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Performance Improvement of Dynamic Source Routing (DSR) Protocol using Ant Colony Optimization for Vehicular Ad-hoc Network (VANet)

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KEYWORDS : Ant Colony Optimization (ACO), Dynamic Source Routing (DSR) and Vehicular Ad-hoc Network (VANET).

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ABSTRACT

Vehicular Ad hoc Network (VANET) is the challenging field in adhoc Network. The set up is constructed with vehicle and rode side unit. The routing protocol is very useful to route the data from source node to destination node. The dynamic routing protocol is reactive on demand routing protocol which uses source routing and maintain routes lively. It is considers in two phases route discovery and route maintenance .DSR is the routing protocol in which correspondent determine the accurate order of nodes of which a packet is propagated . In this paper ,to analyze the multiple route between nodes in the network ant colony optimization algorithm is used .the performance analysis of DSR routing protocol is observed by applying ACO with different QoS parameters like ,delay, throughput, jitter, energy ,packet delivery ratio etc.

I. INTRODUCTION

Vehicular Ad-hoc Network (VANET) part of an ad hoc network. Vehicle in VANET communicate with nearby vehicle or road side unit(RSU)that are mounted on vehicle or at the intersection and parking lots.[1] In VANET ,two types of communication is performed : vehicle to vehicle (V2V) and Vehicle to infrastructure(V2I).In V2V communication nearby vehicles transmit or receive data using short range communication services like Wi-Fi and WAVE. Vehicle have a special electronic gadgets that allows them to receive or relay messages. In V2I ,vehicle are communicate with nearby rode infrastructure unit (RSU) by using Wi-Fi hotspots or long range wireless communication technologies to exchange the data.[2][3]

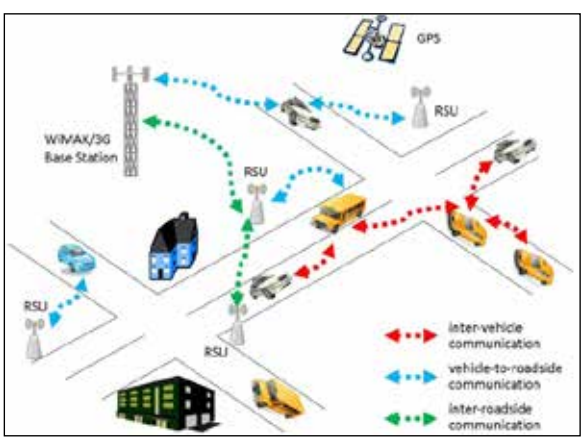

Figure1 : Typical VANET Scenario

In VANET ,Some of the application requires group communication Services .Therefore Multicast routing is the most efficient method ,overcoming the uncast and broadcast routing. The frequent change in the network topology, the high speed of nodes and other features of VANETs, make the multicast routing a real challenge in vehicular scenarios. Therefore, a Proficient protocol to maintain a good performance in the transmission/reception of multicast packets is required.

In VANET network for transferring data entire mobile nodes behaves as router including source and destination .exchanging data the entire mobile nodes behave as a router as well source and destination node. The Dynamic Source Routing (DSR) protocol is the secured routing algorithms for VANET . In this algorithm, the node whose want to send data in the network knows the path from source to destination and store that path in cache. The data packet carries the source path in the header .this protocol use source routing path instead of depending on intermediate nodes. so that path length between source to destination affects the routing overheads. the broken link in this protocol does not repair by route maintenance process, this is the disadvantage of this protocol .

I. INTRODUCTION TO DYNAMIC SOURCE ROUTING PROTOCOL (DSR)

DSR Protocol is a on demand reactive routing protocol. it composed by two mechanisms that work together to allow route discovery and route maintenance in the adhoc network. Route discovery is the mechanism in which source node S sends a packet to a destination node D. and obtain a source route to D. Route discovery is used when S attempt to send a data packet to D and does not already know a route to D. Route maintenance is the mechanisms, if source node sends a data packet to D ,if the topology of the network has changed such that it can no longer use the route from source to destination. Route maintenance indicates the route is broken, then source node find new route again to send a data from source to destination. In DSR Route Discovery and Route Maintenance entirely on demand.

DSR not requires periodic packets of any kind at any level in the network.DSR does not use any periodic routing advertisement ,link status sensing, or

Neighbors detection packets, and does not rely on these functions from any underlying protocols in the network. This entirely on-demand behavior and lack of periodic activity allows the number of overhead packets caused by DSR to scale all the way down to zero, when all nodes are approximately stationary with respect to each other and all routes needed for current communication have already been discovered The operation of Route Discovery and Route Maintenance in DSR are designed to allow unidirectional links and asymmetric routes to be easily supported

III. OVERVIEW OF ANT COLONY OPTIMIZATION (ACO)

Artificial ants used in ACO are stochastic solution construction procedures that probabilistically build a solution by iteratively adding Solution components to partial solutions by taking into account (i) Heuristic information on the problem in-stance being solved, if available, and (ii) (artificial) pheromone trails which change dynamically at run-time to reflect the agents' acquired search experience. [5][6]The interpretation of ACO as an extension of construction heuristics is appealing because of several reasons. A stochastic component in ACO allows the ants to build a wide variety of different solutions and hence explore

a much larger number of solutions than greedy heuristics. At the same time, the use of heuristic information, which is readily available for many problems, can the ants towards the most promising solutions. More important, the ants' search experience can be used to influence in away reminiscent of reinforcement learning the solution construction in future iterations of the algorithm. Additionally, the use of a colony of ants can give the algorithm increased robustness and in many ACO applications the collective interaction of a population of agents Is needed to efficiently solve a problem. The domain of application of ACO algorithms is vast. In principle, ACO can be applied to any discrete optimization problem for which some solution construction mechanism can be conceived.

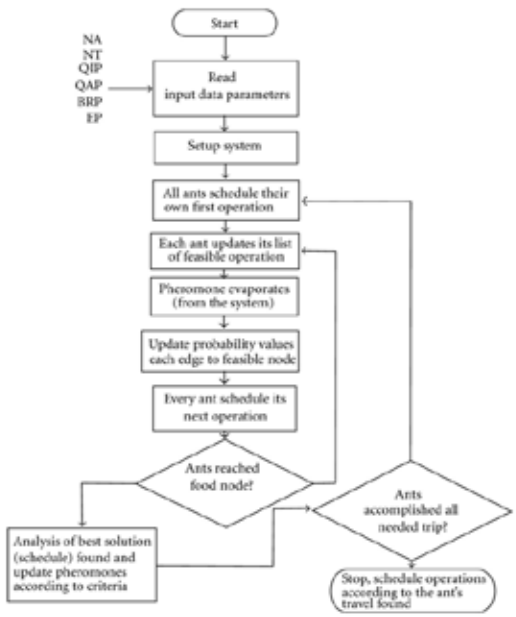

Figure 2: Flow chart of Ant colony optimization algorithm.

Figure2 shows the algorithm of ACO ,as all ants in the system scheduled their own first operation. when ants moves along the path to find the food from source node to destination node ,all ants update their list of fesible operation in the search.

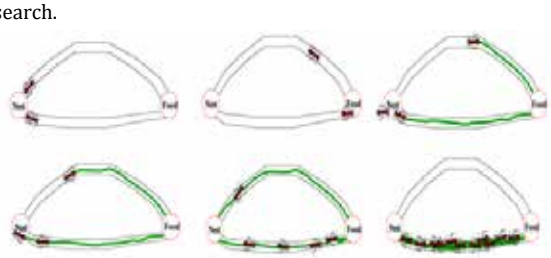

Figure 3: ant behavior

- In above figure 3 from left to right described as follows-
- Two ants start with equal probability of going on either path
- The ant on shorter path has a shorter to-and fro time from its nest to food.
- The density of pheromone on shortest path is higher because of two passes by the ants as compare to the one by other.
- The next ant takes the shortest route.
- Over much iteration more ants begin the path with higher pheromone, thereby further reinforcing it.
- After some time, the shorter path is almost exclusively used.
- The capacity of ants to self classify is based on four main beliefs. They are positive feedback, negative feedback, randomness and multiple communications.
- Positive feedback –used to look up the good result. When ants travel from one node to another, the concentration of pheromone along that trail increases. This helps other ants to travel in this path.
- Negative feedback –used to destroy bad solution. It can be completed by decay of pheromone concentration with value to time. The rate of decay is trouble definite. Low decay rate encourages the bad result not being destroyed for longer time and higher decay rate destroys good solution early.
- Randomness –Path to be taken by ant is completely random hence there is possibility of generation of new solutions.
- § Multiple interactions The solution is found by dealings of different agents, so one ant cannot find the food, as the pheromone would decay. Hence further ants can search food faster in food searching procedure [4].

IV. EXPERIMENTAL RESULTS

Simulation Setup

The simulation of DSR Protocol is performed in the region which is square of 300m * 300m using NS-2. Vehicles are capable to interact with one to many using the IEEE 802.11 MAC layer. The simulation is performed for the nodes ranging from 10-40 nodes for the different QoS parameters like delay, jitter, energy consumption and routing load of the network in case of ACO_DSR and DSR.

The simulation parameter settings are given in following table.

TABLE I: SIMULATION PARAMETER SETTINGS

Parameters	Values
Simulator	NS-2
Area	300m*300m
No. of Nodes	10-40
Packet size	1000 bytes
Packet interval	0.07 seconds
MAC protocol	IEEE 802.11
Transmission Range	50m

Simulation Metrics

The analysis is done on the basis of following different parameters

- Delay: This metric show the time essential for a packet to go through the network from basis node to target node. It characterizes the latency generated by the routing approach.
- Jitter: It is the deviation in the time of packets arriving, caused by network congestion, timing drift, or route changes.
- Energy consumption: Amount of energy consumed in a process or system.
- Routing load: It is calculated by dividing the total number of routing packets sent by the total number of data packets received.

Simulation Results

The evaluation of DSR routing protocol and its optimization using ant colony algorithm is discussed in this .

Figure 4 shows the delay of ACO_DSR and DSR. ACO_DSR produces better results than other routing protocols. This is because of the Ant colony technique in this the shortest path once found then all the routing that is transfer of packets occur on that path which overcomes the process of route finding. So here the delay of ACO_DSR is less than DSR.

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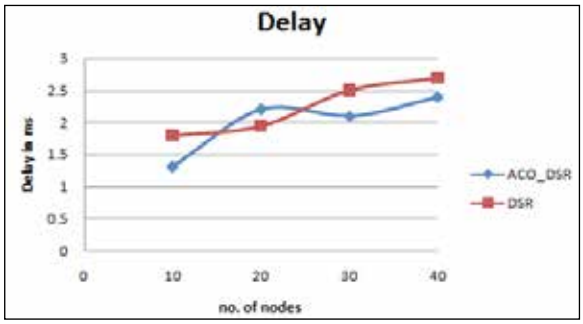

Figure 4. Delay: ACO_DSR Vs DSR

Figure 5 shows that jitter of ACO_DSR and DSR. ACO_DSR produces better results than other routing protocols. This jitter is considered to be as delay minus mean delay. Here the result shows that ACO_DSR has less jitter rate than DSR. This jitter rate is to be shown in ms (milliseconds). The ACO is applied to DSR so it does not require finding many paths, once the shortest path found by ACO technique then the packet transfer occurs from source to destination.

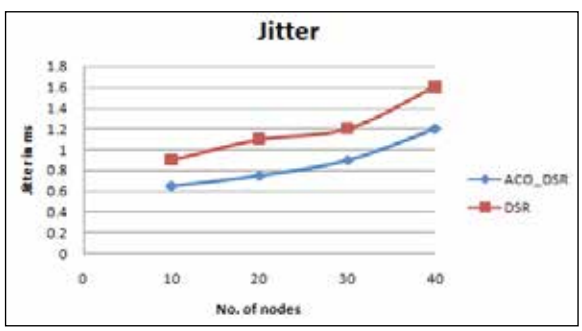

Figure 5. Jitter: ACO_DSR vs DSR

Figure 6. shows Energy consumption graph of ACO_DSR and DSR. In this energy consumption is more in case of ACO_DSR because in ACO there are two processes that is finding multiple path and selection of shortest path. In finding multiple paths ACO_DSR consumes more energy than simple DSR. This is the reason behind ACO_DSR requires more energy than DSR.

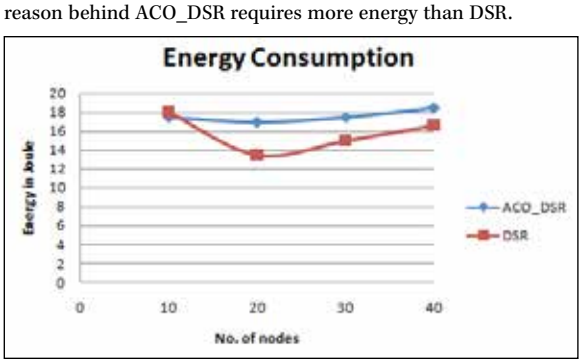

Figure 6. Energy Consumption: ACO_DSR vs DSR

Figures 7. shows the routing load of ACO_DSR and DSR. ACO_DSR and DSR are pure reactive protocol with no concept of zone. When the network size increases a vehicle has more choices for paths to destination which proves the process to be multi path form. As there is applying an ant colony process to optimize the protocol these initially shows a high result as compare to other protocols which is shown below. So the ACO_DSR has less routing load than DSR and same path searching occurs in reactive routing protocol.

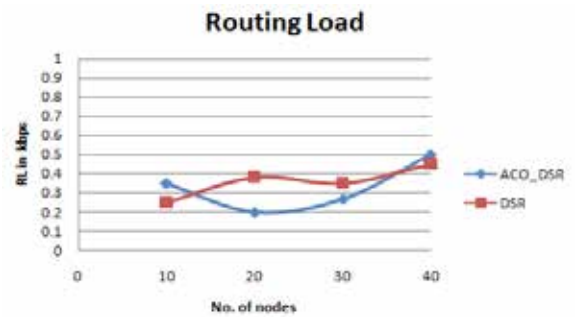

Figure 7. Routing Load: ACO_DSR vs DSR

Figure 8 shows the analysis of percentage of packet delivery ratio. As a result the packet delivery ratio increase as number of nodes increases. The packet delivery ratio increases in the ant colony optimization technique.

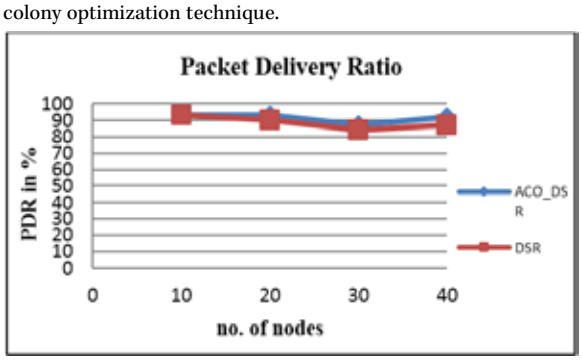

Figure8: Packet delivery ratio ACO_DSR vs DSR

V. CONCLUSION

In this paper we propose a swarm based optimization technique to improve the performance of DSR protocol for vehicular adhoc network. DSR is well suited for VANET because of its self organizing and maintenance features. As discussed in the results ,ant colony optimization technique works well for vehicular adhoc network and improve the various quality of service parameters like end to end delay, jitter, energy consumption in the network ,routing load and packet delivery ratio. The DSR routing protocol gives excellent performance using the ACO algorithm for multihop wireless adhoc network,so applying ACO with DSR will be reliable and optimum for routing of data packages in vehicular ad-hoc networks (VANETs). This work focuses and emphasize on the use of ACO in the routing algorithms for VANET.

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