2. Objectives

1. Selection of an optimized relay nodes on the basis of coverage area.
2. Implementation of link state routing and optimization of the proposed approach with the help of firefly algorithm.
3. Evaluation of parameters such as network yield, overhead, delay from end to end, delivery of packet ratio.
4. Comparison of the proposed work with the existing approach.

3. Proposed System

We proposed a system in which the two challenges being faced in case of urban environment are being solved. The challenges are the selection of an optimal relaying node in an intra-street and the selection of street at the intersection. We proposed a system in which relay nodes are being selected on the basis of coverage area. Link state routing has been implemented for routing and optimization of the proposed approach is with the firefly algorithm. The parameters such as network yield, overhead, end to end delay, packet delivery ratio are being evaluated.

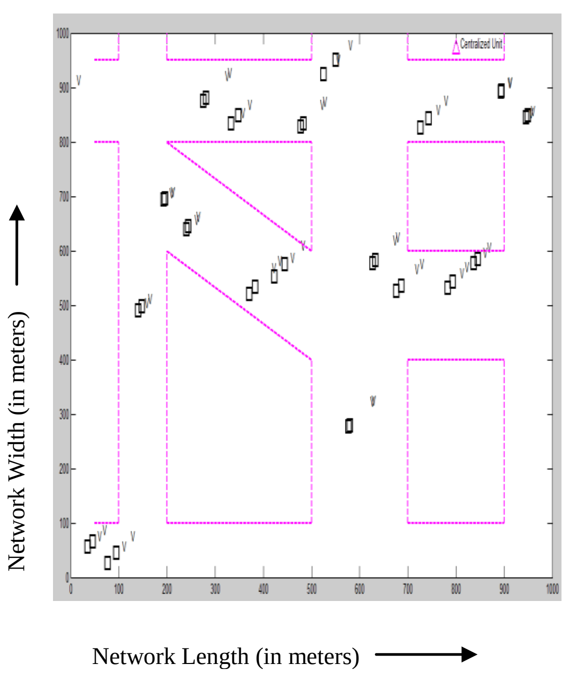

Figure 1: Proposed architecture

The simulation parameters that have been taken into consideration for the design of architecture:

Simulation Parameter	Value
Simulator	MATLAB2013
Simulation Area	1000m*1000m
Number of Nodes	20
Traffic Type	CBR
Simulation Time	300s

Table 1: Parameters for simulation

Packet drop is main problem in case of VANET. The main reason for packet drop is due to the high mobility among the nodes. Main challenges are selection of an relaying node which is optimal in nature in case of an intra-street and selection of street at the intersection in case of urban environment. Therefore improving the VANET routing decision in the context of packet drop with the help of firefly optimization. In case routing overhead increases, it is being optimized. After performing the optimization, parameters are being evaluated to have the comparison among the results of proposed approach and the existing approach. Simulation results are showing that the proposed approach is better in terms of the ratio of packet delivery, delay involved in terms of end to end delivery, yield of the network, and the routing overhead.

4. Assumptions

The following underlying assumptions have been made to evaluate the efficiency of proposed approach for urban environment. This approach has been designed for routing in case of urban scenario. If the routing overhead increases, then we have to go for optimization. The randomness of vehicle has to be reduced, i.e. less is the randomness of vehicle, more stable is the state of vehicle, then the packet drop will be reduced.

1. Each vehicle has been equipped with a device known as GPS and a digital map of streets in onboard navigation system.

2. Vehicles along the street having intersections can have the details related to the vehicles which are in neighbor with in range of communication.
3. Each vehicle is executing the distributed algorithm to have details that will be required for the estimation of end to end cost for transmission across the streets.
4. The information can be collected through the beacons which are iterative in nature for the topologies.

5. Performance Evaluation

5.1. Simulation Parameters

Simulation Parameter	Value
Simulator	MATLAB2013
Simulation Area	1000m*1000m
Number of Nodes	20
Simulation Time	300 s
Channel Data Rate	2 Mbps
Traffic Type	CBR
Packet Size	512 bytes
Minimum speed	30 km/h
Maximum speed	60 km/h
Queue Length	500 packets
Traffic Flow	Free flow of traffic

The following performance parameters have been evaluated for the simulation results:

1. **Network yield**: It is representing forward reliability and the throughput of network. It is defined as the ratio calculated for the sum of amount of packets received at the intended destination node to the sum of data being delivered by all vehicular nodes through the time assigned for the simulation.
2. **Routing Overhead**: It is defined as the ratio calculated for the sum amount of the control packets to the sum amount of packets that have been successfully reached at the intended end node. Here size of control packets is to be considered instead of the number.
3. **Delay calculation from end to end**: This is defined as the average delay in case of transfer of data from the source node to the destination node. It is including the time taken by the packets over the vehicles for transmission which is also taking into consideration the partitions of the network.
4. **Ratio of Packet Delivery:** This is defined as ratio calculated for all packets that have been received successfully at the end node to the sum of packets originated from the source node.

5.2. Simulation Results

For evaluating the efficiency of the proposed system for the efficient routing in urban environment, analysis of the proposed and the existing one has been carried out. The analysis has been done in order to route the packets more efficiently. Observations are being made by taking into consideration and comparing various performance parameters.

Evaluation of ratio of packet delivery:

Evaluation of the packet delivery ratio for the no of vehicles with the speeds in random manner having the range from 30km/h to maximum of 60km/h. On comparing the ratio of packet delivery for the vehicles without and with optimization there is increase in packet delivery ratio. This is due to rise in the vehicle number, there is improvement in the network connectivity, which is reducing chances of encountering the network partition.

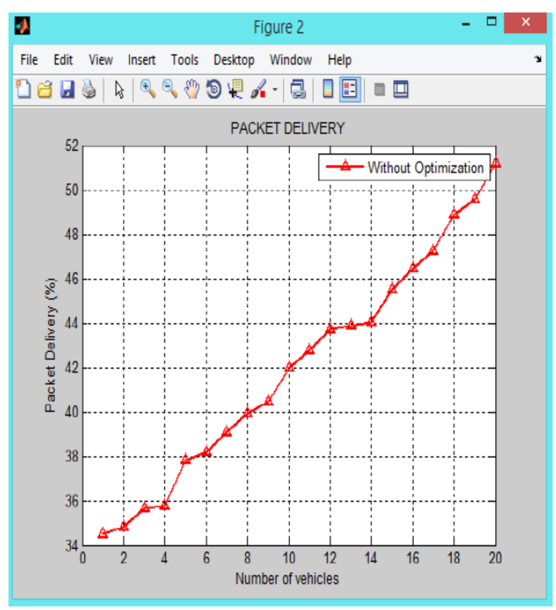

Figure 2: Packet delivery ratio without optimization

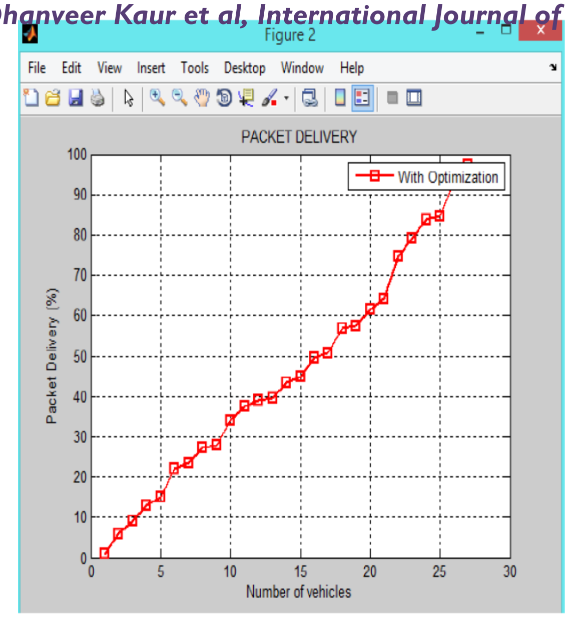

Figure 3: Packet delivery ratio with firefly optimization

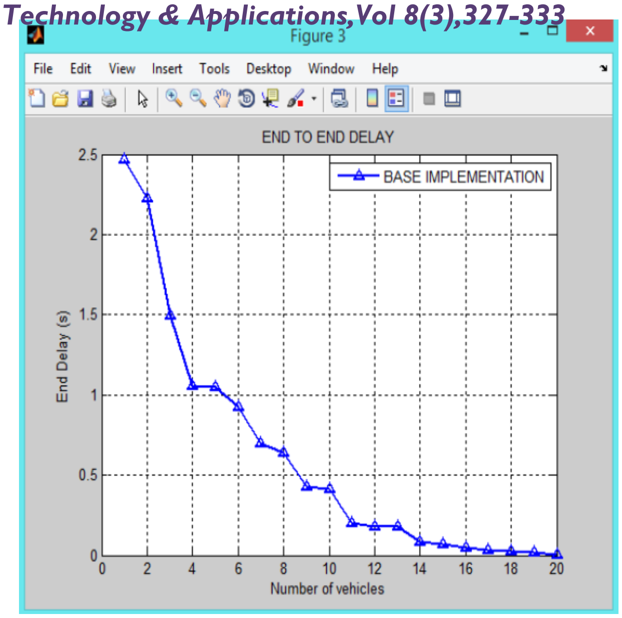

Figure 4: end to end delay without optimization

When the network density is sparse, vehicles are scattered, connectivity of the network becomes bottleneck, which is restricting the improvement in case of performance of routing. As the vehicle number increase there is increase in the network connectivity. There is increase in packet delivery ratio in both the existing and the proposed approach but with the proposed approach there is variation which is due to the optimization, which is managing the increase in routing overhead.

Evaluation of End to End Delay

Evaluating the delay calculation from end to end for vehicle numbers with the speeds randomly ranging from minimum of 30km/h to maximum of 60km/h. On comparing the delay for the nodes without optimization and with optimization there is decrease in end to end delay with the increase in number of vehicles. Here, optimization has been done with the firefly algorithm.

Parameters	Value
Simulator	MATLAB2013
Xlabel	No. of vehicles
Ylabel	End delay
Optimization algorithm	Firefly Algorithm

Table 2: End to end delay evaluation parameters

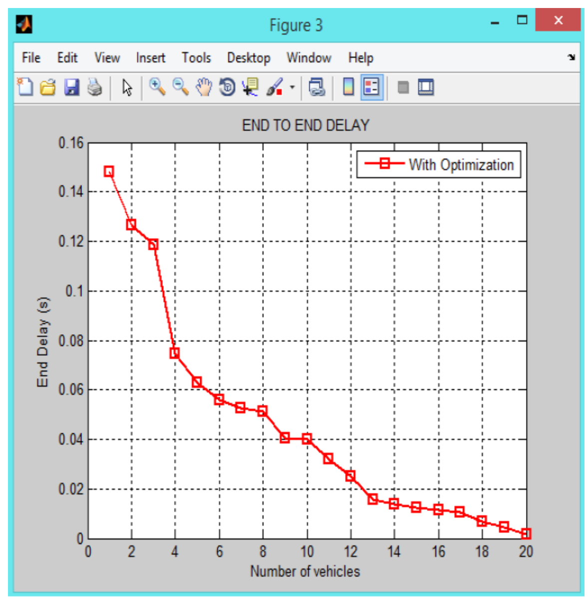

Figure 5: end to end delay with firefly optimization

When the network density is sparse, vehicles are scattered, connectivity of the network becomes bottleneck, which is restricting the improvement in case routing performance. If the intersection has been encountered by the packet, it has to wait till the time an appropriate neighbor has been found residing in the communication range, which is increasing the delay. As vehicle number increases, there is increase in the network connectivity which is leading to the decrease in end to end delay. Proposed approach takes into consideration the network resources consumption and the adjacent streets performance in case of intersections, which is ensuring the efficient transmission of packets and reducing the chances of encountering the partitions in the network.

Evaluation of Network yield

Evaluation of yield of network for the vehicles moving with the random speeds ranging from the minimum 30km/h to maximum 60km/h. Network yield is reflecting the efficiency of network, taking into consideration the routing performance of delivery of packet ratio and the throughput value of the network. As the network density increases, yield of network levels off.

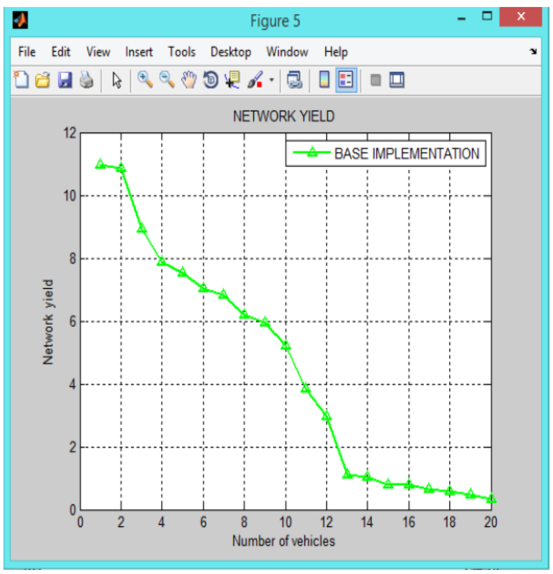

Figure 6: Network yield without optimization

Factors which are balancing the yield of network are:
Increase in the density of network is improving network connectivity, that is further reducing chances of the network partition and which is further increasing the network yield.
Increase in the network density, average hop count for end to end paths for routing also increases, which is further decreasing the network yield.

Parameters	Value
Simulator	MATLAB2013
Xlabel	No. of vehicles
Ylabel	Network yield
Optimization algorithm	Firefly Algorithm

Table 3: Network yield evaluation parameters

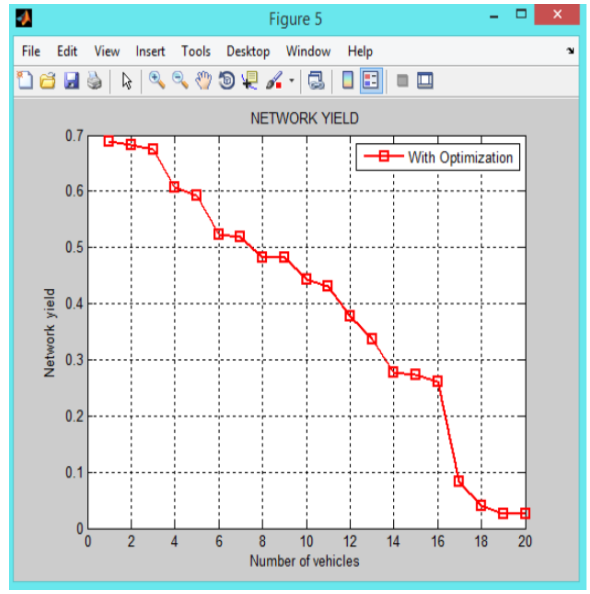

Figure 7: Network yield with optimization

Evaluation of Routing overhead

Evaluating the overhead for the vehicles moving at the random speeds ranging from minimum of 30km/h to maximum of 60km/h. Approach is utilizing the periodic beacons to have the information so that the decisions for routing can be made. The acceptable amount of overhead is important in the design of the routing protocol.

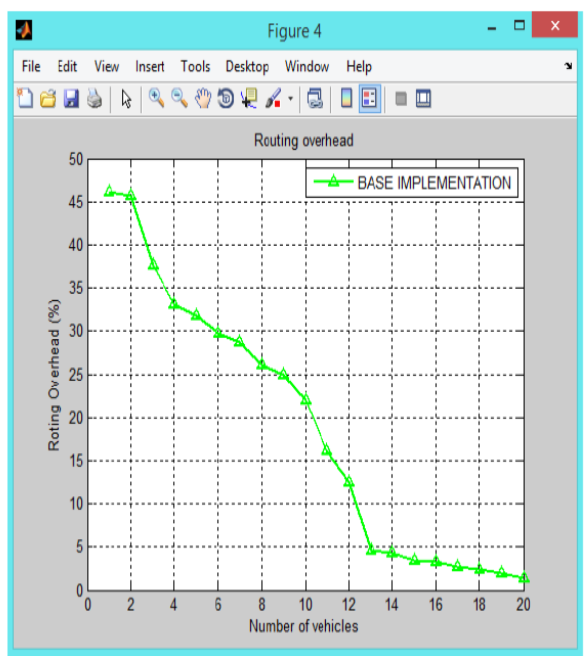

Figure 8: Routing overhead without optimization

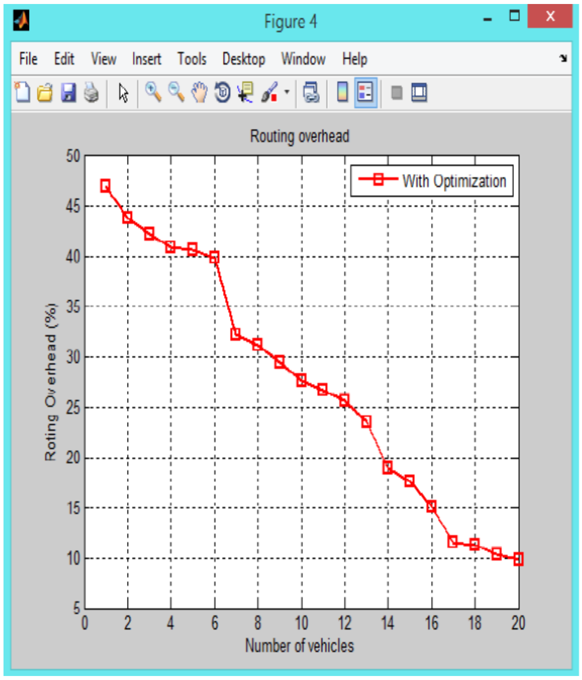

Figure 9: Routing overhead with firefly optimization

The normal amount of routing overhead is dependent on factors such as the amount of the control packets in total and the delivery ratio of the packets. There is increase in the routing overhead of both the approaches at some point. Although our proposed approach is increasing the amount of control packets, the dynamic routing decisions for forwarding the packets at the intersection increases the ratio of packet delivery.

6. Conclusion

We have proposed a system to achieve the maximum reliability for forwarding the data packets in intra-streets and the selection of street in case of intersection. In order to adapt to the urban scenario, we have proposed the system that is selecting the relaying nodes on the basis of minimum distance, and then the link state routing is being performed, after that if routing overhead exceeds then we are opting for the optimization using the firefly algorithm. The results of simulation show that the our proposed approach is better than the existing street-centric opportunistic routing. Results have shown that proposed approach is better in terms of ratio of packet delivery, delay for end to end delivery, yield of network, and the routing overhead.

7. Future Scope

Though we have tried to introduce a system for enhancing the routing in case of urban environment, but still the work is due. In the current scenario we have only focused on the routing. As the future work we can also incorporate the more factors such as direction and the information related to the history of vehicular traffic. We can also consider the security aspects as security is the main threat. Detecting the malicious vehicle and blocking them from interaction in the system which is further increasing the reliability.

8. References

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