



Characterization of Vehicular Area Networks (VANETs) Routing

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Abstract: Vehicular Area network is having the criticality because of its public and dynamic nature. It combines the complexities of both the mobile network and sensor network. The associated challenges include the area limitation, scenario specification and routing constraints. In this paper, all the associated challenges to the vehicular adhoc network are discussed. The paper has also defined the generation of effective route generation so that effective communication over the network will be performed. Author has discussed these routing approaches under the specification of strength and limitation associated with the scenario and criticality.

Keywords: Vehicular Area Network, Tree Based Routing, GPS

I. Introduction

The Vehicular Adhoc Network is considered one of most complex network that combines the complex features of mobile network and sensor network. This kind of network is distributed in wide area with public access to the users. It means a new user can enter into the network for a short interval of time. The inclusion of new users and associated temporal vector increases the criticality of network. Due to the changing behavior of the network, this kind of network performs the communication cooperatively. The network also has complexity in terms of associated infrastructure. The infrastructure includes the special devices called RSU (Road Side Units) that are installed on road sides with the specification of zonal characteristics. Each RSU covers a smaller network area and identify the statistical measures of the zone level network [1][2][3]. The difficulties associated with the communication in such kind of network are shown in figure 1.

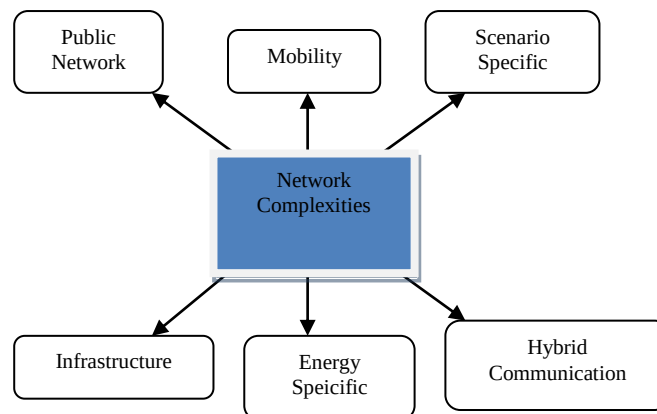


Figure 1: Network Complexities

Mobility is the other complex feature associated with vehicular network. The vehicles nodes are of moving nature with a high degree of mobility. The mobility is here at high speed and direction specific. Because of this nature, the network is dynamic and changes the coverage area rapidly. Because of this mobility, the handoff occur between the RSU and base stations. This mobility and speed also dependent on the scenario in which network is established. The common network scenarios available for vehicular network are city area scenario, highway scenario etc. Each kind of scenario having its own complexities such as city scenarios are having the traffic light controls whereas highway scenarios do not have such communication. The communication in highway is faster as compared to city scenario. The mobility and statistics control is city scenario is controlled generally using Road side infrastructure whereas in the case of highway the group mobility approach is applied to control the communication and to handle the associated network issues [4][5][6][7]. This group mobility is able to handle various communication issues such as handoff, communication security, multi case communication etc.

Another criticality associated with vehicular network communication is energy specific nodes. The vehicular nodes are generally the intelligent sensor nodes with specification of energy, memory and processing unit. With each communication over the network, some amount of energy is consumed because of which the network life and the communication energy requirement is estimated for the network. The effectiveness of VANET communication lies in the network energy effective communication. The smart sensor used in this network also having the memory power to store the next communication hop as well as associated route. The characteristics of this kind of network lies in the decision capabilities of the nodes. The communication in this network is performed by this network includes V2V, V2I and I2I communication. The V2V communication is the most intelligent communication type performed to generate the effective route over the network [8][9][10].

The communication optimization is based on the communication parameters. These parameter values are identified dynamically at a particular instance of time. The session based communication is performed in the periodic interval and analyzed after a fixed interval of time. The dynamic parameters include communication loss analysis, communication delay analysis and communication rate analysis. Based on these parameters, the network route is identified so that the low cost and reliable communication will be drawn over the network [11][12].

In this paper, a study based work is defined to identify the different issues and routing approaches associated with vehicular adhoc network. In this section, the different complexities associated with vehicular network are discussed. These complexities include the short and long distance communication. In section II, the work defined by earlier researchers is discussed. In section III, the description about different routing approaches is presented. In section IV, the conclusion obtained from the work is presented.

II. Related Work

A lot of work is already defined by different researchers to achieve the optimized communication over the network. This kind of network communication is associated with various challenges and criticalities. Some of the work defined by earlier researchers is discussed in this section. Admir Barolli [1] has defined an optimization to the route generation over the vehicular network. The Author has defined a genetic based approach to improve the communication in the network. The Author has defined a study based work to analyze different routing approaches. Author also presented a genetic based approach to generate effective and reliable route over the network. The Author has discussed various genetic based routing approaches to optimize the network communication. Leonard Barolli [2] has improved the network routing QoS under genetic approach. The Author has analyzed the communication under different parameters and obtained the network statistics analysis to generate the optimal communication over the network. The Author has presented the comparative analysis to improve the network communication to improve the communication over the network. In this paper, the author has presented an ACO based approach to optimize the network communication. Author also presented the study based on different routing approaches to identify the improvement. This improvement is analyzed in terms of energy consumption and throughput analysis.

Xi Cheng [3] has presented a work on route optimization in mobile network using ACO approach. The Author has presented a hybrid communication approach by combining the genetic and ACO approaches. Here genetic is used in the earlier stage to generate the population set and the ACO is used at the fitness rule stage to identify the effective route. The Author has analyzed the network under different network model and with different network and communication parameters. Author also compared the proposed routing approach with another individual ACO and genetic approaches to generate the effective communication route over the network. Arijit Khan [4] has definitely a work to improve the performance of vehicular network for DSRC and 802.11 protocol. Author has defined the routing under different reliability metrics and under different mobility scenarios. The Author has defined a study based work to analyze the performance of DSRC in two different cases called non safe applications and safe application. The Author has performed the video and VoIP communication analysis under different communication services. Christoph Sommer [5][6] has definitely a work for road traffic based micro simulation in the vehicular adhoc network. The Author has analyzed different mobility models to obtain real time and meaningful results from the system. The Author has defined bidirectional coupling approach to monitor the network strength under different parameters. Author also provided the communication under different protocols to generate the comparative analysis so that effective network communication will be performed. The Author has monitored the associated problem and performance to control the deployment of the network.

Pratap Kumar Sahu [7] has presented an effective routing scheme for highway networks with the inclusion of unicast communication based discovery process. The Author has defined an effective and controlled mechanism to identify the next neighbor so that the frequent path maintenance will be done. The Author has identified the situations of flooding avoidance and location substantial services to control the overhead communication over the network. The Author has analyzed the communication under delay and congestion parameters to generate the effective route. Jose Santa [8] has defined multihop communication vehicular adhoc network. The Author has analyzed the communication under different communication metrics under bandwidth, delay and distance

level analysis. The Author has defined the route tracking based analysis to generate the effective communication route to obtain the communication in realistic scenarios. Ian Downes [9] has presented the mobility aware communication in mobile wireless networks. The Author has generated the graph level communication and route generation under connectivity trace effective route generation and provides the performance evaluation under different communication parameters. Author integrates the communication under different time expended analysis and route generation, so that the effective network communication will be performed. Author analyzed the physical and communication modeling under different protocols to obtain the results in real time scenarios. Takeshi Matsuda [10] has defined an optimization to the communication under gateway communication and protocol management in mobile network. Author defined the communication in hybrid communication network to provide the network communication for sensitive communication and in reliable mobile network. Author provided the communication analysis in trusted and secure node selection. This work is able to optimize the packet forwarding with risk minimization and trustful communication over the network. Mohammad Azouqa [11] has defined the communication in city scenario to provide different level communication. Author managed the V2V and V2I communication under destination oriented analysis. Author has provided the stable communication under inter connectivity analysis with gateway effective communication. Author provided the road interaction analysis to improve communication under different parameters. Tarik Taleb [12] has defined architecture to provide the clustered communication in mobile network. Author provided the gateway level communication along with stable communication analysis. Author provided the inter connectivity analysis in vehicular adhoc network. Author handled the dynamic clustering nature of network to achieve the optimal network communication.

III. Routing Approaches

In this paper, different routing approaches are discussed that are been used in vehicular network under different parameter selection. These routing parameters includes the area based analysis, distance based analysis and the node behavior analysis. In such kind of network, multihop communication is performed over the network. As the network communication is a multi hop communication, it is required to analyze each node under different parameters and identify next forwarding node till the destination node not found. This kind of network communication includes the feature based analysis. The identification of effective and reliable features over the network is also an associative and effective approach to improve the network communication. This kind of network also includes the fixed as well as the variable position based scenarios. The infrastructure also plays an important role while generating the communication route over the network. This kind of network is defined under three main routing approaches shown in figure 2.

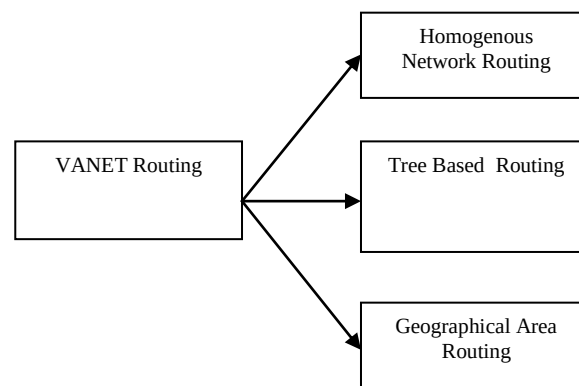


Figure 2: Routing Approaches

This kind of network is connected to the internet or the GPSR system to cover large area for communication. The network routing decisions are performed based on the physical as well as communicational characteristics of the network. This kind of communication also affected through mobility scenario specification and to provide the effective route stability. Author has defined the communication under volume limit specification. The identification of next hop under critical situation analysis. This kind of effective network communication includes the parameter specific and network adopted communication with scenario specific estimation. This estimation includes the wide range communication analysis under different associated infrastructures. Different kind of routing approaches associated in the network are given here under.

A. Homogeneous Network Routing

One of the foremost routing approach adopted in small scale area network is homogeneous network routing. In city scenario such kind of routing approach is applied. This kind of routing is basically handled or generated using the associated RSU (Road Side Units). This kind of network is generated associated with the multi hop communication. The city scenario is a small area network with the specification to the optimized communication route. In this kind of routing all the nodes are of similar type with the specification of the energy

and other physical parameters. The parameters are adaptive to the destination. The network support V2V, V2I and I2I communication to generate the route. The traffic type and the traffic light based intelligent communication are the main features of these kind of networks. The communication is performed so that the communication efforts will be reduced and effective forwarding node will be identified. The routing approach is able to identify the intermediate vehicles or infrastructure to perform the reliable and secure communication. This routing approach is able to identify the effective and reliable communication over the network. This kind of communication under route generation and effective communication over the network. This route optimization approach is able to reduce the flooding so that the reliable and efficient communication will be performed. The traffic vehicle analysis is another criterion to perform the effective and reliable communication. Different kinds of vehicles are having different priority levels. Such as the light vehicles are having the higher priority over heavy vehicles. In same way, the ambulance and police vans are having the higher priority. The effective route is able to identified under critical congestion situation.

B. Tree Based Routing

This kind of communication is basically performed as the zone level routing approach. When the communication is performed for a wide area, then communication is performed via infrastructure devices or the road side units. These RSU are the intelligent communication devices that itself represents a zone with the integrated node specification. The communication is performed of vehicle via these infrastructure devices. The infrastructure devices are placed on road side and cover a side of traffic. They have large memory and processing unit for analyzing the vehicle statistics and to identify the effective route. They are also provide the push message updation to intimate the vehicles about the communication. The controller nodes are attached to perform the adaptive and decision oriented communication. The decision is here taken regarding the sub network specification and generation of the effective communication route. The segmented communication is performed under tree node specific decision criteria specification so that the reliable and effective route over the network will be generated.

C. Geographical Area Routing

This kind of routing approach is performed for large are network where high speed communication is performed. The location is changed very frequently and the network is having the associated communication challenges. This kind of communication is generally controlled by base stations of the satellite. This kind of network requires the heavy signal strength and the communication is performed via group mobility system. This group mobility approach is able to control the communication between the nodes and to control the reliable and signal strength analysis.

IV. Conclusion

In this paper, a study on the vehicular communication challenges and the associated communication factors are identified. The paper has discussed the criticality vectors along with route generation in vehicular network. The paper has divided the routing approaches in three broad categories under the area specification.

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