UVAR: Genetic based path tracking for UAV-Assisted VANET Routing Protocol

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Abstract: Vehicular Ad hoc Network (VANET) as a special class of Mobile Ad hoc Network (MANET) in which it adopts the idea to moving vehicles in order to create an extremely large scale mobile network. Since VANET needs critical road-safety information to be robustly and rapidly delivered to its road users, routing protocols have to be conceived to support the requirements. Consequently, the majority of the proposed routing protocols dedicated for urban cities try to address the problem of frequent disconnections and the wireless links instability. There requires a basic efficiency based technique. In the existing research Dijkastra based technique for identification UAVR is identified. So that the path can be identified on that route where it is required most. It is a graph based technique. But while identification of the route the density factor is not considered. This density factor is the traffic density where it is required most. For identify the optimal path not only on the basis of distance rather the traffic density will be identified. So that the optimal path can be used for moving the UAV. It will reduce the traffic chokes. And increase the performance of various parameters like Packet Delivery Ratio.
End to End Delay, The average Number of Hops, Throughput, Network Routing Load. Such that technique will be more efficient.

Index Terms UAV, VANET, GENETIC, Dijkastra.

I. INTRODUCTION

1.1 VANET: Vehicular Ad-hoc Network (VANET) is ad hoc network that is categorized under MANET and has a significant role in short ranged networks. With increase in road traffic the chance of accidents have become very common and therefore an Intelligent Transportation System was developed, keeping this problem under consideration VANET came into existence in year 2000. Making safe road for driving and avoiding hazard situation as much possible it is due to safety protocols provided in VANET.VANET is combination of nodes i.e. vehicles which moves freely in various directions and they are connected with each other via communication link thus it forms a network. The position of vehicles is dynamic. Roadside units are established in which works to provide internet connections to the moving vehicles and connect vehicle on farthest distance to connect with each other and pass messages as well as receive, roadside units are providers of wireless communications to connect those vehicles in which connection is not possible. Video streaming, ecommerce services, speed sensors, weather services, live television services etc. Infrastructure is not fixed in VANET and each vehicle may have variation in speed and position. Vehicles are equipped with trans receiver so that they may communicate with other vehicles and RSUs i.e. Road Side Units. In VANET two types of communications are there; V2V i.e. communication between vehicle and other vehicle and V2I (Vehicle to Infrastructure) or V2R (Vehicle to Roadside unit). Various automobile companies are investing in development of VANET along that various research communities are working to develop advance techniques to enhance communication. Unbreakable and reliable communication is the key factor which is the main concern of these researches. Various functions are embedded in vehicles making it more applicable for users and VANET is made more advanced. These features include traffic jam area information, fuel outlets available, mechanics available nearby, cafes, restaurants, hotels, motels, schools, navigations, vehicle global positioning System (GPS). The movement of vehicles is very fast hence breakage of connections in very common, researches are focused on making reliable connections. In some cases, there may be hindrance in the communications due to buildings or other reasons. VANET is categorized under the Mobile Ad-hoc Network. Each node is can move freely and is infrastructure free. Government has allocated 5.9 GHz frequency for communication in short ranged networks. Various routing protocols are developed for beakless communication and making VANET working more smooth.

1.1.1 V2V: Vehicle to Vehicle communication between one vehicle with the other vehicle. In V2V vehicle communicate with vehicle in range of vehicle. If vehicle want to communicate with the farthest vehicle to achieve some information, then that vehicle have to adopt some technique that is by keeping other vehicle as an inter- mediator, inter-mediator conveys the message from source to destination.

1.1.2 V2R: Vehicle to RSU i.e. Roadside unit is communication between vehicle with roadside unit. When vehicle want to connect with internet server to access services then roadside unit serves vehicles with services. Accessing information from the other roadside areas from faraway vehicles it can only be possible through roadside units, that information may be traffic information, accident or hazardous conditions, file transferring between vehicles and many more. Roadside Units can also help in finding network or route delivery in case whenever it is required. Roadside unit is also called infrastructure of the VANET that is the reason that it is also referred as Vehicle to Infrastructure communication.

1.2 UVAR: VANET is getting advanced day by day therefore with the advancement of technology and safety of people is getting more secure. VANET being a special kind of MANET include moving vehicles that create a large size of Network. Challenges are to develop effective and efficient protocol for routing in VANET for reliable communication that provide unbreakable connection among vehicles. Although there are two types of communications available in VANET that are V2V and V2R since there is cause of hindrance in the communication and that problem is due to the hindrance caused by the buildings which are very huge in size causing connection breakage between Road side units (RSUs). This problem is not common in small cities where there is less traffic density and no hindrance this is frequently caused in urban cities and link stability is less in that area. Therefore, solution to this problem is very necessary. Various protocols are established but they do not have direct impact on obstacles caused in connectivity and performance. In UVAR the solution to this problem is given. UVAR is abbreviation for Unmanned Aerial vehicle (UAV) assisted Vehicular Ad-hoc network in which UAV is used as an intermediate or message conveyer between the vehicle and the vehicle. In UVAR the focus in to develop break less connection technique in which UAV is intersection node which can move freely over the roads in some predefined path in which it can have maximum energy efficiency and have to travel shortest distance.UAV send hello message to all the vehicles on the road and vehicles reply UAV with reply message, UAV comes to know about the connected nodes which are able to communicate with in the specific area and make a tables of connected nodes. In case when there is hindrance in between any two vehicles then UAV works as an intermediate in between those two nodes. UVAR protocol is based on connectivity of the vehicles and traffic density i.e. UAV will move in the direction where the density of the traffic is more and it helps UAV to place itself on the position where there is maximum traffic coverage and connectivity based on the connectivity tables in which connected nodes and their respective distances are given. The motive of approach is to find fastest and best shortest path among the available other alternatives. Deducting the most connected nodes the best score is calculated but in case of sparse populated area the UAV works as the node forwarder in other case it works as data packet transmitter. UAV is equipped with GPS i.e. Global Positioning System along with it has inbuilt maps of given area and grid location System is used to check the position of the nodes same is the equipment of vehicles therefore it becomes easy to locate and sense the position as well as we can get the overview of that particular area where vehicles are moving. Table of connected nodes is updated by UAVs time to time, battery of UAVs are always enough for the communication from Vehicle to UAV and UAV to Vehicle. Every UAV covers four roads segments and new fields are added in hello packet to know the connected nodes so that vehicles at intersections could make correct decisions.

1.2.1 UVAR Architecture

Architecture of UVAR consists of vehicles, UAVs and Roadside units (RSUs). There are three types of architectures in UVAR protocol:

1. V2V (Vehicle to vehicle) communication: Vehicles can communicate with each other as they are equipped with trans receivers but when there is obstacle or the street they are driving is different in that case we have to use some intermediate medium in the way in that case UAV is used as the message forwarder .UAV connects to the vehicle and making a communication way by sending hello message vehicle send the message to the UAV and UAV forwards the message to the vehicle for which the message was to be send.
2. V2R (Vehicle to Roadside unit) communication: Roadside unit to Vehicle communication is established when the information is needed that is based on Internet services. Roadside unit is equipped with satellite communication system having the capability to receive telecommunication systems and route discovery directories in case of situation when it is requested to find best route. Tracking a vehicle can be possible by connecting to the roadside unit.
3. V2U (Vehicle to UAV) communication: Flying high in the sky UAV communicate with the vehicles because its range is high and no obstacles can disconnect the UAV with vehicles, no human interactions are needed for flying of vehicle therefore range is assumed very large for the communication among UAV to vehicles and vehicles to UAV(U2V/V2U), The communication among vehicles and UAV is dependent on the best score in the specific intersection. If the score in another intersection is best and no connected segment present, then that segment is selected.
   Degree of connectivity is calculated by some mechanism which is centralized and which is only between the UAVs. UAVs keep sending hello messages to the vehicles and vehicles keep sending back the replies and UAVs come to know about the position of the vehicles and the connectivity ratio of the specific area, according to that ratio the hovering

UAVs decide the route which should be followed by them and so on UAVs delivery there forwarding services in the area where there is more traffic density. Every road is divided into segment and UAV collect hello messages and create set of connected nodes in its table and degree of connectivity is calculated according the distribution of nodes and information of connected segments from given information UAV decide the path to be selected and degree of connectivity

Path is selected on the base of the UAV tables and is needed at the intersection position because intersection is the place where there is need of decision to be taken and the position of the vehicles which are coming from opposite direction is required. As soon as the degree of connectivity is calculated by UAV by sending continuous hello messages and table is created following steps are kept under consideration:

- According to the collected tables information the vehicles have the vision of all segments around and they can get routing information as well as connected vehicles.
- In case when connectivity to the desired vehicle is not possible their high degree of connectivity node is selected that is neighboring to that desired vehicle.
- When closest to the destination node highest degree is detected and it is not in neighboring area in that case UAV is required and selection is based on the highest score and in sparse population UAV is used as forwarder.
- Greedy forwarding is used in the case when enough vehicles are available in the road segment providing connectivity.

II. LITERATURE SURVEY

Omar Sami Oubbatiet. al. (2016): It's not easy to build up an efficient routing solution in urban environment that provide reliable data delivery. Due to various obstacles like building the transmission is not clear and finding end to end shortest connected path between vehicles in urban city have to face many problems.UAV i.e. Unmanned Aerial Vehicles are used to overcome this problem as our motive is to evaluate the assistance of UAVs to vehicles in urban areas .In the given paper we develop technique for VANET(Vehicular Ad hoc Networks).the protocol we are using is based on two factors i.e. density of traffic and connectivity among vehicles on road.UAV checks the connectivity by sending hello message and though collect the information of traffic density. Now according to this information UAV is able to place itself to relay data in the case when connectivity on roadside vehicle to vehicle is not possible. Therefore, connectivity between vehicles is improved overall and we achieve improved routing process. A new routing method is developed based on density and connectivity of vehicles. Estimation of traffic density and correct calculation of reliable segments at intersections and avoiding the obstacles that decrease the no. of delivery packets on each road is done by the UAV. Future work in UVAR is to handle and examine the mobility of Unmanned Aerial Vehicles and propose a new technique based on location prediction.

J.HARRI et.al (2006): VanetMobiSim is used to generate realistic movement traces of vehicles for telecommunication network simulators. Interaction between featured macro and micro mobility and ability to reproduce typical phenomena of vehicular traffic is illustrated by VanetMobiSim mobility. VanetMobiSim extension to CanuMobiSim is competent of making mobility realistic traces of several network simulators. Detailed extension about macro and micro mobility is given and simulation results explained the distribution and density of vehicles. Introduced features in paper are essential for realism of VANET mobility.

S.M.MOUSAVI et.al (2007): Mobile Ad hoc Network is infrastructure less network which is made of a collection of nodes creating self-configuring network. MANETs are used in large scale. Various simulator parameters are used in which mobility model plays a vital role in checking the protocol performance in MANET. Therefore analyzing of mobility models and their effect on MANET is essential. In this paper new framework for simulation of mobility in MANET is introduced which is generator of mobility traces in various mobility models. Customization of mobility traces is provided for different network simulators using XML and text formats.GUI and batch processing ability is user friendly making simulator efficient and most efficiently useful in its field. In order to make its behavior more similar to real world mobile node motions new parameters are proposed to fix problems in last proposed methods. In this paper java based mobility simulator is developed which can be used to generate customized configuration. It is capable to trace mobility of network simulators which do not support mobility generation for MANET. User friendly GUI helps in analyzing of mobile nodes. Output traces can be represented in text formats and XML for the convenience of other network simulators. It is to make it more mobility model compatible and create real world behaviors. Work is done on making it more compatible with moving entities so as to use it in robotics and intelligent Transportation Systems. Mobility analyzer software is under construction which recognize patterns of mobility on learning based pattern recognition and can analyze mobility traces.

R.Kirtigaet. al.(2014):VANET is wireless network which includes nodes that are in the form of vehicles which move on road ,information like road safety and traffic information are exchanged among these nodes. Conventional approaches in MANET are not as effective due to fast movement of vehicles in VANET. Demand is to develop a reliable routing strategy that minimizes link breakage and thereby increase throughput in VANET. Model is based on Gaussian distribution i.e. continuous probability

function used to estimate link reliability between the vehicles. Graph is created in dynamic way and reliability is estimated hence most reliable data transmission is achieved. Variable velocity is taken in account by algorithm and computes link reliability along with route reliability value among vehicular nodes. In future link expiration time calculation on the basis of direction of vehicle will be calculated by using fuzzy logic by giving input as route reliability value and route expiration time and it will find most reliable path from source to destination. Sequence of nodes in reliable journey is added as an extension to AOMDV protocol header. Quality of service for VANET is proposed for performance evaluation.

CarlosCambraBasecaet.al.(2013): Intelligent video sensing system can be used by considering three main features which are high definition video transfer which provide high quality of image transmission, wireless ad-hoc network that can locate and focus on sensible issue, sufficient bandwidth to provide high definition quality. In this paper we provide communication protocol designed and deployed for high definition video transfers between devices running on various OS like Android and Linux OS. Using AR Drones and forming ad-hoc network using Wi-Fi that demonstrate big potential we calculate experimental results.AR drones have many controllable sensors which control automatically using GPS or manually by remote therefore it has brought a revolution. Using image processing done intelligent video sensing by using AR Drones. Proposed for intense agricultural production in cereals and error monitoring in irrigation systems. Dry periods are prevented by this visualization in case when sprinkles are blocked by leaf, sand and dirt inside pipes. Demonstration is provided on the base of analysis of QGroundControl and OLSR routing ad hoc protocol usage can be done with mobile communications nodes exchanging information while moving in space and using GPS.

III. ALGORITHM

I. Set the network in small area. The network includes various vehicle nodes moving at different speed. While moving they will communicate to each other.

II. A UAV is the unmanned vehicle which moves from one position to the other position.

III. Identify the density of the nodes in the network area.

IV. Check for the optimal density.

V. Move the UAV to the direction of the max density of the nodes in the network area.

VI. identify the network performance in terms of various parameters.

IV. FLOWCHART

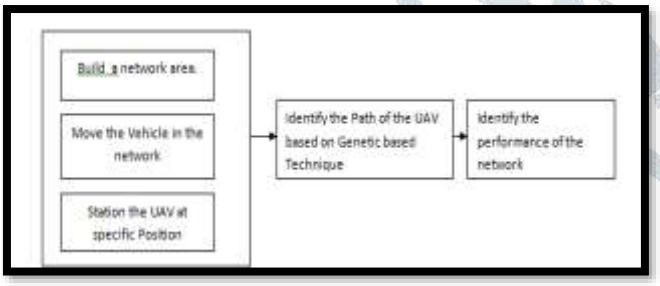

Fig. 1 Flowchart

V. PSEUDO CODE

Test case set S=θ
Distribute nodes randomly in whole network.
For each coverage C do
Find start node,Ns
Repeat
For (i=0; i<|Ns|/2;i++)do
Select two parents in the population
Generate two offspring by crossover operation between two parents
Insert two offspring into new generation list

If a new offspring satisfy the coverage, C then
S=S U (∑ of the offspring)
Break
End if
End for
Mutate some offspring in the new generation List
Until satisfy C or reach maximum iteration
End for

VI. RESULT ANALYSIS

6.1 Network Parameters: The simulation scenario and parameters used for performing the detailed analysis is described below. This facet represents that how the effective performance parameters have been analyzed to simulate the protocols. Following steps have been used for simulation.

- Inputs to Simulator:- Scenario File having movement of nodes, traffic pattern file, simulation TCL file
- Outputs File from Simulator:- Trace file, Network Animator
- Output from Trace Analyzer:- xgr file

Table.1.Simulation parameters

SIMULATION PARAMETERS	
COVERAGE AREA	1000m x 1000m
PROTOCOLS	AODV
NUMBER OF NODES	50
SIMULATION TIME	100 seconds
TRANSMISSION RANGE	250m
MOBILITY MODEL	RANDOM WAY POINT MODEL
LOAD	5 Kb-UDP Packets
MOBILITY SPEED(variable)	(80,90.100,150)Seconds
TRAFFIC TYPE	CBR,UDP,FTP,TCP
PACKET SIZE	512 Kbps
PAUSE TIME	10 ms

6.2 Performance Parameters: The analysis of routing protocols is done using two important performance metrics named as throughput and end to end delay.

- **Average End-to-End Delay**: It is the average time taken by a data packet to arrive at the destination. It includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC and propagation transfer times.

  $$D=\Sigma (Tr-Ts) / \Sigma \text{ No. of Connections}$$

  Where Tr is received time and Ts is sent time.
- **Throughput:** It is the average rate of successful message delivery over a communication channel. It is also called as packet sent per unit interval of time. The throughput is usually measured in bits per second or data packets per time slot.

  Throughput=Total packet received / Total time

These parameters are calculated and drawn as graphs so that the performance can be compared. Many other performance parameters are also present to analyze the performance of wireless networks. Packet delivery ratio, normalized load and jitter are some parameters that define the credibility of network.

6.3 RESULTS AND DISCUSSIONS

6.3.1 Packet Delivery Ratio

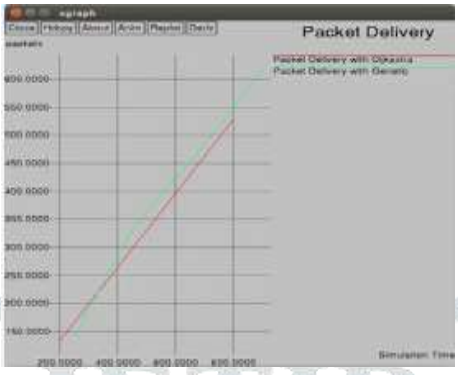

Fig. 2 Packet Delivery Ratio

This graph in Fig. shows the packet delivery ratio comparison between Base and proposed technique. Genetic based proposed technique provides better performance in terms of packets that are being delivered from source to destination.

6.3.2 End to End Ratio

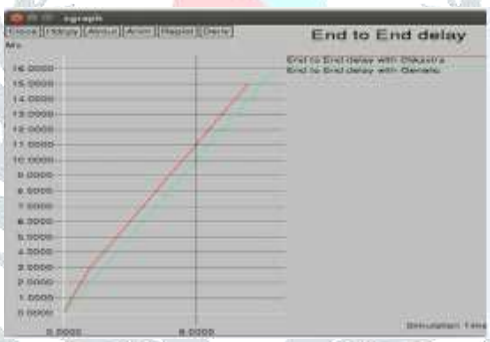

Fig. 2 End to End Delay

Graph in Fig. 2 shows the end to end Delay comparison between base and proposed technique. In proposed technique there is less end to end delay. More efficient path will be identified in case of the Genetic based approach.

6.3.3 Hop Count

Fig. 3 Hop Count

Graph in Fig. shows the Hop Count comparison between base and proposed technique. There are less number of Hops for the Genetic based technique.

VII. CONCLUSION

VANET is the most prevalent type of application of the MANET. Where small area will be covered with wireless communication. So that the vehicle inter communication can be taken place. It will smooth line the flow of the traffic. Also the accidental probability will be reduced. In proposed technique genetic based procedure will be used. This genetic based technique identifies the optimal path. That path will be optimal in both distance and the time. UAV can move on that path with less time and provide the wireless services to the vehicle node in the network. All the parameters like end to end Delay, packet Delivery ratio and the Hop Count has shown the improvement.

VIII. FUTURE WORK

In proposed technique Genetic based technique is used for identify the path of the UAV in the VANET. While identify the path density and the distance as two parameters are used. In future energy saving of UAV can be considered so as to make this technique more reliable and strengthen the technique.

REFERENCES

[1] Saira Sattar , Hassaan Khaliq Qureshi , Muhammad Saleem , Shahid Mumtaz and Jonathan Rodriguez "Reliability and energy-efficiency analysis of safety message broadcast in VANETs" Elsevier, ScienceDirect,2018.

[2] Omar Sami Oubbati et. al (2016)" UAV-Assisted VANET Routing Protocol), a new routing technique for Vehicular Ad hoc Networks (VANets) "IEEE 2016

[3] Muhammd Jafer, M. Arif Khan, Sabih ur Rehman and Tanveer A. Zia "Optimizing Broadcasting Scheme for VANETs using Genetic Algorithm", IEEE, 2016.

[4] Tarunpreet Bhatia, Simmi Kansal, Shivani Goel , A.K. Verma "A genetic algorithm based distance-aware routing protocol for wireless sensor networks" Elsevier,2016.

[5] Abdessamed Derder, Samira,Moussaoui and Abdelwahab Boualouache "Target tracking in VANETs using V2V communication with packet load enhancement"IEEE, 2015.

[6] S.Girijalakshmi, k.Shivakumar and C.Chandrasekhar "DSDV Addendum through Genetic Algorithm in VANET",IJCA, 2015.

[7] Huawen Zheng and Jun Zheng "Energy Efficiency Analysis of a Roadside Relay Point Deployment for Information Delivery in VANET", IEEE,2015.

[8] O. S. Oubbati, N. Lagraa, A. Lakas, and M. B. Yagoubi, "Irtiv: Intelligent routing protocol using real time traffic information in urban vehicular environment, in New Technologies, Mobility and Security (NTMS)", 2014 6th International Conference on. IEEE, 2014, pp. 1–4.

[9] R. Kirtiga, O. GnanaPrakasi, D. Kavipriya, R. Anita, and P. Varalakshmi, "Reliable graph based routing in vanet environment," in Recent Trends in Information Technology (ICRTIT), 2014 International Conference on. IEEE, 2014, pp. 1–6.

[10] Surmukh Singh and Sunil Agrawal "VANET Routing Protocols: Issues and Challenges", RAECS UIET ,2014.

[11] Oscar Arley Orozco and Gonzalo Llano Ramírez " OSA: A VANET Application focused in Energy Efficiency" IEEE,2014.

[12] Divya Gupta and Dr. Rajesh Kumar "An Improved Genetic Based Routing Protocol for VANETs" IEEE ,2014.

[13] Bilal Gonen , Sushil J. Louis "Genetic Algorithm Finding the Shortest Path in Networks" ResearchGate,2014.

[14] K. Z. Ghafoor, M. A. Mohammed, J. Lloret, K. A. Bakar, and Z. M. Zainuddin, "Routing protocols in vehicular ad hoc networks: Survey and research challenges," Network Protocols and Algorithms, vol. 5, no. 4, pp. 39–83, 2013.

[15] C. Cambra Baseca, J. R. Diaz, and J. Lloret, "Communication adhoc protocol for intelligent video sensing using ar drones," in Mobile Ad-hoc and Sensor Networks (MSN), 2013 IEEE Ninth International Conference on. IEEE, 2013, pp. 449–453.

[16] Shabad Kaur and Amandeep Kaur Virk "AODV Extension Using Genetic Algorithm in VANET", IJSR, 2013.

[17] Karim Benbouabdallah and Zhu Qi-dan "Genetic fuzzy logic Control Technique for a Mobile Robot Tracking a Moving Target", IJCSI, 2013.

[18] Deepak Goyal and Malay Ranjan Tripathy "Routing Protocols in Wireless Sensor Networks: A Survey" IEEE ,2012.

[19] C. Zhao, C. Li, L. Zhu, H. Lin, and J. Li, "A vehicle density and load aware routing protocol for vanets in city scenarios," in Wireless Communications & Signal Processing (WCSP), 2012 International Conference on. IEEE, 2012, pp. 1–6.

[20] Saeid Akhavan Bitaghsir and Faramarz Hendessi "An Intelligent Routing Protocol for Delay Tolerant Networks Using Genetic Algorithm" Springer, 2011.

[21] W. Chen, R. K. Guha, T. J. Kwon, J. Lee, and Y.-Y. Hsu, "A survey and challenges in routing and data dissemination in vehicular ad hoc networks," Wireless Communications and Mobile Computing, vol. 11, no. 7, pp. 787–795, 2011.

[22] Y. Ding and L. Xiao, "Sadv: static-node-assisted adaptive data dissemination in vehicular networks," Vehicular Technology, IEEE Transactions on, vol. 59, no. 5, pp. 2445–2455, 2010.

[23] Ahmed Younes Hamed "A genetic algorithm for finding the k shortest paths in a network"Egyptian Informatics Journal (2010) 11, 75–79.

[24] Dr. Rakesh Kumar , Mahesh Kumar "Exploring Genetic Algorithm for Shortest Path Optimization in Data Networks" Global Journal of Computer Science and Technology,2010.

[25] M. Jerbi, S.-M. Senouci, T. Rasheed, and Y. Ghamri-Doudane, "Towards efficient geographic routing in urban vehicular networks," Vehicular Technology, IEEE Transactions on, vol. 58, no. 9, pp. 5048–5059, 2009.

[26] Huan Wang Ming-wu Ren Jing-yu Yang "Object Tracking based on Genetic Algorithm and Kalman filter", IEEE, 2008.

[27] S. M. Mousavi, H. R. Rabiee, M. Moshref, and A. Dabirmoghaddam, "Mobisim: A framework for simulation of mobility models in mobile ad-hoc networks," in Wireless and Mobile Computing, Networking and Communications, 2007. WiMOB 2007. Third IEEE International Conference on. IEEE, 2007, pp. 82–82.

[28] J. H¨arri, F. Filali, C. Bonnet, and M. Fiore, "Vanetmobisim: generating realistic mobility patterns for vanets," in Proceedings of the 3rd international workshop on Vehicular ad hoc networks. ACM, 2006, pp. 96–97.

[29] M. Le, J.-S. Park, and M. Gerla, "Uav assisted disruption tolerant routing," in Military Communications Conference, 2006. MILCOM 2006. IEEE. IEEE, 2006, pp. 1–5.

[30] C. Perkins, E. Belding-Royer, and S. Das, "Ad hoc on-demand distance vector (aodv) routing," Tech. Rep., 2003.