International Journal of Pure and Applied Mathematics
Volume 118 No. 24 2018
ISSN: 1314-3395 (on-line version)
url: http://www.acadpubl.eu/hub/
Special Issue

http://www.acadpubl.eu/hub/

A Review of Compound-weighted based metric algorithms for Vehicular Ad Hoc Networks

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May 23, 2018

Abstract

Nowadays peoples modern life of travel become easier due to Vehicular Ad-hoc Networks which is a combination of communication of mobile and Internet of Things. The algorithms will provide an efficient weighted metric of vehicles which is proposed by the transport services. The cluster head selection is based on the compound weighted metric which provides the optimum solution. In this review paper, we presented efficient algorithms based on compound weighted metric and their computational complexity is also examined.

***Key Words*:**Clustering; VANET; MANET;

1 Introduction

Due to the constraint features of movement of vehicles, the algorithms developed in existing systems have problems when communicated with network for applications of vehicular adhoc networks.

The main objective is to provide energy saving, efficient movement and finally safety in vehicular adhoc networks. The benefits of clustering algorithm includes: 1) construction of hierarchical network trees 2) development of coverage rate of network 3) shortest path for vehicles. Due to the combination of communication of mobile [1] and Internet of things, VANET provides inspiration on travel and life of people. VANET has been widely used in both Intelligent Transportation System (ITS) and Electronic Toll Collection (ETC) systems.

The method which is followed in MANET can also be executed by VANET [2]. The nodes which are in MANET are replaced by vehicles in VANET. The mobility of nodes in VANET provides some constraints on the topology of the road and also in traffic lights. Due to continuous power supply in VANET, there is no restriction on power supply in VANET. But limited power supply for device portability of MANET. The density of network will vary based on density of traffic in VANET, whereas in MANET it varies slowly. There is rapid change in network topology while vehicle movement is faster in VANET, whereas in MANET it is stable. The scalability of network is high in VANET, whereas in MANET it is limited. The ability of computation in VANET depends on sensors and availability of resources, whereas in MANET it is limited due to portability of device.

The aim of this effort is to contemporary a perilous review of the most dominant compound-weighted metric algorithms, describing their important characteristics.

The main aim of this paper can be prcised as follows:

- To review the traditional algorithms for how clustering formation is made.
- To recognize the importance of VANETs
- To recognize the modern enhancements in this domain.
- To existent the effects of algorithms in real-time applications

The rest of this paper is as follows: In Section II the most efficient compound-weighted metric algorithms are described. The list of algorithms with comparison characteristics are described in Section III. Section IV concludes the paper.

2 COMPOUND-WEIGHTED METRIC ALGORITHMS FOR VANETS

DMAC algorithm [3] is a distributed based and mobility-adaptive for clustering the VANET. In general, the algorithm divides the nodes of multi-hop network into number of clusters which gives a hierarchy structure. The algorithm performs adaptive changes in the topology of network due to the movement of nodes and addition or deletion of nodes. DMAC algorithm provides an efficient formation of cluster and implemented for specific applications. DMAC algorithm is to overcome the difficulties during set up of clusters and also in maintenance stage. The cluster head selection is based on the parameter of each node. The greater node is elected for cluster head. When two or more nodes are neighbors, the smaller node among them will resign and greater node becomes cluster head.

In G-DMAC algorithm [4] the nodes of the cluster can move during set up phase. The role of the node is decided by itself. The G-DMAC algorithm is defined by two properties. One of the parameter of the algorithm is their number of neighbor nodes. The node can decide itself their role. Each node is associates with their cluster head and also the cluster head have specified number of neighbour cluster heads.

WAC algorithm [5] is a weighted clustering algorithm for vehicular adhoc network. The mobile nodes are modified during dynamic movement of vehicles and the reconfiguration of the system is compulsory. This makes difficult for deciding the topology and their stability. To avoid this complexity, Weighted Clustering Algorithm takes place for power of transmission, ideal degree, and mobile node battery power. WAC algorithm keeps the stability of the nodes during dynamic nature of their movement. In WAC algorithm, the cluster head selection depends on their mobility, battery power and their power of transmission. The cluster head is selected as early as possible which reduce the system changes. The cluster head can identify the nodes within the cluster for effective functioning and high throughput of the system. The battery power consumption is more and can be effectively used for transmission of data. Mobility is used for selection of cluster heads. The cluster head selection is based on finding the nodes neighbour during first stage. The degree difference of each node is computed. The sums of the distances

of all their neighbors are also calculated. The time complexity of processing each node is computed. Finally it computes the battery power of cluster head.

MobHid algorithm [6] is mobility aware with highest degree method which creates a cluster structure with stability. In this algorithm the overhead of controlling the cluster head is minimal. The virtual backbone is created with the help of cluster head and gateways, such that the delay routing messages will be small. The modification of protocol for routing inside each cluster is not needed and routing choices is direct inside each cluster.

UF algorithm [7] is a utility-based technique which requires specific agents for formation of clusters. The cluster head information is defined and stored with the help of augmenting the vehicle in a traffic environment. The UF algorithm identifies ID with lowest and degree with highest techniques are executed and tested. The utility function tracks the cluster head and selects the local region for determining the vehicle. Each candidate is computed with utility function by using the candidate set and information received from the local broadcast. Due to non-increasing order of utility, the cluster head candidate is selected. The cluster head candidate is broadcast to the selected vehicle. If a vehicle reaches its limit of membership of cluster, then it avoids selection as head for the cluster.

DBC algorithm [8] is density based algorithm for VANET. The DBC algorithm mainly concentrates on stable formation of nodes and providing information of active clusters. The density graph is help for providing formation of clusters. The formation of clusters is based on graph density, quality of link, position of node and reputation of node. The DBC algorithm is divided into three stages. In the first stage, it computes the connectivity level of the node, which is based on the number of connections already defined and determines the network structure. The second stage is used to select stable links. The third stage is used to give information about their history of communication between nodes. The following information is collected for each simulation: 1) average number of cluster size 2) average cluster nodes 3) average number of clusters 4) average number of cluster head which modifies per node 5) average time taken for which the node spend during clustering.

AMACAD algorithm [9] is an adaptable clustering algorithm

for mobility awareness in vehicular networks. The host mobility and topology change becomes the main drawback of clustering algorithms which is rectified by AMACAD algorithm. The algorithm is based on destination positions for providing mobility pattern and reducing the overhead. The figure 1 shows the urban scenario. The AMACAD algorithm forms the clusters in initial stage. Hello messages are exchanged between nodes and their relative values are computed. The weighted function is computed for all vehicles and construction of cluster is performed, in which cluster head is selected. The process of calculating the weighted function is repeated until all vehicles is computed. The performance of AMACAD algorithm is computed by using cluster head lifetime, node membership lifetime, number of clusters and re-affiliation rate.

K-HOP algorithm [10] is a multi-hop clustering method for VANET. The vehicle node periodically sends beacon messages to each other. The vehicle node calculates the relative mobility with each other nodes and also computes their aggregate mobility metric. The cluster head selection of particular node is depends on lowest aggregate mobility metric. The K-HOP algorithm defines three states such as UNDECIDED_CLUSTER, MEMBER_CLUSTER, and HEAD_CLUSTER. Initially the cluster is in undecided state until the vehicle switches status. The lowest aggregate mobility node is selected as head of the cluster; otherwise it is selected as member of the cluster. VWCA algorithm [11] a vehicular clustering algorithm created on the weighted clustering. The algorithm is based on the distrust value parameters, vehicle direction and the entropy. It uses transmission range for message communication in vehicles. VWCA uses two different types of methods such as transmission range for allocation malicious vehicle monitoring method. The vehicles categories is divided into three categories: 1) Honest vehicles which has behaves normally for transmission of messages. 2) Abnormal vehicles which fail to receive the messages in the networks. 3) Malicious vehicles: If the behaviour of the vehicle is abnormal continuously, then it is treated as malicious vehicles. Initially, the algorithm gets the distrust value from malicious value monitoring system and defines the weighting factors as well as neighbourhood list. If it has a neighbour then, it becomes acting as clustering head and executes malicious vehicle monitoring method and repeat the process. Otherwise it defines the priority for

distrust value. The neighbors direction is computed and its entropy is also calculated. The value of weighted clustering is evaluated and finding minimum sum of their weighted value.

TC-MAC algorithm [12] is a TDMA based Medium Access Control method for clustering VANET. The network issues are addressed while transmission messages between them and also solves high density, hidden terminal issues and mobility, data rate issues. The algorithm is used for intra-cluster transmission in VANETs which addresses the cluster management and a novel method for slot reservation of TDMA. The algorithm allows sending and receiving of non-safety messages between vehicles. The cluster head manages the intra-cluster transmission between vehicles. The algorithm is able to handle the cluster formation, transmission of intra-cluster between vehicles and slot reservation of TDMA.

TABLE I. LIST OF COMPOUND-WEIGHTED METRIC ALGROTIHMS FOR VANETS

Algorithm	**Metric Categories**	**CH selection Metric**
DMAC	Connectivity	Weight Metric
WCA	Average Velocity, Linear distance, Remaining Time, Connectivity	Combined Weight
MobHiD	Connectivity	MobHiD
UF	Either one ID, Velocity Deviation, Average distance Location, Either one connectivity, Stability Probability	Utility function
GDMAC	Either one ID, Either one connectivity	Weighted Metric
DBC	Euclidean distance, Signal-to-noise ratio	Weighted Metric
AMACAD	Relative velocity, Euclidean distance	Weighted Metric
K-Hop	Relative delay, Hop Count	Aggregate Mobility
VWCA	Linear distance, Distrust degree	Weighted Metric
TC-MAC	Relative Velocity, Average distance	Clustathaad level
VMaSC	Velocity deviation, Hop Count	Average relative speed
PassCAR	Link Expiration Time, Expected Transmission count	Priority

VMaSC algorithm [13] is an efficient multi-hop algorithm for handling stable clustering method. With the help of local coordination, it handles the modifications in VANETs. The The algorithm defines mobility pattern for reducing the overhead of clustering methods. The mobility function is computed by making different between neighboring nodes through the concept of multiple hops. The aim of the algorithm is used to create the cluster formationin which the nodes can communicate with cluster with minimum predefiined value. The cluser heads are reduced for communication

between the cellular networks and increase the stability of the cluster heads. PassCAR algorithm [14] is an efficient algorithm for aided routing protocol in passive clustering. The algorithm effectively solves issue of frequent topology modification in VANETs. For reliable and stable transmission of messages between vehicles, a routing protocol is established. The algorithm is one of the most effective approaches among all the traditional methods. The algorithm improves the routing performance and defines the cluster structure during route finding stage. Each node determines the priority level with the help of node degree, lifetime of link and their transmission count. The algorithm evaluates the performance ratios such as throughput, path delivery ratio, path lifetime and path discovery ratio.

3 COMPARISON CHARACTERISTICS OF COMPOUND-WEIGHTED METRIC ALGORITHMS FOR VANETS

Table 1 shows a list of compound-weighted metric algorithms for VANETS.

4 CONCLUSION

Vehicular Ad Hoc Networks (VANETs) are used in numerous areas in modern times. The research community performs clustering of vehicles is various perspective. It is one of the challenging tasks due to dynamic changing of topology. This review paper provides a complete list of algorithms that are used to handle compound weight metric in VANETs.

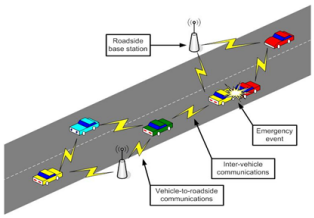

FIGURE 1. URBAN SCENARIO

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