IJETIE International Journal of Emerging Technology and Innovative Engineering
Volume I, Issue 4, April 2015
ISSN: 2394 - 6598
www.ijetie.org

A Study of Novel Congestion control with load balancing using AOMDV routing in MANET

[1] Ms. Antima Jain, [2] Dr. Suresh Jain , [3] Mr. Abhishek Gaur, [4] Ms. Manu Singh

[1]Research Scholar, Deptt. of CSE, Mewar University, Ghaziabad

[2]Dean, School of SDBCE, Indore

[3]Asst. Professor, Deptt. of ECE, GB Pant Govt. Engineering College, New Delhi

[4]Asst. Profeesor, Deptt. of CSE, Guru Tegh Bahadur Institute of Technology, New Delhi

***Abstract*—** In the MANET (mobile ad-hoc network) important challenge in congestion control mechanism because how the sender know about network congestion and adjust the rate, so our objective is to work in the challenging field of congestion control for minimization waiting time as well as dropping of data packet and we design an congestion control with load balancing using multipath routing mechanism in mobile ad-hoc network, so that we eliminate congestion as well as we can minimize routing overhead of the network and also increase the packet delivery ratio of the network. For that purpose we will propose Congestion control with load balancing using AOMDV routing in MANET. Our protocol will ensure that there will be no dropping of packets in the network through the congestion and hence ensure that there will be successful data transfer with lowest overhead required.

Keywords—MANET, Routing, AODV, AOMDV, Congestion

I. INTRODUCTION

Mobile ad-hoc network is a collection of temporary nodes that are capability, improving the performance of Transmission capable of forming dynamic temporary network, self and challenges in designing a MANET network. Because dynamic organize, and infrastructure less with nodes contains routing Control Protocol (TCP) associated with the presence of multi-hop MANET is one of the research challenges in wireless mesh networks. Mobile Ad-hoc Networks (MANETs) very attractive for time-critical applications. There are a lot of issues topology structure and node change every second on its position, one of the measure challenges in congestion, in MANET if sender node want to send data into the some specific receiver so very first broadcast routing packet onto the network and get destination through the shortest path (if we apply AODV) or minimum intermediate hop (if we use DSR) after getting path sender sends actual data through uni-path link but at the same time more than one sender share common link so congestion occur onto the network that is measure issue for MANET. So various researcher works in that field for minimization of congestion from network.

II. RELATED WORK

In this Section presenting survey about existing work done in the field of MANET routing protocol, congestion control and load balancing mechanism.

Makoto Ikeda, Elis Kulla et. al. "Congestion Control for Multi-flow Traffic in Wireless Mobile Ad-hoc Networks" [4] In this paper, we focus on congestion control for multi-flow traffic in wireless mobile ad-hoc networks (MANET) using OLSR routing. This approach done through OLSR routing we also apply multi flow in AODV routing approach.

M. Ali, B. G Stewart et. al. In his work titled "Multipath Routing Backbones for Load Balancing in Mobile Ad Hoc Networks" [5] This paper presents a new approach based on multipath routing backbones for enhanced load balancing in MANETs. Nodes in MANETs really differ with each other in terms of communication and processing capabilities. In the future move towards, numerous routing backbones are identified from source to destination using intermediate nodes that have better communication and processing capabilities to take part in the mobile routing backbones and efficiently participate in the routing process. This work use multipath technique but not execute multipath simultaneously that case use alternative base load balancing technique.

S.Karunakaran et al [5] proposed a "cluster based congestion control (CBCC) protocol that consists of scalable and distributed cluster-based mechanisms for supporting congestion control in ad hoc networks". The clusters independently and proactively monitor congestion within its localized scope. The present approach improves the responsiveness of the system when compared to end-to-end techniques. After estimating the traffic rate the length of a path, the sending rate of the starting place nodes is adjusted accordingly. Thus this protocol look forward the injection of dynamic flows in the network and proactively adjusts the rate while waiting for congestion feedback.

S.Venkatasubramanian et al [6] proposed "QoS architecture for Bandwidth Management and Rate Control in MANET". The expectations QoS architecture contains an adaptive bandwidth management technique which measures the available bandwidth at each node in real-time and it is then propagated on demand by the QoS routing protocol. The starting place nodes execute call admission control for different priority of flows based on the bandwidth information provided by the QoS routing. A rate control mechanism is used to regulate best-effort traffic, whenever network congestion is detected.

Yuanyuan ZOU, Yang TAO at el [6] proposed a "A Method of Selecting Path Based on Neighbor Stability in Ad Hoc Network" in this paper we studies about routing

IJETIE International Journal of Emerging Technology and Innovative Engineering
Volume I, Issue 4, April 2015
ISSN: 2394 - 6598
www.ijetie.org

algorithm based on the stability in mobile Ad-Hoc network and presents a routing mechanism based on neighbor stability. They put the mechanism in multicast routing protocol MAODV [4] and propose a improved routing algorithm NBS-MAODV which is based on MAODV algorithm. NBS-MAODV algorithm sends data according to the neighbor stability metric in the path building process. It can reduce the times of link crack caused by network mobility and increase the total overhead of network.

Ashish Bagwari et al [7] proposed "Performance of AODV Routing Protocol with increasing the MANET Nodes and its effects on QoS of Mobile Ad hoc Networks" In this paper they are analyzing the performance of reactive routing protocol via enhancing number of nodes and observe how it effects to QoS of existing mobile Ad-hoc network. Here Mobile ad-hoc network are dividing into clusters. Each cluster has MANET node with CHG. Beginning one cluster to another cluster or inside the cluster we applied reactive routing protocols specifically AODV to evaluate AODV protocol behavior and performance and check what kind of effect made by particular protocol on QoS.

Finally, they concluded results that confirm AODV giving better performs under such types of situation, providing better QoS based on high-quality throughput and acceptable End-End Delay, less data drops. One of the notable features of this AODV protocol scheme is that, it reduces our network load which can be responsible for congestion at the time of announcement. Consequently it can be used to extend the network coverage.

III. PROPOSED WORK

In this part we tend to focus our analysis proposal consistent with totally different module like congestion control, load aware and load balance. Simulate the behavior of network and analyze outcome results, through the result we tend to additionally check achievability of the system.

MANET (Mobile Ad-Hoc Network) are follow the rule of dynamic, meaning uncertainty of the network topology, therefore each separate time period node modified established routing path from one to a different and will increase the routing overhead still as drop information packet, that time pleased to seek out the rationale of data packets drop, that's following like drop through collision, route error, time out, route not exist, duplicate information packet, finish of simulation time and many more other reasons. Each one purpose is to degraded the performance of the network and generate retransmission condition and bring the validation for congestion prevalence and maximize delay, therefore our focus in initial module of congestion control technique. Here we tend to deploy design of congestion control technique still as AOMDV theme for load equalization and increase the performance of the network.

A. Load aware:

For load aware we tend to generate check traffic and so check total data packets transmission, receiving and forwarding of every node and calculate of load of every node for this purpose we tend to use following mathematical formula.

If total variety of node = N;

Total transmitted packet via N together with (routing packet) = Tx-total

Total receiving packet via N including (routing packet) = Rx-total

Total drop packet via N including (routing packet) = Dx-total

$$\text{Load of } I^{th} \text{ node} = \left(\frac{Tx+Rx+Dx\,(\text{via Ith node})}{Tx-total+Rx-total+Dx-total}\right) * 1 \quad \text{.....(1)}$$

1) Bandwidth Estimation for Congestion control

In our proposed work we tend to use acknowledgement time intervals to estimation on the advertise bandwidth information for congestion control. This on the obtainable data packets information measure estimation helps to avoid congestion within the network. In consideration of effusive congested situation over intermediate path node, the delay of acknowledgments receiving per estimated time period at the sender node can be pretentious to the fair share of bandwidth. In a fully congested situation, fair share of data cannot be higher than achieved throughput then it is affect the performance in case of congestion. In case congestion over intermediate path nodes, the delay of acknowledgments reception per calculable fundamental quantity at the sender node may be affected to the fair proportion of data information measure. During a congestion state, fair proportion cannot be more than achieved output because it can have an effect on different flows, except for partial congestion or no congestion, the fair proportion is definitely more than the achieved output, means that if we tend to transmit information packet in ideal case (without congestion) means that traditional information delivery to the destination, however if any intermediate path node use by the any other sender node at a similar time on a similar route owing to increase data packet causation load on intermediate path node as a result of initial node already causation data packet on same intermediate path node therefore initial sender information delivery delay are will increase and additionally if each sender send's information larger than the on the market information measure therefore secure that information has been born and acknowledgement of causation packet are delay owing to congestion on intermediate path node, to avoid this example we tend to used data packets measure estimation technique to get available data measure of intermediate nodes of established path. If the delay of received acknowledgment of the causation packet at the sender node is will increase, then in

IJETIE International Journal of Emerging Technology and Innovative Engineering
Volume I, Issue 4, April 2015
ISSN: 2394 - 6598
www.ijetie.org

our approach we tend to calculate delay distinction between previous acknowledgment and current acknowledgment send by the destination node, we tend to assume Δt is delay distinction of 2 acknowledgement. So, we will calculate Δt as follows.

$$\Delta t = (ack_n - ack_{n-1}) \quad \ldots\ldots(2)$$

This delay difference of acknowledgement used to estimate available bandwidth information of intermediate paths node for modified the old data rate and allot new data sending rate according to the existing bandwidth of the intermediate path node to avoid congestion in the network. At the start {when we|once we|after we} produce connection and decide sender node and destination node we considered d is information packet, t1 is time taken to information packet causation from sender node to destination node through intermediate path node and t2 is time taken to acknowledgement to sender node from destination node through intermediate path node and that we assume UBDSR is good case basic information causation rate. Therefore we will calculate UBDSR in rate from following equation (3).

$$U_{BDSR} = d/(t1 + t2) \quad \ldots\ldots (3)$$

When acknowledgments of causation packets are delayed caused by congestion over significant loaded route, then in our theme we tend to estimate accessible information measure from delay distinction between 2 received acknowledgements. We tend to calculate it by subtracting delayed current acknowledgement time from previous acknowledgement time. If increase and reduce distinction between these 2 acknowledgements we tend to needed set new rate to avoid congestion over significant loaded route within the network. from following equation (4)

$$N_{Threshold} = int\left(\left(U_{BDSR} \times (W/\Delta t)\right)\right. \ldots\ldots\ldots (4)$$

Where W is window size. with equation (3) the new information causation rate for next packets are modified consistent with that equation, and if the acknowledgment delay time increase then the $N_{threshold}$ worth are decreases therefore the packets are sent in network through the on the available information measure thus congestion won't occur within the path and each time this calculation unconsciously change the data causation rate that technique additionally known as dynamic window base congestion control technique.

3. AOMDV module for Multipath information transmission

Ad-hoc on demand multipath distance vector is AN extension to the AODV protocol for computing multiple loop –free and link- disjoint methods. to confirm loop-freedom the node solely accepts AN alternate path to the destination if it's a lower hop count then the advertised hop count for that destination. The planned reconciling load-balancing approach is applied in route request procedure. once a source node needs to speak with a destination node and has no accessible routing data concerning the destination, it'll initiate a route request procedure to seek out a route by broadcasting a RREQ message. However not each immediate node that receives the message, can answer the RREQ. Before broadcasting the RREQ once more, the intermediate node itself initial makes a choice if it's qualified. If its interface queue occupancy is below the edge worth, the node is qualified and ready to broadcast it. The queue occupancy mean the amount of packets waiting to be transmitted in interface queue, if the node's queue occupancy is over the threshold worth, it isn't qualified and can drop the RREQ.

Both on top of module give congestion free still as load balance approach to the network and will increase the performance of the network.

In information assortment module give the data concerning internal, intermediate and outer structure of simulation structure through this theme we tend to collect information and analyze them. All the inner module coded through C++ (object orientating approach) and outer module coded through TCL (tool search language base) each ar interlinked via object file that generated once compilation of internal C++ file and every one ar jointly known as OTCL (object tool command language). For analysis purpose we tend to use AWK (abstract window tool kit) and generate end in the shape of diagrammatically approach.

IV. Sampling Design

In sampling design we deploy sample outcomes result like network animated graph that provide structure of network and then result parameter like throughput, packet delivery ratio, routing overhead, end-to-end delay etc. through all that parameter base we analyze result and then we study about feasibility of our system.

All result retrieve through Trace file that format in case of wireless mobile ad-hoc are following form:

Here we provide sample design of network animation, through that structure we show animated node mobility, communication, radio range and data drop visualization, in that figure we apply colour code scheme for identification of sender and receiver node, and transmit data through intermediate nodes, this tool also called visualization tool. NS-2 is a discrete event simulator because that provide event occurring base output file, after that we analyze result in the form of various network parameter base technique.

IJETIE
International Journal of Emerging Technology and Innovative Engineering
Volume I, Issue 4, April 2015
ISSN: 2394 - 6598
www.ijetie.org

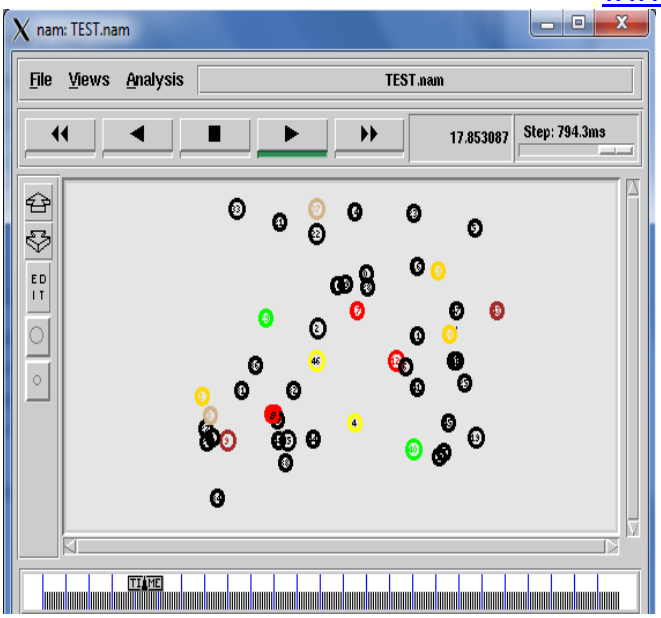

Figure1: Sample Network Structure for Working of MANET Routing

That graph represent 17th second time topology structure, and after some time duration topology will change because we know about MANET characteristic is that no static topology that means every movement scenario case topology view has been change.

V. Data Collection strategy (Primary & Secondary methods)

In our approach we use data collection tool as network simulator -2 that gives the behavior of network and analyses approach for our work.

A network simulator is a piece of software or hardware that predicts the behavior of a network, exclusive of an actual network being there. A network simulator is a software program that imitates the working of a computer network. In simulators, the computer network is classically modeled with strategy, traffic etc. and the performance is analyzed. Typically, users can then modify the simulator to fulfill their specific analysis needs. Simulators classically come with support for the most popular protocols in use today, such as WLAN, Wi-Max, UDP, and TCP and MANET protocol like AODV, DSR, and DSDV etc.

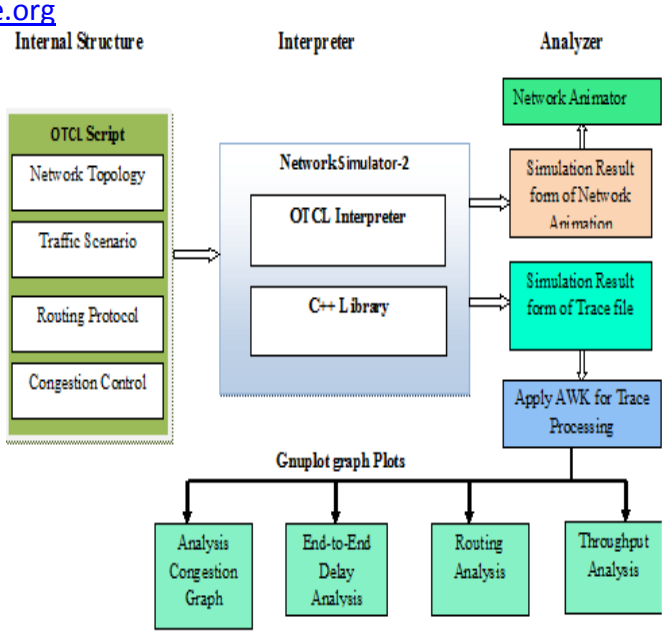

Figure2: Data collection module Architecture

The data collection module provides the information about internal, intermediate and outer structure of simulation structure through this scheme we collect data and analyze them. All the internal module coded through C++ (object oriented approach) and outer module coded through TCL (tool command language base) both are interlinked via object file that generated after compilation of internal C++ file and all are collectively called OTCL (object tool command language). For analysis purpose we use AWK (abstract window tool kit) and generate result in the form of graphically approach.

VI. Performance Metrics

In our approach for congestion control with load balancing under ad-hoc on demand distance vector routing time we analyze the behaviour through generated data name as trace file, that format briefly explain under sample design topic.

Our proposed work simulated under Network simulator-2 so initially we create own package and inbuilt on the bases of internal structure and provide connectivity in between all package then we compile and produce object file, in second module we produce TCL (tool command script) and generate output file (trace and NAM) for further analysis, we analyze network behaviour on the bases of network parameter as well as congestion control parameter like throughput, congestion percentage decrement, routing overhead, packet delivery ratio and drop analysis.

We have primarily selected the following parameters in order to study the performance of our proposed technique

• The Packet Delivery Ratio is defined as the number of received data packets divided by the number of generated

data packets (it's also percentage of data delivery in receiver end).

• End to End delay: It is the occasion taken used for a packet to be transmitted from the source node to the destination node (that measure through micro seconds).

• Average Throughput: It is the average number of messages successfully delivered per unit time i.e. average number of bits delivered per second.

• Routing packets: The total number of routing packets transmitted that is also called routing overhead because number of routing packet broadcast before communication established.

• Dropped Data Packets: - The number of data packets that are not successfully sent to the destination but actual transmitted by sender node.

We also apply number of various extra network parameters and measure the result of our proposed work.

VII. CONCLUSION

Mobile Ad hoc network is dynamic in nature with no centralize control because every node works on temporary bases and frequently changes their location, that is why we can't predicate that where the actual destination node is and what movement the nodes can take. Some time it may happen that whole data or part of data is not reached at destination on time because of congestion or by other reasons in the network, since it is dropped in the network. So we have a need of such routing protocol that can send the packet from multiple paths by which if part of data is dropped at any hop, it will never cause loss at the end when it is collected since it will reach from other hops in network. The multipath AOMDV protocol has a capability to improve the routing strategy as compare to unipath AODV routing protocol. The performance matrices represent the performance of both the protocols and the routing performance of AOMDV is much better than AODV.

VIII REFERENCES

[1] Makoto Ikeda, Elis Kulla, Masahiro Hiyama, Leonard Barolli, Rozeta Miho and Makoto Takizawa "Congestion Control for Multi-flow Traffic in Wireless Mobile Ad-hoc Networks" 2012 IEEE Sixth International Conference on Complex, Intelligent, and Software Intensive Systems, 2012.

[2] Tuan Anh Le, Choong Seon Hong, Md. Abdur Razzaque; Sungwon Lee, Heeyoung Jung "An Energy-Aware Congestion Control Algorithm for Multipath TCP" IEEE Communications Letters, Vol. 16, No. 2, pp. 275-277, February 2012.

[3] Jingyuan Wang, Jiangtao Wen, Jun Zhang, Yuxing Han, "An Improved TCP Congestion Control Algorithm and its Performance", INFOCOM, pp. 2894 - 2902, 2011.

[4] M. Ali, B. G Stewart, A. Shahrabi, A.Vallavaraj, "Multipath Routing Backbones for Load Balancing in Mobile Ad Hoc Networks", 16th IEEE Mediterranean Electrotechnical Conference (MELECON), pp.749-752, 2012.

[5] S. Karunakaran, P. Thangaraj, "A cluster based congestion control protocol for mobile ad hoc networks", International Journal of Information Technology and Knowledge Management, Volume 2, No 2, pp. 471-474, 2010

[6] S.Venkatasubramanian, N.P.Gopalan, "A quality of service architecture for resource provisioning and rate control in mobile ad hoc network", International Journal of Ad hoc, Sensor & Ubiquitous Computing (IJASUC), Vol 1, No 3, September 2010

[7] K. Chen, K. Nahrstedt, N. Vaidya, "The Utility of Explicit Rate-Based Flow Control in Mobile Ad Hoc Networks", Proc. IEEE Wireless Communications and Networking Conference (WCNC 04), pp 1921-1926, 2004.

[8] K. C. Rahman, S. F. Hasan, " Explicit Rate-based Congestion Control for Multimedia Streaming over Mobile Ad hoc Networks", International Journal of Electrical & Computer Sciences IJECS-IJENS, Vol 10, No 04, 2010.

[9] H. Zhai, X. Chen, Y. Fang, "Rate-Based Transport Control for Mobile Ad Hoc Networks", IEEE Wireless Communications and Networking Conference, pp 2264 – 2269, Vol 4, 2005.

[10] E. Lochin, G. Jourjon, S. Ardon P. Senac, "Promoting the Use of Reliable Rate Based Transport Protocols: The Chameleon Protocol", International Journal of Internet Protocol Technology, Vol 5, Issue 4, pp 175-189, March 2010.

[11] Y. Xu, Y. Wang, C.S. Lui, D-M. Chiu, "Balancing Throughput and Fairness for TCP Flows in Multihop Ad-Hoc Networks", 5th International Symposium on Modeling and Optimization in Mobile Ad Hoc and Wireless Networks and Workshops (WiOpt), pp 1 – 10, 2007

[12] Yuanyuan ZOU,Yang TAO "A Method of Selecting Path Based on Neighbor Stability in Ad Hoc Network" This work is supported by chongqing science and technology key research projects (No.2009AB2245) , 2012 IEEE.

[13] Ashish Bagwari, Raman Jee et al. "Performance of AODV Routing Protocol with increasing the MANET Nodes and it's effects on QoS of Mobile Ad hoc Networks" IEEE International Conference on Communication Systems and Network Technologies, 2012.

[14] Vishnu Kumar Sharma and Dr. Sarita Singh Bhadauria "Mobile Agent Based Congestion Control Using AODV Routing Protocol Technique For Mobile Ad-Hoc Network" International Journal of Wireless & Mobile Networks (IJWMN) Vol. 4, No. 2, April 2012, DOI : 10.5121/ijwmn.2012.

[15] Sandeep Bajaj, Lee Breslau, Deborah Estrin, Kevin Fall, Sally Floyd, Padma Haldar, Mark Handley, Ahmed Helmy, John Heidemann, Polly Huang, Satish Kumar, Steven McCanne, Reza Rejaie, Puneet Sharma, Kannan Varadhan, Ya Xu, Haobo Yu, and Daniel Zappala, Improving Simulation for Network Research, Technical Report 99-702, University of Southern California, March, 1999.

BIOGRAPHIES (AUTHOR'S PROFILE)

ANTIMA JAIN (jain_antu@rediffmail.com) received his B.Tech degree in Information Technology from Rajiv Gandhi Technical University, Bhopal, India and M.Tech degree in Software Engineering from Devi Ahilya University, Indore, India in 2004 & 2008 respectively. She is currently working as an Asst. Professor in G.B Pant Govt. Engineering College, Delhi in Deptt. of Computer Science & Engineering.In addition to it, She is also pursuing her doctorate degree from Mewar University, Rajasthan, India.Her research interests include Ad-hoc Networks, Wireless Sensor Networks, Cloud Computing, Software Testing, Software Engineering and Wireless Backhauling.

Dr. Suresh Jain is currently Director of Sushila Devi Bansal College of Engineering (SDBCE), Indore. His research area includes Ad-hoc Networks, Wireless Sensor Networks, Cloud Computing, Mobile Computing, Software Testing, Software Engineering and Wireless Backhauling.

ABHISHEK GAUR (a.abhishekgaur@rediffmail.com) received his B.Tech degree in Electronics & Communication Engineering and M.Tech degree in Digital Communications from Guru Gobind Singh Indraprastha University, Delhi in the year 2010 & 2012 respectively. He is currently working as an Assistant Professor in G.B Pant Govt. Engineering College, Delhi in Deptt. of Electronics & Communication Engineering. In addition to it, He is also pursuing his Doctorate Degree in the field of Passive Optical Networks from Galgotias University, India. His research interests include Optical-Wireless Converged Networks, Optical Access Networks, Digital Design, Control Systems, Microwaves, Antennas, RF Systems and Wireless Communications.

MANU SINGH is currently working as an Assistant Professor in Guru Tegh Bahadur Institute of Technology affiliated to Guru Gobind Singh Indraprastha University, New Delhi. She is an Engineering postgraduate with hands on experience of nearly seven years, in the challenging and competitive environment of IT education, with various skills (quick learning, good communication, technical expertise). Her area of interest includes underwater acoustic wireless networks, Vehicular Ad-hoc Networks (VANETs), Data Warehousing and Wireless Communication.