

# Review on Swarm Intelligence Routing Protocol in Vehicular Ad-hoc Network

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**Abstract:** Vehicular Ad-hoc networks are likely to become most relevant form of mobile Ad-hoc network. There are various challenges are faced in Ad-hoc environment. There are number of issues with Vehicular Ad-hoc networks like security, congestion, intelligence system. While working with Vehicular Ad-hoc network the Geographic selection is also a problem. Review work trying to represent to solution for same problem. In Vehicular Ad-hoc networks topology of network change very often. There core implementation of efficient routing protocol is very important problem. In many studies specific Ad-hoc protocol are used in Vehicular Ad-hoc networks scenarios like AODV, DSDV etc. but they have a poor performance. The main goal of this paper is to discuss the issues related to finding path between the communication end points, what is aggravated through the vehicle mobility.

**Keywords:** Vehicular Ad-hoc Networks (VANETs), Routing protocols, Swarm intelligence (SI).

## 1. Introduction

VANET is a communication network organizing and connecting vehicles to each other, which consists of instrumented vehicles and network infrastructure. Each vehicle is supposed to equip with on-board computing, wireless communication devices, and a GPS device enabling the vehicle to track its spatial and temporal trajectory. Vehicles are typically equipped with short-range communication devices where they can exchange information with other vehicles within their radio range, leading to the creation of ad-hoc wireless networks. Vehicular networks are spontaneously formed between moving vehicles equipped with wireless interfaces that could be of homogeneous or heterogeneous technologies. The Figure 1 shows the VANET Architecture. These networks, also known as VANETs, are considered as one of the ad hoc network real-life application enabling communications among nearby vehicles as well as between vehicles and nearby fixed equipment, usually described as roadside equipment [9]. The vehicular network provides wide variety of services, ranging from safety-related warning systems to improved navigation mechanisms as well as information and entertainment applications [10].

VANETs pose many challenges on technology, protocols, and connectivity which increase the need for research in this field. Factors like efficient message dissemination, network scalability, and wireless transmission are still major research areas in the area of vehicular ad hoc networks. One of the major issues in VANET is routing due to the mobility of the vehicle nodes. Routing means the act of moving information across an internet work from a source to a destination [1].

Vehicles acting as nodes in VANET are able to make queries and respond to queries from other participating nodes in the ad hoc network. Node or vehicle mobility may cause frequent topology changes, thereby rendering proactive routing techniques ineffective or severely constrained with

respect to network congestion. For a VANET to function effectively the nodes or vehicle should be able to overcome network fragmentation and relay messages to other nearby networks. In Vehicular Ad-hoc networks topology of network change very often. So there core implementation of efficient routing protocol is very important problem. In many studies specific Ad-hoc protocol are used in Vehicular Ad-hoc networks scenarios like AODV, DSDV etc [3] but they have a poor performance. Propose work trying to represent to solution for same problem.

The Routing protocol is base on swarm intelligence. Swarm intelligence deals with collective behaviors that result from the local interactions of individual components with each other and with their environment. Swarm Intelligence based routing protocol show promising results in Vehicular ad hoc networks in terms throughput, latency, data delivery ratio and data delivery cost [3].

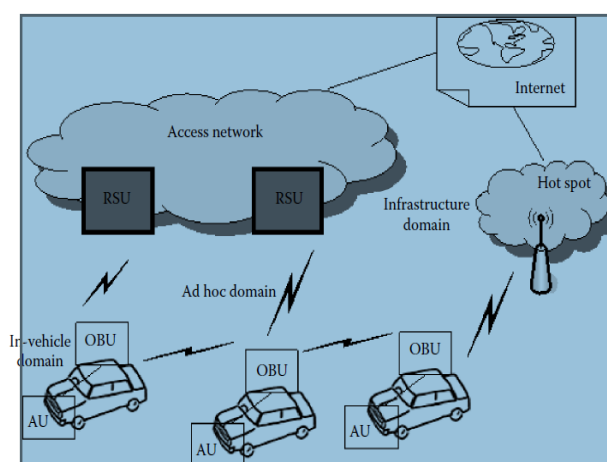


Figure 1: C2C-CC reference architecture

## 2. Related Work

Inter-vehicle communication and path discovery are important research goals in VANET. The field is very important for research point of view. The Survey of work are as follows-

In [1], Alpna Dahiya, Madhu, Niyati Bansal describe the Owing to its high dynamic topology and unpredictable channel distribution, it aspires for a suitable routing protocol algorithm that can generate a near seamless network connectivity among the vehicular nodes. In the proposed work the author represents an algorithm to solve the congestion problem in all path networks and to get such a path that will provide efficient data transmission over the network. In the network author divide the whole network into sub-networks and we perform the transmission over the sub goal and to achieve the efficient and reliable data transmission.

In [2], Prasan Kumar Sahoo, Ming-Jer Chiang, Shih-Lin Wu describe the traffic connectivity for the vehicular adhoc networks is modeled taking various speed and safety distance between the cars that are running along bidirectional two lane roads. The connectivity at a large traffic square is analyzed when vehicles of different size pass through it. The connectivity is analyzed along the city roads where traffic signal is included in the analysis. Besides, the effect of change in lane due to overtaking of vehicles is also incorporated in the connectivity analysis. From the simulation result, the author observed that connectivity in terms of duration of packet delivery fluctuates with different speed of the vehicles and change in direction of vehicles also affects the connectivity.

In [3], S. S. Manvi, M. S. Kakkasageri, C. V. Mahapurush outlined the Comparison and evaluation of the performance of routing protocols AODV, DSR, and SWARM, and analyzed the differences in their performance. These performance evaluations are necessary to devise the new routing protocols for VANETs. An important observation was that the examined routing protocols showed highly heterogeneous performance results. Author found out that AODV and DSR may not be suitable for vehicular environments, whereas SWARM showed promising results.

In [4], Brijesh Bhatt, Vasundhara Uchhula the author compares the various ant based algorithm. Among wireless networks Anthocnet is more efficient among all the considered ant based algorithms because it has greater chance of exploring new paths based on probability but it is more costly and requires more resources for implementing it. This is due to the fact that there is lot of ant traffic generated. PERA is better in terms of less cost and also efficient in maintaining and exploring new paths. ARA is similar to PERA but in ARA both forward and backward ants update pheromone value.

In [12], Camara and Loureiro outline a source routing scheme in which the network relies on location information and support from fixed infrastructure. Owing to a source routing approach, the algorithm relies heavily on a source M destination route which is available at the time of message

creation. New nodes in the network start with using their neighbor's routing table. The routing table, generated using shortest path algorithms, on the other hand, may contain information which is outdated. Ants are unicast from a source to specific destinations, for example, the destination node may be the node with the oldest information in the routing table. This mechanism is used to make sure that the routing information in the source is updated and recent. Thereby, ants are used in [12] with the semantics of routing information updates, like classical distance vector protocols such as DSDV or DBF—ants are not used as feedback agents to reinforce routes positively (in the case when a route is still good), negatively (when a route is no longer good) or explore new routes randomly—ants in this approach are unicast to specified direction, not allowing for amplification of fluctuations, and depending on known metrics such as timestamp of a route in the routing table.

The approach used in [13] by Heissenbttel and Braun also relies on location information, and is a purely proactive routing approach based on dividing the network into logical zones and assigning logical routers to each. Ants—forward ants and backward ants—are used by logical routers in this approach to periodically check if the logical links connecting it to a randomly chosen destination are functional and reflect on the current state of the network surrounding the logical router. Positive and negative reinforcement are achieved by means of multiple interactions and pheromone additions (by forward and backward ants) and pheromone aging, respectively. Random amplification of a new good route in the face of topological fluctuations is possible by random dissemination of ants to destinations.

In [14], Gunes et al. outline ARA, a multipath, purely reactive scheme. ARA uses forward ants and backward ants to create fresh routes from a node to a destination. When routes to a destination D are not known at S, a forward ant is broadcast, taking care to avoid loops and duplicate ants. When a forward ant is received at an intermediate node X via node Y, the ant reinforces the link XY in X to route to all the nodes covered so far by the forward ant. When a forward ant is received at D, a backward ant is created which back track the path of the corresponding forward ant. At each node the backward ant is received, the link via which the backward ant is received is reinforced, like the forward ant does, for all nodes which have been visited by the backward ant. In ARA, data packets perform the necessary (positive) reinforcement required to maintain routes. When a path is not taken, it subsequently evaporates (negative reinforcement) and cannot be taken by subsequent data packets. Under the described scheme, amplification of topological and network fluctuations is not possible except under extreme conditions when routes break often.

## 3. Approach Towards ANSI Protocol

The idea of swarm based routing algorithms derives from real swarms of certain insects, which develop a form of 'Swarm intelligence' and solve complex problems through cooperation. Routing in VANET is a Dynamic Optimization Problem as the search space changes over time. The routing policy is defined as the rule that specifies what node to take next at each decision node to reach the destination node. Due

to the time varying nature of the topology of the networks, traditional routing techniques such as distance-vector and link-state algorithms that are used in fixed networks, cannot be directly applied to Vehicular ad hoc networks. One autonomous ant itself obeys primitive instincts and only performs limited, specialized tasks. However, the colony at large shows a global intelligent behavior.

There are different types of ant colony optimization algorithm which are used for routing in networks. They are Ant Based Control algorithm, Antnet algorithm, Mobile Ant Based Routing, Ant Colony Based Routing Algorithm, Termite Probabilistic Emergent Routing Algorithm, AntHocNet [4]. In this work, the main interest is routing in vehicular ad-hoc network using swarm intelligence Based Routing Algorithm. The algorithm is based on proactive and reactive protocol.

### 3.1. Proactive Routing

The proactive routing means that the routing information like next forwarding hop is maintained in the background irrespective of communication requests. The packets are constantly broadcast and flooded among nodes to maintain the path, and then a table is constructed within a node which indicates next hop node towards a destination. The advantage of proactive routing protocols is that there is no route discovery is required since the destination route is stored in the background, but the disadvantage of this protocol is that it provides low latency for real time application, it also leads to the maintenance of unused data paths, which causes the reduction in the available bandwidth. The proactive protocol is also known as table driven routing protocol. These protocols work by periodically exchanging the knowledge of topology among all the nodes of the network. The DSDV, FSR is Example of the proactive routing protocol.

### 3.2. Reactive Routing

Reactive routing opens the route only when it is necessary for a node to communicate with each other. Reactive routing consists of route discovery phase in which the query packets are flooded into the network for the path search and this phase completes when route is found. These protocols are called as on-demand routing protocols as they periodically update the routing table, when some data is there to send. But these protocols use flooding process for route discovery, which causes more routing overhead and also suffer from the initial route discovery process, which make them unsuitable for safety applications in VANET. The AODV, DSR is Example of Reactive Protocol.

### 3.3. Hybrid Routing

In proactive protocols nodes in the network maintain routing information to all other nodes in the network by periodically exchanging routing information. Nodes using reactive protocols delay the route acquisition until a demand for a route is made. Swarm based intelligent routing protocols use a combination of both proactive and reactive activities to gather routes to the destinations in a network—nodes for example, proactively collect routes in their zone, and other routes are collected reactively. Our protocol, ANSI, is a hybrid protocol proposed for hybrid ad hoc networks.

## 4. ANSI Routing Protocol

The outline of the process of ANSI routing is as follows:

1. When a route to a destination D is required, but not known at a node S, S broadcasts a forward reactive ant to discover a route to D
2. When D receives the forward reactive ant from S, it source-routes a backward reactive ant to the source S. The backward reactive ant updates the routing table of all the nodes in the path from S to D, allowing for data transfer from S to D.
3. When a route fails at an intermediate node X, X first checks if there are other routes which can be used to route the packet to D. If not, then ANSI buffers the packets which could not be routed and initiates a route discovery to find D by using a forward reactive ant to perform local route repair. Additionally, X sends a route error message back to the source node S.
4. Nodes belonging to more capable, infrastructure networks maintain routes to their connected components proactively, by periodic routing updates using proactive ants. Nodes belonging to more capable, infrastructure networks also use stochastic routing when multiple paths are available. In addition, each node in the infrastructure collects information about which vehicle nodes are connected to which infrastructure node.
5. When a route at D is known at a VANET node S, ANSI deterministically chooses the best next hop to reach the destination. If S is part of a highly capable infrastructure, then S may choose to perform stochastic routing to the destination D, depending on the availability of multipath routes.

## 5. Robustness of Algorithm

Our protocol, ANSI, is a hybrid protocol proposes for hybrid ad hoc networks. Some characteristics seen in traditional on-demand routing protocols can be seen in ANSI. Unlike traditional VANET protocols which engage in route maintenance discovery activity only when links break, ANSI continuously updates a node's neighborhood information using data packets and control packets to alleviate the negative effects due to flooding the network with route discovery and maintenance [6].

In addition, unlike traditional VANET protocols, ANSI has a flexible cost function which allows it to perform metric-centered routing. We have to perform congestion-aware routing, but it is easy to see how this cost function can be modified to perform, say, energy efficient routing. When compared to other ant algorithms for VANET routing, we note that to the best of our knowledge, there exists no other ant algorithm for hybrid ad hoc networks, but ANSI is able to perform well in both pure VANET and hybrid ad hoc networks. In addition, the ANSI design understands the advantages of proactive routing in immobile, highly capable infrastructure and applies it only in those nodes, rather than letting pure VANET nodes incur the costs due to the same under high mobility conditions. Lastly, the flexible cost function in ANSI leverages the inherent nature of swarm

intelligence by collecting multiple routes and using them to perform load balancing in all sections of the network.

## 6. Expected Result

SWARM Intelligence based routing protocol showed promising result in VANETs in terms throughput, latency, data delivery ratio and data delivery cost. Proposed system should compares the routing protocols AODV, DSDV, SWARM, and analyze the differences in their performance. These performance evaluations are necessary to devise the new routing protocols for VANETs. An important observation will be useful for examining routing protocols. Proposed system will checked out that AODV and DSDV may be suitable or not for vehicular environments

## 7. Future Scope

As ANSI Algorithm find the path between the communication end points what is aggravated through the vehicle mobility. The propose routing strategy could be optimized to support communications in Vehicular ad hoc networks based on Swarm intelligence routing protocol and provide Quality of Service features in the presence of dynamic topology, absence of centralized authority, time varying etc. This ANSI protocols in VANET satisfying user's requirement which need to be maintain consistency. For further extending this system using ANSI algorithm, the minimum data rate that is the data rate can be calculated which will be the contribution in the field of data communication.

## 8. Conclusion

This paper describes the review, design swarm intelligence-based hybrid routing protocol, ANSI, for hybrid ad hoc networks. Swarm systems have motivated and simulated many for the disseminated model of algorithms, especially in the routing algorithms. The proposed routing strategy could be optimized to support communications in Vehicular ad hoc networks based on Swarm intelligence routing protocol. The major complexity in Vehicular ad hoc network is to maintain the Quality of Service features in the presence of dynamic topology, absence of centralized authority, time varying etc. The challenges reside in vehicular ad hoc networks is to find a path between the communication end points satisfying user's requirement which need to be maintain consistency.

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