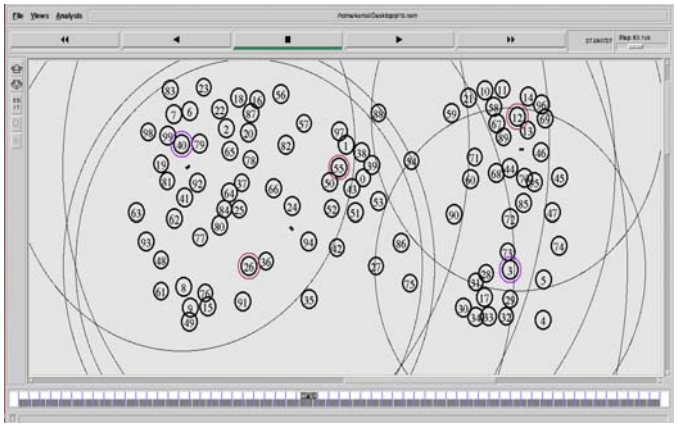

Fig.3 Network scenario for 100 nodes corresponding to the high traffic density

B. *Performance Evaluation*- The proposed work will be evaluated for the following performance metrics:

1. *End-to-End Delay:* End to End delay is the average time taken by a packet to travel from source to destination. Delay depends on number of hops and congestion on the network. It also includes the delay caused by route discovery process and the queue in data packet transmission. Only the data packets that successfully delivered to destination that counted.

   ∑ (arrive time – send time) / ∑ Number of connections

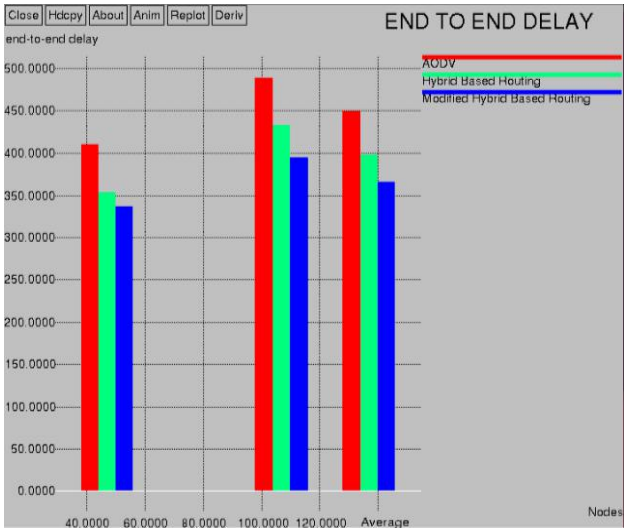

Fig.4 Showing the Bar graph comparison of the routing protocols at different nodes along with the overall comparison

2. *Packet Delivery Ratio*: The Packet delivery ratio is the ratio of the number of delivered data packet to the destination. This illustrates the level of delivered data to the destination.

   ∑ Number of packet receive / ∑ Number of packet send

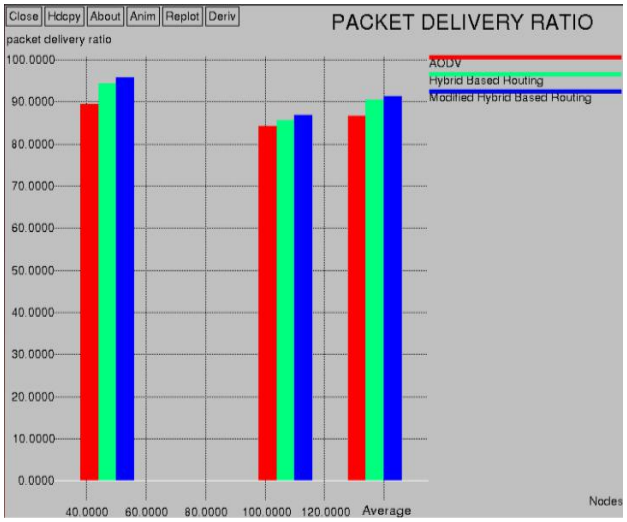

Fig.5 Showing the Bar graph comparison of the routing protocols at different nodes along with the overall comparison.

3. *Normalized Overhead Ratio:* The Normalized Overhead Ratio is defined as the number of routing packets required for the communication that is the total number of routing packets divided by total number of data packets delivered. This ratio is the measure of the extra packets other than the data packets generated as the percentage of the total data packets.

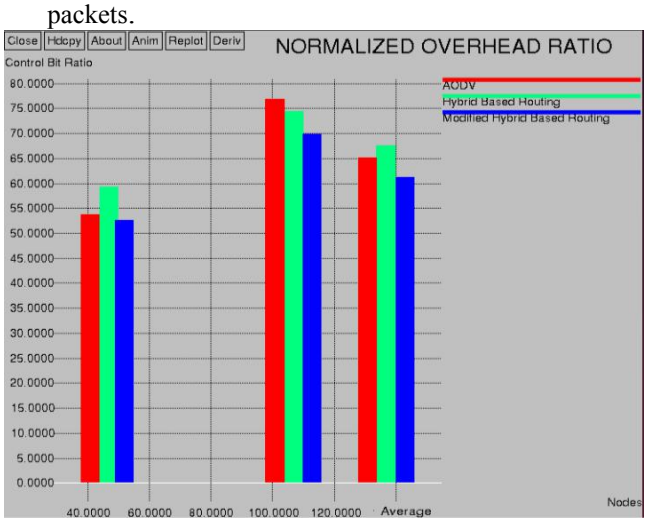

Fig.6 Showing the Bar graph comparison of the routing protocols at different nodes along with the overall comparison.

VI. CONCLUSION

In this paper, the proposed algorithms have been comparing with one dynamic that is Bee Swarm Routing Protocol and other one is the static routing protocol AODV. There is considerable improvement in the network parameters: end to end delay, packet delivery ratio and normalized overhead ratio. The proposed algorithm is simulated on NS2 simulator which is tested for 40,100 nodes. The results shows a significant improvement over the network parameters due to the one primary reason that it has combined the bee swarm routing algorithm and genetic algorithm in order to obtain the more optimized path, which consequently leads to increase in the efficiency of the routing algorithm and network performances.

ACKNOWLEDGMENT

I would like to express my sincere gratitude to my advisor Er.Vinod Kumar for his valuable and constructive suggestions during the planning and development of this research work. His guidance helped me in all the time of research and writing of the thesis. Working under him was an extremely knowledgeable experience for me.

REFERENCES

[1] K.D. Kalambe , A.R. Deshmukh, S.S Dorle, " Particle Swarm Optimization based Routing Protocol for vehicular Ad hoc Network" International Journal of Engineering Research and General Science, ISSN 2091-2730, Volume 3, Issue 1, January-February, 2015 .

[2] Bilal Mustafa , Umar Waqas Raja, "Issues of Routing in VANET" Department of Computer Science and Information Engineering, School of Computing Blekinge Institute of Technology,Sweden, June 2010.

[3] Chinju R.Nair, " Analysis and comparative study of topology and position based routing protocols in VANET" International Journal of Engineering Research and General Science, Volume 4, Issue 1, January-February, 2016 .

[4] M.Sumathi, "Swarm Intelligence based Bee inspired routing protocol for multipath routing in MANET" International Journal of Advanced Research in Computer and Communication Engineering , Vol. 4, Issue 2, February 2015.

[5] P. Saravanan, T. Arunkumar, " Bee Optimized Fuzzy Geographical Routing Protocol for VANET" International Journal of Computer, Electrical, Automation, Control and Information Engineering, Vol:8, No:12,2014.

[6] R. S. Raw, Vikas Toor, and N. Singh, "P ATH DURATION ANALYSIS IN VEHICULAR AD HOC NETWORK" International Journal on AdHoc Networking Systems (IJANS) Vol. 2, No. 4, October 2012.

[7] Adil Baykasoùlu, Lale Özbakır and Pınar Tapkan, "Artificial Bee Colony Algorithm and Its Application to Generalized Assignment Problem" Department of Industrial Engineering, Erciyes University,Turkey.

[8] Pratik Gujar, "BIO-INSPIRED ROUTING PROTOCOL FOR VEHICULAR ADHOC NETWORKS" International Journal of Advancements in Research & Technology, ISSN 2278-7763, Volume 3, Issue 4,April-2014 .

[9] Samanpreet Singh and Gagangeet Singh Aujla, "A Noble Routing Protocol for Vehicular ad hoc Networks (VANETs) with Less Routing Overheads" International Journal of Future Generation Communication and Networking , Vol.7, No.5 (2014), pp.23-34 .

[10] Rahul Bhoyar, Dinesh Datar, " REVIEW OF ROUTING PROTOCOLS IN VEHICULAR AD HOC NETWORK" International Journal of Research in Advent Technology (IJRAT) Vol. 1, No. 3, October 2013, ISSN: 2321–9637.

[11] Md. Humayun Kabir, "Research Issues on Vehicular Ad hoc Network" International Journal of Engineering Trends and Technology (IJETT) – Volume 6 Number 4- Dec 2013.

[12] Komal Kamran, Saira Afzal, M. Mateen Yaqoob and Muhammad Sharif, "A Comparative Survey on Vehicular Ad-hoc Network (VANET) Routing Protocol using Heuristic and Optimistic Techniques" Research Journal of Information Technology 6(2): 14-24, 2015 ,ISSN: 2041-3106; e-ISSN: 2041-3114.

[13] Salim Bitam,Abdelhamid Mellouk, "QoS Swarm Bee Routing Protocol for Vehicular Ad Hoc Networks" This full text paper was peer reviewed at the direction of IEEE Communications Society subject matter experts for publication in the IEEE ICC 2011 proceedings.

[14] YUN-WEI LIN, YUH-SHYAN CHEN AND SING-LING LEE, "Routing Protocols in Vehicular Ad Hoc Networks: A Survey and Future Perspectives" Department of Computer Science and Information Engineering,National Chung Cheng University,Chia-Yi,Taiwan, R.O.C.

[15] T. Taleb, E. Sakhaee, A. Jamalipour, K. Hashimoto, N. Kato, and Y. Nemoto, "A stable routing protocol to support ITS services in VANET networks," IEEETrans.Veh.Technol.,vol.56,No.6, pp.3337–3347, Nov. 2007.

[16] Shouzhi Xu, "QoS Evaluation of VANET Routing Protocols" JOURNAL OF NETWORKS, VOL. 8, NO. 1, JANUARY 2013.

[17] The Network Simulator-ns-2. http://www.isi.edu/nsnam/ns.

[18] Sara Esmaeillou , Ramin Karimi and Seyed Mahdi Jameii, " Spatial-based Grouping of VANETs Using Particle Swarm Optimization Algorithm" International Journal of Computer Science and Telecommunications,Volume 6, Issue 11, December 2015.