Effect of Information Dissemination Parameters on VANET using Swarm Intelligence

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Abstract **-** For vehicular traffic and road safety, the most promising technology is VANET. VANET is the technology that provides the proper solution for controlling traffic. Swarm Intelligence is an interactive system to solve problems on communication, direction and distance under community. V2V communication is established in VANET. V2V communications are implemented for the safety on roads for the vehicles. In VANET, effective inter-vehicular communication is a challenge. VANETs are self-organizing communities containing cars, buses, trucks, small vehicles, traffic signals. The concept behind the swarming is, collision does not occur in between them and with proper communication. There are bee hives, ant colonies and bird flocks techniques, for improvement in time delay, packet delivery ratio and throughput. In this project, multiple swarm intelligence algorithms are going to be proposed to broadcast information in estimated range. The bee inspired, ant inspired and bird flocks inspired swarm intelligence algorithms manipulate communication for the vehicle to vehicle communication. Simulations will be conducted and results will be analyzedand to show the effectiveness of the algorithm and further it will be compared for better outcome. It will help to improve the performance of the V2V communication in VANET using interactive property of swarm intelligence.

Keywords- *Vehicular Ad-hoc Networks (VANETs), Vehicle to vehicle(V2V), Mobile Ad-Hoc Networks (MANETs), Intelligent Transportation System (ITS), Adhoc On Demand Distance Vector(AODV).*

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I. INTRODUCTION

The vehicles quantityare increasing day by day and it's the main cause to control traffic with this excessive traffic on roads. With this increasing quantity in vehicles, the quantity of roads is not enough to maintain that traffic[4]. And it is not possible to increase the quantity of roads. So, VANET[6] is the technology that will help the vehicles to communicate with each other by broadcasting the messages.If any accident happened on road, any construction work held on road, any traffic jam or any other that causes traffic.MANETs subclass is VANET[2]. To provide safety to the roads and also comfort ITS must be improved. VANET helps the drivers to maintain proper communication and coordination among themselves to avoid critical conditions like accidents, traffic jams, speed control. VANETs are self-organizing communities containing cars, buses, trucks, small vehicles, and traffic signals. Swarm Intelligence is the best technique to handle various issues for VANET. Swarm intelligence is a system where many individuals are interacting with each other and transferring data in between them locally[5]. In this, individuals like bees[1], ants send data or communicate with each other but in their respected groups. This communication principle is very useful in our project that the vehicles in a specified range can communicate with each other and send information that they realized about any road accident, construction on roads, traffic and more, so they can avoid traffic and choose the most prominent way for their vehicles to reach to their goal in less time without causing more traffic[8].

In this project we are using bee inspired, ant inspired and bird flock[1][2] inspired swarm intelligence technique in VANET. In this, like bees, ants and birds all other vehicles are interconnected with each other but in a specific range. That all the vehicles continuously broadcasting information. That information contains details about road traffic and due to this information traffic may be reduced. This method is basically a vehicle to vehicle(V2V) communication. In this project, the data that we have processedby all three swarm intelligence techniques will be compared and most prominent data will be used for the proper communication and for information dissemination. In bee hives, they are wandering for the flowers and if any of the bee gets flowers it sends the signal to its mates so that they can reach to that place and collect honey. It also warns other bees if any danger occurs. It occurs in ants also[9]. They are wandering in search of food and shelter, so if they cause any trouble they send information to their colonials. Bird flocks technique useful against the road mapping. So in this project, if any vehicle gets road with clean traffic it will send signals to other vehicles about that or if there is traffic it also sends signal that there is traffic on road so choose

other way. This is the best method to control traffic on roads[3].

For sending information about traffic, vehicles are having traffic detection sensors. It sends the traffic related information to other vehicles and avoids the traffic or avoids the congested area and chooses the other feasible path. These sensors can send information like road condition, information on traffic jam/accident, road under construction. Our main aim to minimize the traffic related problems by comparing the data gathered from all three swarm intelligence technique and go for suitable one for VANET.AODV protocol is basically used for the Route Discovery, Optimal Route Selection and Route Maintenance[7].

II. FLOWCHART

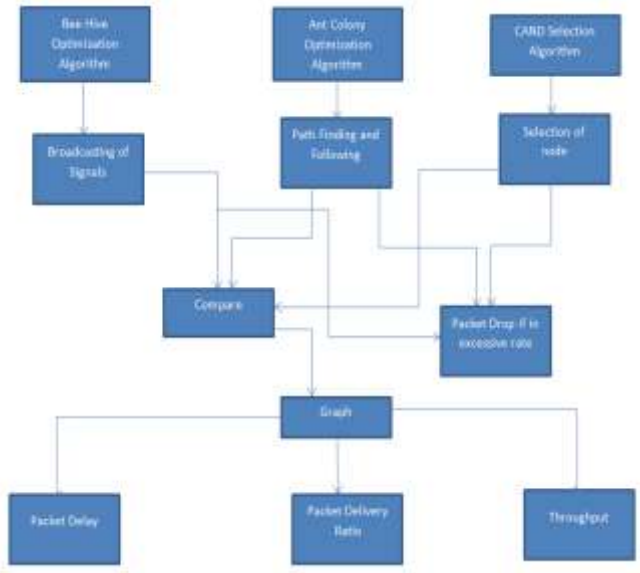


Figure 1: Flowchart of design

III. METHOD OF DISASSEMBLING

A. Swarm Intelligence

Swarm Intelligence is the technique where communication between similar kinds of species can communicate in pattern. So the techniques like Bee inspired, ant colonies and bird flocks are the major swarm techniques that can be used to deliver proper and prominent data.Improvement in time delay in transmission of information.Stimulate in various scenarios and apply swarm intelligence method.Due to the multiple swarm intelligence algorithms, the range of the transmission may be increased and data dissemination will be betterComparing results of delay, packet delivery ratio and range of transmission of multiple/different swarm intelligence algorithms in VANET.

B. Bee Inspired Swarm Intelligence Technique

Communication between bees having a different pattern like they can communicate only in bee hives. This means that all bees having specific limitations over their range. So the bees can transmit data only between their hives bees. Bee inspired algorithm is helping in a way that the vehicles can transmit data between only vehicles in the specific range.

C. Ant colony technique

Ant Colony Technique is for the optimum path. The technique is being used in a way that ants are having some pattern that they always choose optimum path between source and destination. And this technique is very important in that kind of work. Ant colony technique is also named as optimum path finding technique.

D. Bird flock technique

Bird Flock Technique is having a pattern of flying. Means if birds want to move from one place to another, they are having some specific pattern that they are following.

E. Flooding

This is the kind method used for the benchmark in this project. This is the method is basically used for the comparison. This is the benchmark for the all three algorithms which I have been discussed earlier.

F. AODV

AODV is a protocol basically used for the Route Discovery, Optimal Route Selection and Route Maintenance. First of all route discovery phase being performed to get all the routes between source and destination.And then selection of optimal route is following so the best route can be selected. And the third phase being followed by the route selection i.e. route maintenance. In route maintenance the data rate of all the three techniques will be compared and use of any of one will be happened.

Figure 2: AODV Routing Protocol

IV. PROPOSED PLAN OF WORK

Bee inspired, ant colonies and bird flocks are the major swarm techniques that can be used to deliver proper and prominent data.Improvement in time delay in transmission of information.Stimulate in various scenarios and apply swarm intelligence method.Due to the multiple swarm

intelligence algorithms, the range of the transmission may be increased and data dissemination will be better. Comparing the results of delay, packet delivery ratio and range of transmission of multiple/different swarm intelligence algorithms in VANET.

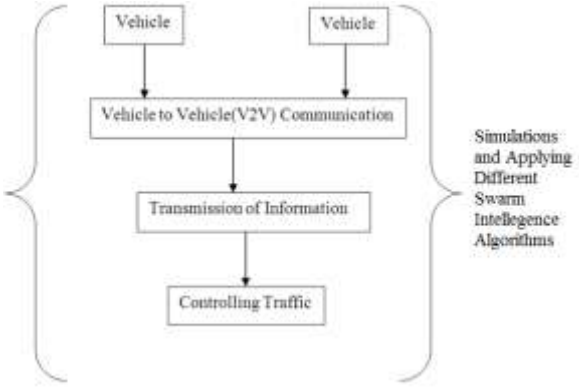


Figure 3: Flow diagram of proposed work

V. WORKING OF ALGORITHMS

Let
n_1, n_2 => two nodes
R => Transmission range
x'_1, y'_1 => The coordinate for node n_1
x'_2, y'_2 => The coordinate for node n_2 velocity
v_1, v_2 => Velocities
θ_1, θ_2 => Directions
x_1, y_1 => New coordinates of n_1 after time t
x_2, y_2 => New coordinates of n_2 after time t
For time t let
d_1, d_2 => Distance travelled by nodes n_1 and n_2.

$$d_1 = v_1 t$$
$$d_2 = v_2 t$$

Figure 3: Formula for Calculating d_1 and d_2

$$x_1 = x'_1 + x_1 = x'_1 + d_1 cos\theta_1 = x'_1 + t(v_1 cos\theta_1)$$
$$y_1 = y'_1 + y'_1 = y'_1 + d_1 sin\theta_1 = y'_1 + t(v_1 sin\theta_1)$$
$$x_2 = x'_2 + x_2 = x'_2 + d_2 cos\theta_2 = x'_2 + t(v_2 cos\theta_2)$$
$$y_2 = y'_2 + y_2 = y'_2 + d_2 sin\theta_2 = y'_2 + t(v_2 sin\theta_2)$$

Figure 4: Formula for calculating new coordinates (with respect to old coordinates)

The above formulas used for the calculations of distances between the nodes.

$$D^2 = \{(x'_1 - x'_2) + t(v_1 cos\theta_1 - v_2 cos\theta_2)\}^2 + \{(y'_1 - y'_2) + t(v_1 sin\theta_1 - v_2 sin\theta_2)\}^2$$

$$D = \sqrt{\{(x'_1 - x'_2) + t(v_1 cos\theta_1 - v_2 cos\theta_2)\}^2 + \{(y'_1 - y'_2) + t(v_1 sin\theta_1 - v_2 sin\theta_2)\}^2}$$

Figure 5: Formula for calculating distance between two nodes at time t

$$LS = \frac{R}{D} = \frac{R}{\sqrt{\{(x'_1 - x'_2) + t(v_1 cos\theta_1 - v_2 cos\theta_2)\}^2 + \{(y'_1 - y'_2) + t(v_1 sin\theta_1 - v_2 sin\theta_2)\}^2}}$$

Here,
LS: Link stability between any two nodes over time period t.
R: Maximum transmission range.
D: Distance between two nodes at time t.

Figure 6: Formula for calculating link stability between two nodes at time t

Packet Delivery Ratio:

$$PDR = \frac{Total\ number\ of\ packets\ delivered}{Total\ number\ of\ packets\ transfered} \times 100$$

VI. PERFORMANCE TABLES

Below tables shows the performances of all the parameters hats been used in the project i.e. PDR, Packet Delay and Throughput.

PDR			
ACO	BEE	CAND	FLOOD
0.10 0.01	0.10 0.02	0.10 0.03	0.10 0.02
0.12 0.021	0.12 0.03	0.12 0.042	0.12 0.0321
0.14 0.03	0.14 0.04	0.14 0.053	0.14 0.0431
0.16 0.05	0.16 0.059	0.16 0.088	0.16 0.068
0.18 0.07	0.18 0.079	0.18 0.090	0.18 0.080
0.20 0.09	0.20 0.099	0.20 0.120	0.20 0.100
0.22 0.12	0.22 0.129	0.22 0.135	0.22 0.115
0.24 0.13	0.24 0.139	0.24 0.155	0.24 0.145
0.26 0.13	0.26 0.139	0.26 0.2	0.26 0.19

Table 1: Performance table of PDR

Packet Delay			
ACO	BEE	CAND	FLOOD
10000	7000	4000	3500
11300	8000	6000	4500
13000	9000	6500	5000
16000	10000	7500	6500
17000	11000	8200	7200
19000	11600	9000	8000
21000	12500	10200	9200
22000	13700	12000	11000
23100	15000	13400	12400
25000	16000	15000	14000

Table 2: Performance table of Packet Delay

Throughput			
ACO	BEE	CAND	FLOOD
5	8.1	10.1	8.1
6	8.2	10.2	9.2
6.5	8.5	11.5	10.5
7	9	11.1	11.1
7.2	9.2	12.21	11.99
7.3	9.5	12.51	12.3
7.4	9.4	12.42	12.4
7.1	10.1	13.12	12.8
7.2	10.9	13.93	13.01
7.5	10.8	13.84	13.4

Table 3: Performance Table of Throughput

VII. RESULTS AND GRAPHS

The results of all four algorithms are shown below.

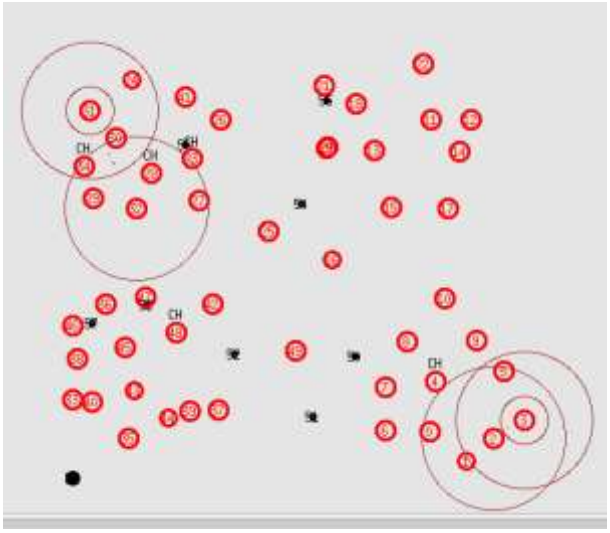


FIGURE 7: SENDING AND RECEIVING SIGNALS IN CAND

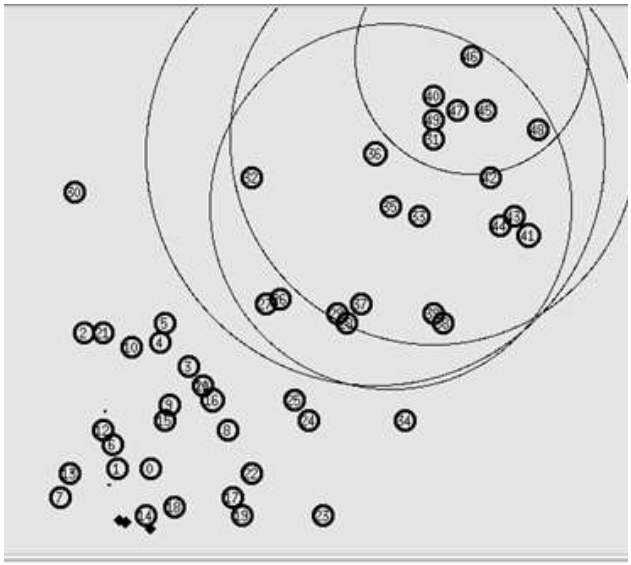


FIGURE 8: SENDING, RECEIVING AND PACKET DROPPING IN ACO

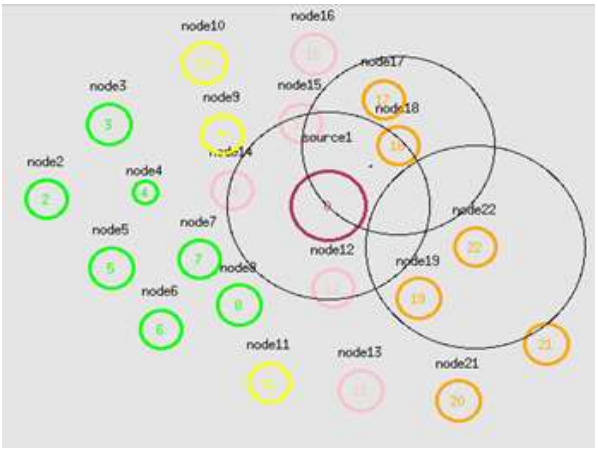


Figure 9: Sending and Receiving signals by Queen and Slave bees

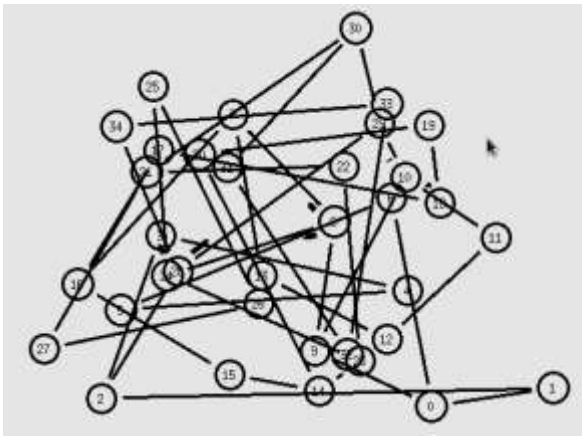
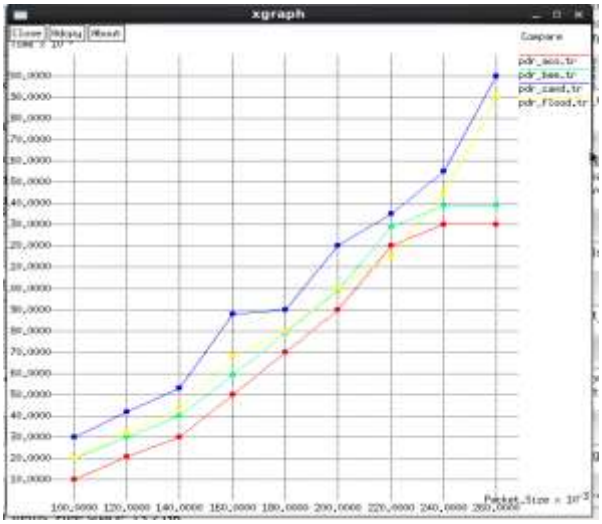


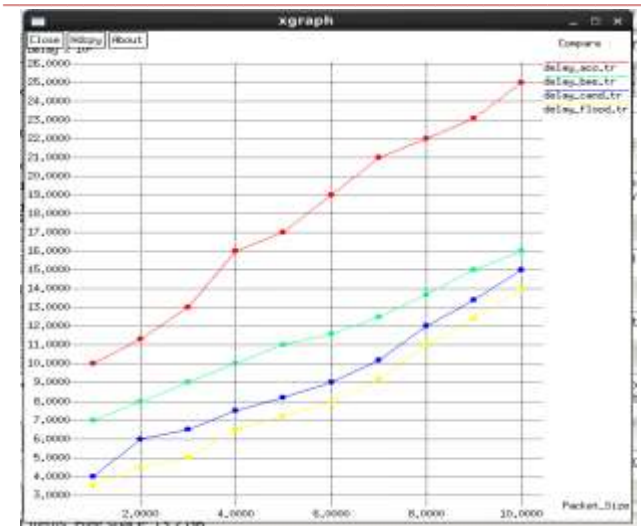
Figure 10: Static connections between nodes in Flooding

The graphs of PDR, Delay and Throughput are shown below.



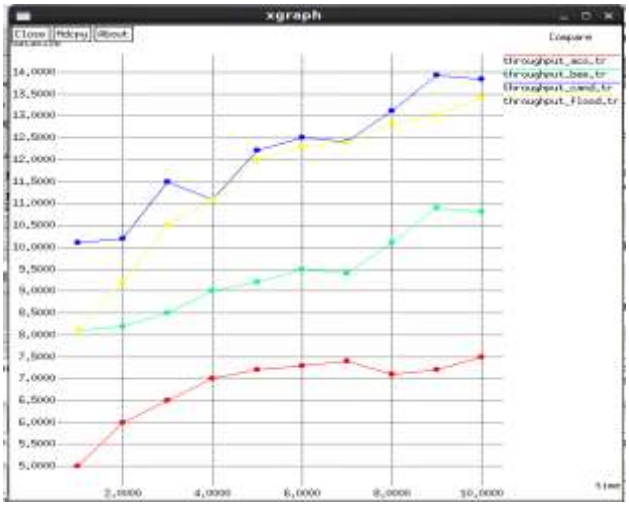
Graph 1: PDR

The best performance in Throughput according the graph is CAND.



Graph 2: Delay

The best performance in Throughput according the graph is Flooding.



Graph 3: Throughput

The best performance in Throughput according the graph is CAND.

VIII. CONCLUSION

The algorithms are applied to solve the packet delivery ration, comparison between data rates between different swarm intelligence techniques like bee inspired, ant colony and bird flocks. The benchmark that's been used worked properly to compare all the three algorithms. The main work was to compare algorithm that being performed and the route discovery, optimal route finding and route maintenance is also done.The routing protocols are better being performed that they can find the routes and send the signals or data to the other vehicles. Simulation is performed to show all the results.

References

[1] SeytkamalMedetov, Mohamed Bakhouya, JaafarGaber, Khalid Zinedine, MaximeWack, "A Bee-Inspired Approach for Information Dissemination in VANETs", IEEE International Conference onMultimedia Computing and Systems (ICMCS), 2014.

[2] HimaniRana, ParimalaThulasiraman, Ruppa K. Thulasiram, "MAZOCORNET: Mobility Aware Zone Based Ant Colony Optimization Routing for VANET", IEEE Congress onEvolutionary Computation (CEC), 2013.

[3] KomalMehata, Dr.L.G.Malik, Dr.P.R.Bajaj," VANET: Challenges, Issues and Solutions", IEEE 6th International Conference on Emerging Trends in Engineering and Technology (ICETET), 2013.

[4] V.A.Gajbhiye, R.W.Jasutkar," Biologically Inspired Routing Protocol for Vehicular Ad Hoc Network," IEEE 6th International Conference on, Advanced Infocomm Technology (ICAIT), 2013.

[5] S.Cloudin, Kalairani," Reliable Routing Strategy for Data Communication in Vehicular Ad Hoc Networks" ,IEEE IET Chennai 3rd International on Sustainable Energy and Intelligent Systems (SEISCON 2012), 2012.

[6] Huixian Wang, Ren Ping Liu and Wei Ni,"VANETModeling and Clustering Design Under Practical Traffic, Channel and Mobility Conditions", IEEE Transactions on Communications, 2015.

[7] S.S.Manvi, M.S.Kakkasageri, C.V.Mahapurush, "Performance Analysis of AODV, DSR and Swarm Intelligence Routing Protocols in Vehicular Ad Hoc Network Environment," IEEE ICFCC International Conference onFuture Computer and Communication, 2009.

[8] Ramnik Sharma, Anita Kumari, "A Review on Traffic Route Optimizing by Using Different Swarm Intelligence Algorithm", ICFCC International Conference on Future Computer and Communication, Vol.4 Issue.5, pg. 271-277, May- 2015.

[9] Kponyoj.j.,YujunKuang, Zejiao Li, "Real Time Status Collection and Dynamic Vehicular Control Using Ant Colony Optimization", IEEE International Conference on Computational Problem-Solving (ICCP), 2012.