A developed Clustering Approach to Model the Data Dissemination Types in a Highway

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Abstract: **One of the special subclasses of ad hoc networks is a Vehicular Ad hoc Network (VANET). VANET aims to enhance and save road traffics. Providing information about traffic, accident, possible deviation, weather information, and dangers are important to the vehicle's driver. VANETs are characterized by high mobility and dynamic topology changing which resulted in frequent communication link failures. One of the more famous methods to solve this problem is the stable clustering approach to reduce network topology changes. This paper introduces a developed clustering algorithm, that aims to build a stable cluster in a Highway environment in terms of many parameters such as traffic type, speed, number of nodes, and transmission range of each vehicle. This paper's clustering method is center base depends on Road Side Units (RSUs) as a supervised approach. A simulation is considered to evaluate the performance of the developed algorithm in terms of three types of data dissemination (i.e. broadcast, multicast and unicast) using Net logo programming as an agent-based modeling approach. In this paper we compared the proposed algorithm with the framework in [1] results after apply its parameters in our scenarios according to the performance metrics, the analytical results show increasing the number of vehicles improves the stability and the staying duration, as well as, the average number of clusters improves to be decreasingly.**

Keywords__VANET; V2V, V2I, clustering, CH election, Data dissemination.

I. INTRODUCTION

One of the special subclasses of ad hoc networks is Vehcular Ad hoc Network (VANET) that aims to enhance and save road traffic, this can be done by providing information about traffic, accident, possible deviation, weather information, and dangers. There are urban, rural, and highway scenarios in VANET. In highway scenarios, the topology is sparser and the connectivity is more intermittent. In urban, the topology is dense [2].

Notable attention had been taken by both industry and academic fields in the issues of considering the fluidity and road traffic because it can provide safety and comfort to the drivers and passengers [3]. The connection between two vehicles is called V2V, the connection between vehicle and roadside unit is called V2I, in addition to the hybrid connection that contains V2V and V2I together. These types are worked based on Wireless Local Area Network (WLAN) technology. There are many important issues in VANET like network stability, scalability, efficient data dissemination, etc. The high speed of vehicles causes a periodic change in network topology, this is the main challenge faced by data dissemination among vehicles.

To deal with all these issues, the clustering technique is one of the most famous solutions to send messages between source and destination in the method that achieves saving the Qos and making performance metrics near to the optimum. A cluster is a set of connected nodes doing together closely for the same reason and has a position with the same topological structure. The clustering algorithms are different from one to the other in clusters formations and selecting the cluster head method, there are many criteria to choose the cluster head that save the performance metrics without degraded [3, 2, 9]

As we mention in VANET there are many communication techniques V2V, V2I, and I2I the infrastructure such as Road Side Unit (RSU) in addition to the application server, it export and import information for entertainment or safe driving or navigation. communication in VANET is categorized into two classes, dedicated short-range communication (DSRC) and long-term evolution (LTE). Due to the DSRC is about 300 meters, it used to communicate the V2V in the range of one cluster. LTE uses to communicate V2I and I2I because the range is larger than DSRC. The combination between DSRC and LTE is useful to decrease overhead via DSRC and congestion via LTE because the connection is between cluster heads and RSU instead of all the nodes and this drops the overhead. In our approach, we combine DSRC in V2V and LTE in V2I together due to the previous reasons. Therefore in the designed scenario, each vehicle has two interfaces one for DSRC and the other for LTE. This architecture can improve the performance metrics but it requires a high stable cluster and a small number of cluster heads to ensure maximum bandwidth utilization, it is a challenge to solve these problems, therefore the main task of this paper is designing an efficient clustering algorithm. [1, 7, 8].

In this paper, we concern with the highway environment due to its challenges and because there is only 10 percent of researchers work in this environment [9]. The rest of this paper is organized as follows: Section 2 reviews related works. In section 3, the clustering theory and process are discussed in detail. In section 4, a methodology is discussed in detail. Section 5 gives the performance metrics and simulation environment. Section 6 summarizes the experimental results and conclusion.