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Advancement in VANET Routing by Optimize the Centrality with ANT Colony Approach

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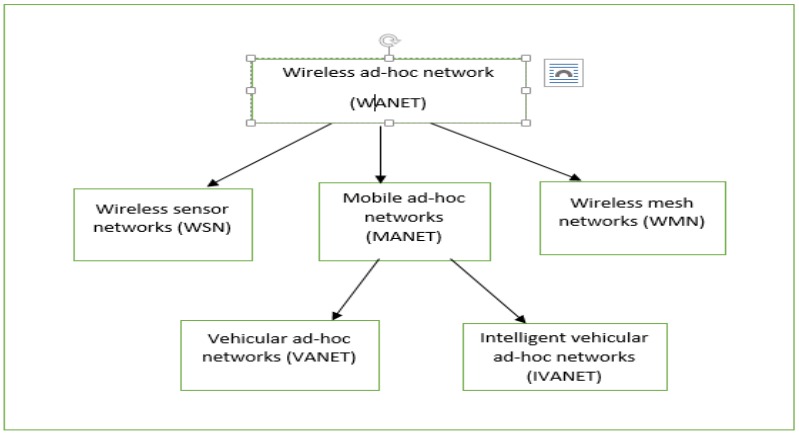
ABSTRACT
In a wireless ad hoc network, an opportunistic routing strategy is a strategy where there is no predefined rule for choosing the next node to destination (as it is the case in conventional schemes such as OLSR, DSR or even Geo-Routing). A popular example of opportunistic routing is the "delay tolerant" forwarding to VANET network when a direct path to destination does not exist. Conventional routing in this case would just "drop" the packet. With opportunistic routing, a node acts upon the available information, In this thesis optimize the routing by centrality information then refine by ant colony metaheuristics. In this method validate our approach on different parameter like overhead, throughput.

Keywords: *ACO, ONE Simulator, Betweenness Centrality*

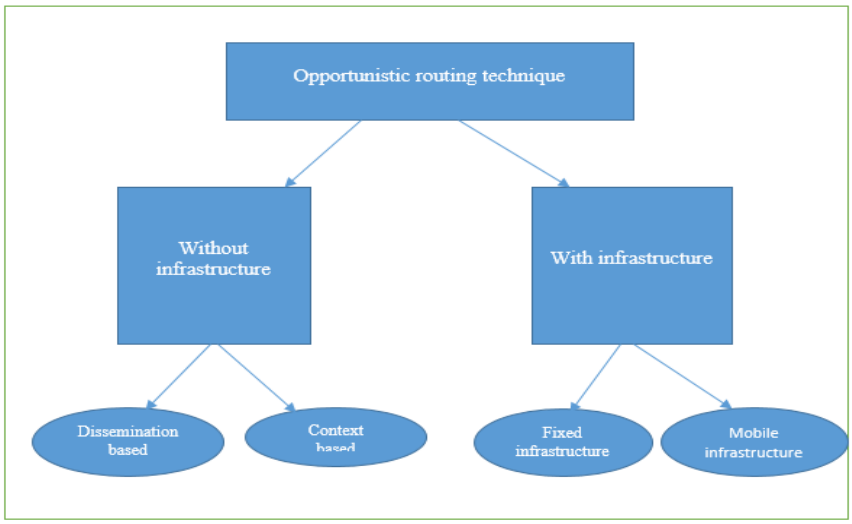
I. INTRODUCTION

Vehicular Ad-hoc network (VANET) is based on a principles of mobile ad-hoc networks (MANET). It is a spontaneous process of data exchange from one node to another node. Vehicular networks comes with new promising field in wireless technology which is used to deploy a vehicle to vehicle communication (V2V) and vehicle to infrastructure (V2I) communication between nodes. VANET is based on wireless fundamental concept that is classified into different networks such as wireless sensor networks (WSN), wireless mesh networks (WMS) and mobile ad-hoc networks (MANET). VANET is a subset of MANET having different characteristics like node mobility, self-organizing, frequently-data exchange. In vehicular ad-hoc network every node is a vehicle that are communicate with each other or a nearby vehicle and road side units. When communication between vehicles occur it is called V2V (vehicle to vehicle) communications and when vehicle communicate with road side equipment\units then it is known as V2I (vehicle to infrastructure) communications. ITS improve the road safety, comport and efficiency. The topology of VANET changes because of the movement of vehicles at high speed. The mobility pattern of vehicles depends on traffic environment, roads structure, the speed of vehicles, driver's driving behavior and so on. The communication environment between vehicles is different in sparse network & dense network.



Structure of wireless ad-hoc networks (WANET)

Opportunistic networks consist of a group with the shortest communication range carried by people, vehicles and the mobile nodes in the certain area. Because of no. of mobile node, the limited communication range and battery power, so it is difficult to maintain the connection between source and the destination. Opportunistic networks are the one of the most interested evolution of mobile ad-hoc networks. Main requirement of MANET is sender and receiver are connected to the network at the same time. If the destination is not connected to the network when sender wants to send the message then they get dropped at some point of network.Opportunistic network aim to make user able to exchange information even in a disconnection environment. In opportunistic networks, mobile nodes are enabled to communicate with each other even if a route connecting them never exists. Routes are built dynamically, while messages are en route between the sender and the destination(s), and any possible node can opportunistically be used as next hop, provided it is likely to bring the message closer to the final destination. These requirements make opportunistic networks a challenging and promising research field. The design of efficient routing strategies for opportunistic networks is generally a complicated task due to the absence of knowledge about the topological evolution of the network.



Routing technique of opportunistic network

II. RELATED WORK

Gray k. w. wong, "Performance evaluation of social relation opportunistic routing in dynamic social network". In this paper SROR (social relation opportunistic routing) algorithm is used for mobile social networks and define social relation and profile among the nodes. SROR algorithm is used to solve the routing issues by searching and forwarding the node. Social computing has adapted to solve the networking protocol design such as routing and scheduling.In this paper aim to provide the more accurate and extensive performance evaluation results with quality of service metrics. Social based approaches are more promising than the traditional opportunistic routing protocols, social properties provide more stable over the unstable dynamic characteristics. Social characteristics of nodes, routing protocol can efficiently predict and deal with the dynamics of networks.

Juan luo, "opportunistic routing algorithm for relay node selection in wireless sensor networks". Wireless sensor networks having a wide range of application in area such as traffic monitoring, medical care, robotic exploration. In this paper focus on minimizing energy consumption and maximizing the network lifetime for data relay in one-dimensional queue network. Extensive simulations and real testbed results show that the proposed solution ENS-OR can significantly improve the network performance on energy saving and wireless connectivity in comparision with other existing WSN schemes. The proposed routing protocol algorithm will be extended sleep mode and longer network lifetime can be achieve.

Mingjun Xiao, "Community-aware opportunistic routing in mobile social networks". Mobile social networks (MSN) are delay tolerant network that consist of lots of mobile nodes with social characteristics. Many algorithm is proposed to address routing problem in MSN. In this paper proposed CAOR (community aware opportunistic routing) algorithm. Our main contributions are that they proposed home aware community model which turn MSN into a network. CAOR can achieve the minimum expected delivery delay in simplified network. CAOR uses a reverse Dijkstra algorithm to calculate the minimum expected delivery delay. CAOR achieve the optimal routing performance at very low cost. The optimal and predictable routing performance is the biggest advantage of CAOR algorithm.Xuebin Ma, "An overlapping community detection algorithm for opportunistic networks". In this paper community structure are design to understand the networks which can also beneficial for routing protocol and QOS schemes designing. Opportunistic network which consist of no. of

mobile nodes, its topology change over the time. Therefore community detection become more difficult than static nature. The overlapping community detection is more complex problem. This paper analyzes the time varying topology of opportunistic networks and the overlapping community structure of human. Community detection algorithm applied on social science, complex networks and graph theory. The algorithm is highly reliable and flexible for overlapping community detection in the opportunistic networks.

Mingjun Xiao, "Deadline-sensitive opportunistic utility based routing in cyclic mobile social networks". In this paper define utility based routing into cyclic MSNs, and proposed a deadline sensitive utility based routing model. A cyclic mobile social network (MSN) is a new type of delay tolerant network, in which mobile nodes are move periodically and carried short distance communication devices. In this paper introduce a deadline sensitive utility model into MSN routing. Under this model, proposed a single-copy routing algorithm DOUR (deadline sensitive opportunistic utility based routing model), and a multi-copy routing algorithm m-DOUR csn achieve a maximum utility for each message delivery. Both provide a good balance among the benefit, delay and cost.Jie luo, "A mobile infrastructure based VANET routing protocol in the urban environment". In this paper, first analyze the unique features of urban VANET that vehicle have different types, and move like clusters due to the influence of traffic lights. So, the concept of using buses as a mobile infrastructure to improve the network connectivity is proposed. In this paper proposed a routing protocol named MIBR (Mobile infrastructure based VANET routing protocol).This protocol make full use of the buses, making them a key component in route selecting and packet forwarding. MIBR is a location based routing protocol. MIBR achieves the highest packet delivery ratio.MIBR protocol improve the network connectivity by increasing the transmission range.

Marco Dorigo, "Ant colony system: A cooperative learning approach to the traveling salesman problem". In this paper introduce the ant colony system (ACS). It is a distributed algorithm which is used to the travelling salesman problem (TSP). In the ACS, a set of cooperative agents called ant cooperate to find the good solution to TSP's.Real ants capable of finding the shortest path from a food source to their nest. ACS is an interesting approach to parallel stochastic optimization of the TSP. ACS is also a very good constructive heuristic to provide such starting solutions for local optimizer.John E. Bell, "Ant colony optimization techniques for the vehicle routing problem". In this paper use a meta-heuristic approach for ant colony optimization (ACO) to establish a set of vehicle routing problem (VRP).Modification are made to the ACO algorithm used to solve the travelling salesman problem to allow to search the multiple route of the VRP. Finding efficient vehicle route is an important logistics problem. The application of ACO technique applied to the routing problem with unique clustering feature such as logistic problem. Ant colony approach is used to find a good optimal path. Ant colony optimization is a meta- heuristic technique that use artificial ants to find the solution to combinatorial optimization problem. ACO is based on the behavior of real ant and possess enhanced abilities such as memory of fast action and knowledge about the distance to other locations.

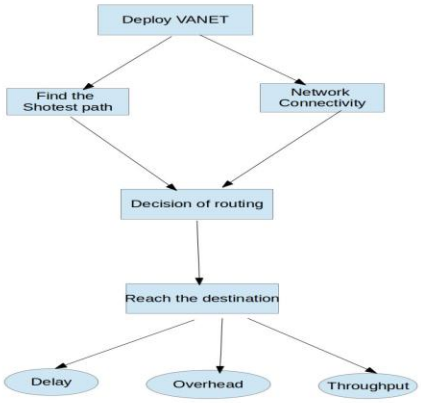
Saab Ghaleb Yaseen, "Ant colony optimization". In this paper we studied about the ACO optimization is model for bio simulation due to their relative individual simplicity and their complex behavior. This paper introduce ACO as a distributed algorithm that is used to solve the travelling salesman problem. A meta-heuristic is a set of algorithm concept that is used to define a heuristic method applicable for a wide set of problem. ACO is used to find a optimal path from source to destination. Use of ACO algorithm for good propagation process, help to find the systematic, effective procedure to find good path for good propagation with respect to some predefined cost and constrains function. ACO algorithm include two mechanism that is: trail evaporation and daemon action.

Michael Barbehenn,"A Note on the Complexity of Dijkstra's Algorithm for Graphs with Weighted Vertices". In this paper, the time complexity of Dijkstra's algorithm, implemented with a binary heap. Dijkstra's algorithm is an often cited and well-known algorithm to solve the single-source shortest paths for a given graph *(V, E) with nonnegative edge weights. The complexity of Dijkstra's algorithm is as follows. It takes 2(|V|) time to construct the initial priority queue of |V| vertices [3]. Each of the subsequent priority queue operations takes time 2(log q) where q is the current size of the queue. Therefore, the complexity of Dijkstra's algorithm for vertex-based cost functions is 2(|E| + |V| log |V|) using a binary heap implementation for the priority queue.

Chung-Ming Huang, Kun-chan Lan, "A Survey of Opportunistic Networks". In this paper opportunistic network as one type of challenged networks where network contacts are intermittent or where link performance is highly variable or extreme. In such a network, there does not exist a complete path from source to destination for most of the time. In addition, the path can be highly unstable and may change or break quickly. Opportunistic network is an emerging system that is getting growing interest in networking research community. The opportunistic network places different research challenges on different layers of a protocol stack. In this paper, we provide a quick overview of the state-of-the-art work in providing solutions to various issues in an opportunistic network.DongKai Fan, Ping Shi, "Improvement of Dijkstra's Algorithm and Its Application in Route Planning". In order to improve the efficiency of road network route planning, many experts and scholars have conducted some studies, Dijkstra's algorithm is a research hotspot. The Dijkstra's algorithm has its own shortcomings when seeking an optimal path between two points, but it has irreplaceable advantages. Dijkstra's

algorithm is the most classical and mature algorithm for searching a shortest path in the graph, however, this algorithm has the highly time complexity and takes up a larger storage space. Dijkstra's algorithm to its own traits reduces the searching scale of algorithm and improves running efficiency. The results show that the improvement of algorithm is reasonable and effective.

Methodology used:



1) In first step use a one simulator to deploy a VANET network. The ONE is a simulation environment that is capable of

- generating node movement using different movement models
- routing messages between nodes with various DTN routing algorithms and sender and receiver types
- visualizing both mobility and message passing in real time in its graphical user interface.

ONE can import mobility data from real-world traces or other mobility generators. It can also produce a variety of reports from node movement to message passing and general statistics.

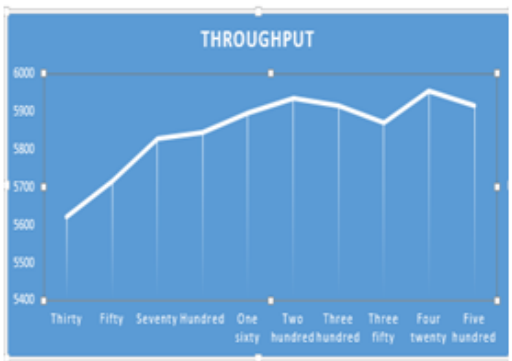
2) In second step to find a shortest path by using Dijkstra algorithm is used. It is graph based searching algorithm that solve the single source shortest path problem. This algorithm is also used in routing. Dijkstra algorithm is used for finding the shortest path with minimum cost. It is an algorithm for finding the shortest path between nodes in a graph. Dijkstra algorithm does not use a min-priority queue & run in time $O(|V|^2)$.

3) Betweenness centrality:- Betweenness centrality is used to gather the social information of the node. It shows how much packet deliver from source to destination. Betweenness centrality also shows how much packets drop in a network.

4) Decision of routing is done by ACO algorithm. Ant colony optimization is a meta-heuristic technique that uses artificial ants to find solutions to combinatorial optimization problems. Ant colony optimization is the part of a large field of swarm intelligence in which scientist study the behavior pattern of bees, termites, ants, and other social inspects in order to simulate processes. Ant colony optimization is an iterative distributed algorithm.

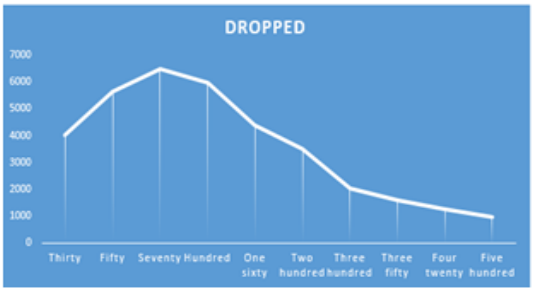
III. Results

Throughput: The amount of material or items passing through a system or process. Network throughput is the rate of successful message delivery over a communication channel.



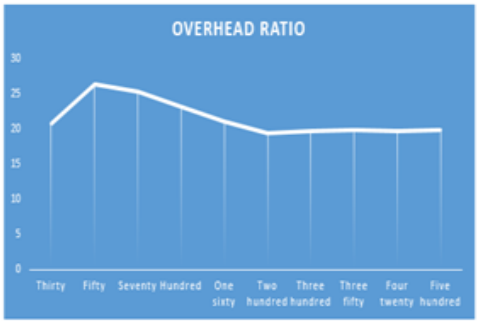
Nodes	Throughput
Thirty	5622.385
Fifty	5714.14
Seventy	5829.17
Hundred	5843.77
One Hundred Sixty	5895.07
Two Hundred	5934.4
Three Hundred	5914.57
Three Hundred Fifty	5871.24
Four Hundred Twenty	5954.18
Five Hundred	5916.5

Dropped:Packet loss occurs when one or more packets of data travelling across a computer network fail to reach their destination. Packet loss is typically caused by network congestion.



Nodes	Dropped
Thirty	4012
Fifty	5630
Seventy	6476
Hundred	5958
One Hundred Sixty	4400
Two Hundred	3492
Three Hundred	2032
Three Hundred Fifty	1612
Four Hundred Twenty	1258
Five Hundred	980

Overhead Ratio: Overhead ratio is defined as the amount of processing time. Overhead ratio is calculated by number of packet dropped, number of packet delivered and number of packet receive at a node.



Nodes	Overhead Ratio
Thirty	20.76
Fifty	26.34
Seventy	25.28
Hundred	23.24
One Hundred Sixty	21.14
Two Hundred	19.35
Three Hundred	19.71
Three Hundred Fifty	19.81
Four Hundred Twenty	19.68
Five Hundred	19.91

IV. CONCLUSION

VANET is a spontaneous process of data exchange from one node to another node.In this thesis use ACO optimization for improving the throughput of a network. With the help of centrality reduce the drop packet and also reduce overhead ratio. In carrier-based routing, nodes of the infrastructure are mobile data collectors. They move around in the network area, following either pre-determined or arbitrary routes, and gather messages from the nodes they pass by. They can be the only entities responsible for messages delivery, when only node-to-carrier communications are allowed, or they can simply help increasing connectivity in sparse networks and guaranteeing that also isolated nodes can be reached. In the latter case, delivery of messages is accomplished both by carriers and ordinary nodes, and both node-to-node and node-to-carrier communication types are allowed. A popular example of opportunistic routing is the "delay tolerant" forwarding to vanet nework when a direct path to destination does not exist. Conventional routing in this case would just "drop" the packet .In this thesis optimization refinement reduce the packet drop and reduce the overhead.

V. FUTURE SCOPE

Enhancement of this work by reducing the packet drop by hybrid optimization with learning approaches and reduce the centrality information by different betweenness centrality and game theory which increase the social information of nodes.

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