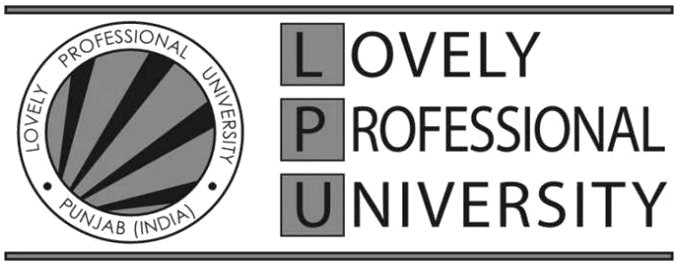

"Efficient Data Scheduling in Vehicular Ad-hoc Networks"

A Dissertation Proposal Submitted

By

Kezhalenuo Rutsa

To

Department of Computer Science & Engineering

In partial fulfillment of the Requirement for the

Award of the Degree of

Master of Technology in Computer Science & Engineering

Under the guidance of

Mr. Mohinder Kumar

(May 2015)

ABSTRACT

Vehicular Adhoc Networks (VANETs) is an application of Mobile Adhoc Network (MANETs) which provide communications between vehicles to impart diverse sort of data, data with the end goal of safety measures like prevention of accidents, traffic jams and provide comfort services to passengers. The objective of this paper is to improve the reliability and availability of data across the whole network.

Due to high vehicle mobility and untrust communication, has practically degraded the execution of data access in Vanets. To address this issue, a platoon novel is introduced where each vehicle participated by contributing some parts of its buffer for replication data in the same platoon and also produces the ability for a vehicle to prefetches the neccesaary data and store in another vehicle buffer, when a vehicle is about to leave the platoon so that the performace of accessing data is not affected.

To attain this objective, the availablity of each vehicle buffer in a platton and also the stability of the vehicle are kept into account by the platoon leader during replication process. The result produces that data access in Vanets can successfully enhance.

CERTIFICATE

This is to certify that Kezhalenuo Rutsa has completed M. Tech dissertation proposal titled "**Efficient Data Scheduling in VANETs"** under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of the dissertation proposal has ever been submitted for any other degree or diploma.

The dissertation proposal is fit for the submission and the partial fulfillment of the conditions for the award of M.Tech Computer Science & Engineering.

Date: Signature of Advisor

Place: **Mohinder Kumar**
UID

ACKNOWLEDGEMENT

I would sincerely thank **Mr. Mohinder Kumar**, Computer Science and Engineering Department who suggested many related points and is always very helpful and constructive.

I find it hard to express my grateful to the Almighty in words for bestowing upon me his deepest blessings and providing me with the most wonderful opportunity in the form of life of a human being and for the warmth and kindness he has showered upon me by giving me life's best.

I wish to express heartiest thanks to my friends and colleagues for their support, love and inspiration.

Date: Kezhalenuo Rutsa

Reg.no.11110641

DECLARATION

I hereby declare that the dissertation proposal entitled, **"Efficient Data Scheduling in VANETs"** submitted for the M.Tech Degree is entirely my original work and all ideas and references have been duly acknowledged. It does not contain any work for the award of any other degree or diploma.

Date:_____ Kehalenuo Rutsa

Place:_____ Reg.No.11110641

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CHAPTER 1
INTRODUCTION

VANETs are an infrastructure less, distributed, self-organizing communication networks created by moving cars known as nodes. It provides wireless communication between moving nodes. Vehicles can speak with other vehicle specifically shaping vehicle to vehicle correspondence (V2V) or to correspond with settled structure beside the street called Road Side Unit (RSU) framing vehicle to framework correspondence (V2I).

In this type of communication, it allows the vehicles to share and exchange information to prevent accidents, traffic jams and provides comfort services to passengers. Nodes in VANET are highly mobile that is the topology is dynamic .As the topology of VANETs changes dynamically which causes the division of the network to several separated fragments. Nodes inside one piece would not have the capacity to get to the information from the nodes that are in other section. Information scattering has been broadly used to lessen the impact of irregular network and enhance information access execution in conveyed frameworks. The point of information dispersal is to enhance the dependability and accessibility of information gets to over the entire system. In altered systems, information is regularly put away on the nodes that need them most, with a specific end goal to lessen the expense of remote information access. In any case, in VANET because of extraordinary portability of OBU (On Board Unit) nodes, this sort of arrangement gets to be inadequate. The accessibility and dependability (consistency) of information is turning into an imperative issue.

VANET being a part of the MANET with diverse attributes, for example, movement qualities, the speed of vehicle, driving and information access design. The result in low information availability can be because of high speed which causes time obligations issue in conveyance of information. The components influencing time demands can be because of overwhelming movement and impact of information demand in the remote system, for example, clogging, and message misfortune and postpone in wired system.

Information replication in RSU can be an extraordinary choice to tackle the time obligations

issue in a perplexing and entangled system since the appeal on recreated information obliges no correspondence cost. For enhancing information availability with information replication in RSU, it is critical to pick which information thing is duplicated because of restricted stockpiling in RSU. For the most part there are two sorts of driving example and as per that example, information replication can be keep up and moved forward. The two driving pattern are transient and frequent vehicle. Transient vehicles are those which pass the road once, the vehicles that won't be available again on the same street. Frequent vehicles are those vehicles which passes the same road frequently. The data access in transient vehicles is likely to request once and disappear after a while whereas frequent vehicle can produce good performance in data access.

1.1 VANETs Architecture

The communication between V2V and V2I is done by a wireless medium called WAVE (wireless access in vehicular environment). The communication provides sharing and exchange of information which enable applications like safety and non-safety to the clients.

The main system components consist of application unit (AU), on board unit (OBU), road side unit (RSU) [2].

- On Board Unit (OBU): An OBU is a wave gadget [2] which is mounted ready for vehicle used to trade data with the RSUs or with different OBUs. It comprises of asset order processor (RCP) and asset including a read/compose memory used to store and recover data, a client interface. It likewise gives interchanges administrations to AU and advances information for different OBUs in a system. The primary capacities are remote radio access, system blockages control, solid message exchange, information security and IP mobility
- Application unit (AU): it is a gadget prepared inside the vehicle where the applications are given by the suppliers utilizing the OBUs interchanges capacities. AU can associate with the through wired or remote associations. It speaks with the system by means of OBU which assumes liability for all portability and systems administration capacities.
- Road side unit (RSU): The RSU is a wave gadget typically settled next to the street. It is an administration supplier and can likewise join with the web or to an alternate server which permits AUs from numerous vehicles to associate with the web. The fundamental capacities of RSUs are developing the correspondence run by

redistributing and sending to different OBUs. Information replication in Vanets can be extraordinary choice to tackle the time obligations issue in a perplexing and entangled system since the appeal on recreated informations obliges no corresponding cost.

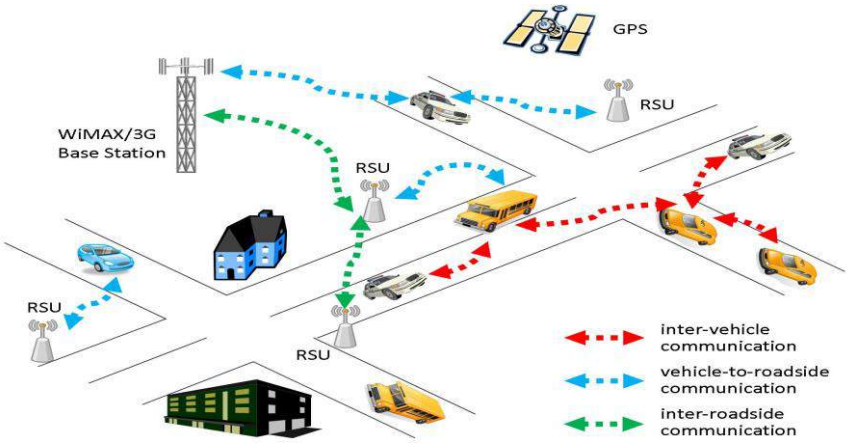

Figure 1.1: Architecture of Vanet[2]

1.2 VANET Communication Domain

There are three types of communications in VANET (fig-2):

- In-vehicle domain**:** This area comprises of one OBU and different Aus. The correspondence can be wired or remote. The OBU gives a correspondence connection to the AU to convey utilizing the correspondence communication abilities of OBU.
- Ad-hoc domain: This area comprises of OBUs in vehicles and RSU. In this domain V2V communications occurs directly if there's a direct connection available between them [2]. In case of no direct connections routing protocols are use to forwards the messages. In order to extend the communications range vehicles communicate with the RSU by sending, receiving and forwarding data from one node to another.
- Infrastructure domain: RSU can connect to other infrastructure networks like the internet, allowing OBUs to access the data from one node to another introducing V2I communication.

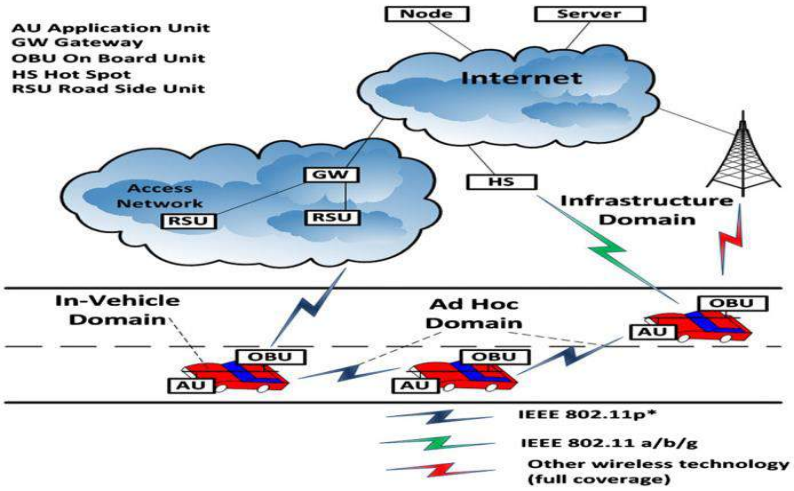

Figure 1.2: Vanets communication domain[2]

1.3 Wireless technology in vanet

To provide best networked for vehicle communication there are various wireless access technology available in vanet. With this access technologies it intended to improve the applications provided in vanet.

Some of the basic wireeless access technology are as follows:

- Cellular networks

  It is aphone system or versatile system which is remotely disseminated over area territories known as cells, and is function with no less than one location transceiver known as base station. Different frequencies are alloted to each cell to avoid interference and also to guarenteed bandwidth in each cells..

  At the point when joined together these cells give radio coverage over a wide geographic territory. This empowers an extensive number of versatile handsets (e.g., cell telephones, pagers, and so forth.) to correspond with one another and with transceiver and phones anyplace in the system, by means of base stations, regardless of the possibility that a percentage of the transceiver are traveling through more than one phone during transmission.

  Some standards of cellular network are:

  GSM: GSM reffered as Global System for Mobile Communication. It is an advanced cell innovation utilized for transmitting mobile voice and information administrations. GSM is a circuit-switched framework that partitions every 200 kHz channel into eight 25 kHz time-spaces. GSM uses Time Division Multiple Access (TDMA) strategy for

transmitting signs. It has data capacity from 64 kbps to 120 mbps data rates. It is also know as second generation (2G). GSM gives essential voice and data administrations including roaming.

GPRS: A packet radio system which is commonly termed as 2.5G a forward to third-generation (3G) for accessing internet. it is otherwise called GSM-IP that is a Global-System Mobile Communications Internet Protocol as it provide the clients of this framework on the web, permits to make voice calls, and access web . It can accomodate a data rate of upto 170kbps. A high data rate is required to transmitt multimedia data which lead to the development to third generation(3G). A data rate upto 2mbps was intoduced which is called UTMS (universal mobile telecommunication system).

- WLAN/WIFI: Wi-Fi are utilized by gadgets or clients to give for accessing web within the scope of a remote system that is associated with the Internet. The scope of one or more interconnected access focuses can reach out from a territory as little as a couple of rooms to as vast the same number of square kilometers.it enables V2V and V2I communication. Wifi are based on IEEE 802.11 standards to provide wireless connectivity. Standards of 802.11 are 802.11 a,b,g etc. IEEE 802.11a uses 5-Ghz band providing data rates 6,9,12,18,24,54 mbps [16]. IEEE 802.11b uses 2.4 –Ghz band providing data rates 5.5 mbps and 11 mbps.
- WiMAX: it is known as Worldwide Interoperability for Microwave Access, introduced with data rates of 30 to 40 megabit-per-second . WiMAX is based upon IEEE Std 802.16e-2005, affirmed in December 2005. WiMAX can give at-home or versatile Internet access crosswise over entire urban areas or nations. It application provides reliable communication by introducing broadband access through wireless. it also provide quality of service (Qos) for features like voice over IP (VoIP).
- DSRC/WAVE: it is termed as dedicated short-range communication are one-way or two-way short-range to medium-range remote correspondence stations particularly intended for auto use and a relating arrangement of conventions and standards. In October 1999, the United States Federal Communications Commission (FCC) allotted 75 MHz of range in the 5.9 GHz band to be utilized by intelligent transportation service (ITS) and later, the European Telecommunications Standards Institute (ETSI) designated 30 MHz of range in the 5.9 GHz band for ITS [16]. DSRC frameworks comprise of Road Side Units (RSUs) and the On Board Units (OBUs). The DSRC

norms determine the operational frequencies and framework data transmissions, additionally take into account discretionary frequencies which are secured (inside Europe) by national regulations. DSRC provides communication range of 300m to 1000m with data rate of more than 27mbps in which vehicles can accelerate upto 200kmph.

1.4 VANETs Characteristics

The following are the some of the characteristics of VANETs:

- Predict mobility: nodes have a tendency to moves in arbitrary courses as vehicles are imperative by the street topology and format to obey movement lights and street signs and to react to other vehicle heading the consistency according to their portability.
- Information like safe driving are providede, enhancing traveler solace and improving activity productivity.
- No power constraints: Vehicles can give ceaseless energy to the OBU by means of the long life battery.
- Variable network density: the system density relies on upon the activity thickness in VANET which can be increase or decrease
- .Large scale networks: The network can be extended to dense urban areas.
- High computational abilities: since vehicles are nodes in VANETs, applications like sensors can be mounted with sensors, GPS, antenna technology etc to increase the computational capacities in a node.

1.5 Challenges in VANETs

The type of challenges in VANET is as follows:

- Signal fading: The efficiency of VANET can be affected when an object is placed between two communications vehicles and that can be buildings o or other vehicles in cities which can fade the transmitted signal.
- Bandwidth limitations: There is no coordination to maintain the communications between nodes so utilizing the bandwidth efficiently is necessary.
- Connectivity: frequent fragmentation in a network occurs due to frequent changes in the network topology and high mobility which degrade the communication performance.

- Security and privacy: to provide a trust communications between sender and receiver is a major challenge in Vanets.
- Routing protocol: one of the most critical challenges in VANETs is the routing protocol due to high mobility and frequent topology changes; appropraite routing protocol is difficult to provide in a specified time.

1.6 VANETs Applications

Vehicle communication provides the ability to vehicles to communicate with each other. Data can be collected, exchange and process at any time. The applications are given below (figure 1.3)

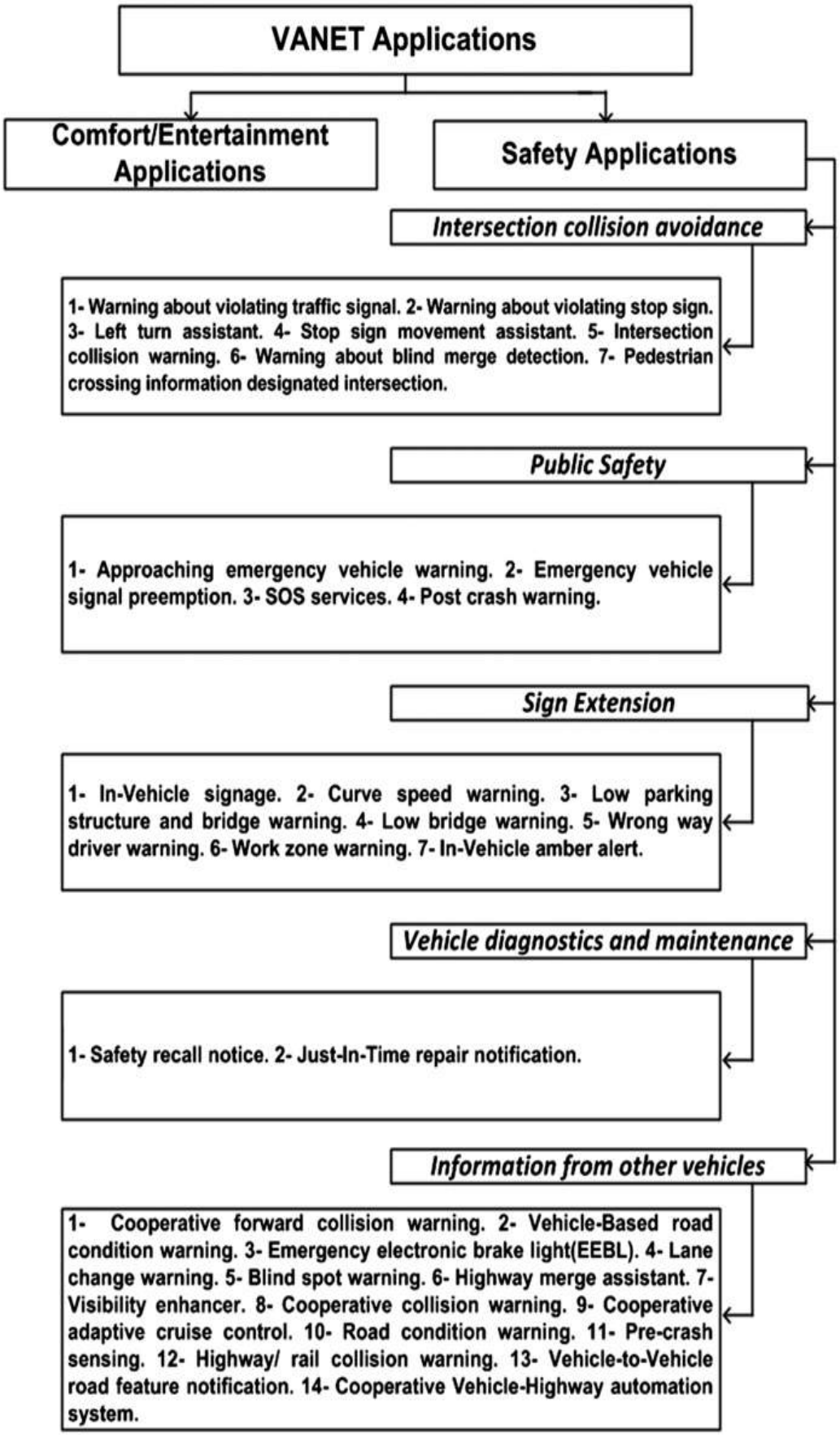

Figure 1.3: Vanets application[2]

The VANETs applications are as followed: (Figure-1.3):

- Non-safety applications: This category is for comfort and entertainment for both drivers and passengers. It provides necessary information about the traffic or important locations needed by the drivers. For passengers it provides online application. The passengers can play games, access to internet even on journey, exchange of messages through online etc. This tends to improve the drivers and passengers comfort levels.
- Safety applications: This category uses the internet connections by providing the information on improving road safety so that accidents can be avoided and safe lives of people. This application has essentials information as it avoids collisions which introduce road safety. Prior information will be achieved via sensors from other vehicles so road accidents can be avoided. This application also provides information about road signs. In short, this application provides prior warning for road safety

1.7 VANET simulators

Wireless technologies no wonder has affect our day by day lives. From wireless LANs to cell portable systems, wireless advances have profited thousands of clients around the world. The period of vehicular ad- hoc networks (VANETs) is currently developing, picking up consideration and energy. Specialists and engineers have manufactured VANET reenactment programming to permit the study and assessment of different media access, steering, and crisis cautioning conventions. VANET reenactment in a general sense unique in relation to MANETs reenactment in light of the fact that in VANETs, vehicular environment forces new issues and prerequisites, for example, compelled street topology, multi-way blurring and roadside deterrents, movement stream models, trek models, changing vehicular rate and versatility, activity lights, movement clogging, drivers' conduct, and so on. Presently, there are VANET mobility generators, network systems, and VANET simulators. Some of the existing network simulators available for vehicle communications are: NS2, GloMosim, SWAMS, SNS

- NS2: Its a discrete test system introduced by the VINT task exploration bunch at the University of California at Berkeley. The test system was developed by the Monarch examination bunch at Carnegie Mellon College to include: (a) hub versatility, (b) a reasonable physical layer with a radio proliferation model, (c) radio system interfaces,

and (d) the IEEE 802.11 Medium Access Control (MAC) convention utilizing the disseminated coordination capacity (DCF) [3].

- GloMoSim: It is an adaptable recreation environment for remote and wired system. It has been planned utilizing the parallel discrete-occasion recreation ability gave by Parsec . GloMoSim has been constructed utilizing a layered methodology like the OSI seven layer convention model [3]. Standard APIs are utilized between the distinctive recreation layers. This permits the quick combination of models created at distinctive layers by diverse individuals.
- JiST/SWANS: its a superior discrete occasion reproduction motor that runs over a standard Java virtual machine. It is a model of a new broadly useful way to deal with building discrete occasion test systems, that binds together the conventional frameworks furthermore, dialect based test system plans [3]. It beats existing profoundly enhanced recreation motors both in time and memory utilization.

  JiST changes over an existing virtual machine into a reenactment stage, by implanting reenactment time semantics at the byte-code level. Along these lines, JiST reenactments are composed in Java, accumulated utilizing a general Java compiler, and run over a standard, unmodified virtual machine.

  SWANS is a versatile remote system test system based on top of the JiST stage. It was made principally in light of the fact that current system recreation apparatuses are not sufficient for ebb and flow research needs. SWANS contains free programming segments that can be created to shape finish a remote system on the other hand sensor system. Its abilities are like ns-2 what's more, GloMoSim, yet SWANS is capable of reenacting much bigger systems [3].
- SNS(a Staged Network Simulator) . Conventional remote system test systems are restricted in rate also, scale on the grounds that they perform numerous excess processings both inside a solitary reenactment run, as well as over various summons of the test system. The focal thought behind arranging is to reserve the aftereffects of costly operations and reuse them at whatever point conceivable. SNS is an arranged test system in light of ns-2. On a generally usedad hoc system recreation setup with 1500 hubs, SNS executes more or less 50 times quicker than standard ns-2 and 30% of this change is expected to organizing, and the rest to building [16]. This level of execution empowers SNS to reproduce expansive systems.

	NS-2	GloMoSim	JiST/SWANS	SNS
Software portability	**yes**	**yes**	**yes**	**Yes**
Freeware	**yes**	**yes**	**yes**	**Yes**
Opensource	**yes**	**yes**	**yes**	**Yes**
Large networks	**no**	**yes**	**yes**	**Yes**
Console	**yes**	**yes**	**yes**	**Yes**
GUI	**yes**	**yes**	**yes**	**Yes**
Scalability	**poor**	**high**	**high**	**High**
Ease of setup	**easy**	**moderate**	**hard**	**Easy**
Ease of use	**hard**	**hard**	**hard**	**Hard**
obstacles	**No**	**No**	**No**	**No**

Figure 1.4: comparison of network simulators

CHAPTER 2
REVIEW OF LITERATURE

This chapter contains the review of several papers done by different researchers. It describe different methods used by them in improving the data access management in Vanets. They are describe below:

2.1 An efficient and reliable MAC in VANETs

Duc Ngoc Minh Dang et al. [4] have proposed a protocol called VER-MAC, an efficient and reliable MAC to improve the broadcast reliability in VANETs.

VER-MAC uses the metrics called One Control Channel (CCH), Six Service Channel (SCH) for the transmission of data packets [4]. This protocol improved the data access in VANET by utilizing the CCH during the SCHI for broadcasting the Emergency Packet (EMG). It also increases the packet delivery ratio in each periodic-driven EMG packet. This protocol works as follows: When an EMG packet is transmitted at the MAC layer, the node tries to broadcast it on the CCH in the current CCHI and then rebroadcast in the next CCHI or SCHI. If the node has any service packet to exchange with the transmitted packet, it sends a WSA handshaking including the CUL (Channel Usage List). Each node performs WSA handshaking to select transmission slots (TxSlot) of a SCH.

When the receiver receives the WSA, it selects the common transmission slots called the TxSlots which is used for collision –free service data transmission with the help of SCH based on the CULs of both the sender and receiver. The receiver then sends the ACK indicating that it has selected slot from [TxSlot,SCH] to the sender. The sender after receiving the ACK sends the RES (Reservation) to confirm the selected slot chosen.
Both the sender and receiver switch to the selected SCH in the selected TxSlot to exchange their service packets. On the other hand the neighbor nodes update their NIS (Neighbors Information List) and CULs when they overhear the ACK and RES messages during transmission between the sender and the receiver.

In conclusion of this paper, this protocol outperforms the IEEE 1609.4 in terms of the PDR (Packet Delivery Ratio) of emergency packets and the throughput of service packets. However this protocol suffers from more delay of emergency packets.

2.2 A trusted enhanced secure clustering framework for wireless Adhoc networks

Chatterjee et al. [3], have proposed a Secure grouping in Wireless Ad Hoc Networks is a critical issue. Conventional cryptographic arrangement is pointless against dangers from inner traded off hubs. In light of this, they propose a novel circulated secure trust mindful grouping convention that gives secure answer for information conveyance. A trust model is suggested that registers the trust of a hub utilizing self and suggestion proofs of its one-bounce neighbors. Hence, it is lightweight regarding computational and correspondence necessities, yet effective regarding adaptability in overseeing trust. What's more, the proposed bunching convention sorts out the system into one-bounce disjoint groups and chooses the most qualified, dependable hub as a Clusterhead. This race is finished by a verified voting plan utilizing parallel various marks. Examination of the convention demonstrates that it is more proficient and secure contrasted with comparable existing plans. Reproduction results show that proposed convention beats the mainstream ECS, CBRP and CBTRP as far as throughput and parcel conveyance proportion with a sensible correspondence overhead furthermore, dormancy in vicinity of noxious hubs.

2.3 Improving data availability in Vanets

Preeti aggarwal et al. [8] have proposed a journal related to improving data availability in vehicular adhoc network. In their journal they study and compared different technique which are already proposed regarding data dissemination.

They proposed their work by considering two scenarios – urban and rural. The traffic density for both this scenarios is different. The traffic density of urban is more as compared to rural and due to difference in traffic density the routing strategy also differs slightly.

Their proposed system was simulated using NS-2 simulator. Their aim was to show that when both RSU and OBU acts as data distributer , data dissemination is more improved in case of both urban and rural traffic density environment and providing high data availability.

Firstly their proposed system starts by creating a scenario and generate mobility to get the

number of vehicles, vehicle speed and area and placing an RSU as a data distributers. Secondly data distributer is initiated by RSU to OBU. If OBU is in range the data is distributed through RSU else OBU broadcasts the messages to all the nodes.

2.4 Data dissemination in urban vehicular Adhoc networks with diverse traffic conditions

Guilherme Maia et al. [6] have proposed a protocol called HyDiAck for data dissemination in VANET which is applicable in dense and sparse scenarios. It is later then compared with two protocols called UV-CAST and slotted 1-persistence.

This protocol is based on ROI (Region of Interest). Before communication occurs between vehicles it checks whether the new incoming message from a vehicle is inside the ROI. If it is outside of ROI it is discarded. Thus communication is only in ROI.

In HyDiAck message are also discarded with respect to time-to-live (TTL).With the help of only one hop neighbor information, they proposed a mechanism which broadcast the massages. They also combined with a time-based mechanism and are applicable to vehicles that are outside the forwarding zone to rebroadcast their messages only when there are on vehicle in forwarding zone. This mechanism increases the message delivery in both dense and sparse scenarios. In their proposed system they assumed that all vehicles are equipped with a GRS (Global Positioning System) and periodically broadcast their location.

This proposed system provides some advantages. They are: increases messages delivery to those vehicles which are closed to each other, able to deliver messages to all vehicles inside the ROI also decreasing load in network. The future work on this proposed can be done on the impact of the beacon frequency and GPS error.

2.5 Secure cooperative data downloading framework in Vanets

Yong hao et al. , [9] have proposed a secure cooperative data downloading framework in VANETs. In their paper they develpoed an application layer data sharing protocol depending on the vehicle movements. Date proposed their protocol in V2I environment i.e. data are accessed through RSU.this method avoid collision during transmition like multi-hop.

Moreover they addressed the security and privacy of data access like downloading and sharing in V2I framework.

To achieved cooperative downloading, the vehicle are classified into three categories:- aplicant, downloading and relay vehicles. For security they introduced sign system for each group where each group consists of onr public key and multiple private keys. They also introduced location based data sharing protocol for efficient data downloading by the vehicles.

2.6 A framework for secure and efficient data acquisition in Vanets

Khaleel Mershad et al. [7] have proposed a framework to improved security issues related to the exchange of messages between users and RSUs holding the location privacy of users too where Advanced Encryption Standard (AES) is used to increased its security measures. They also suggested two mechanisms for data confidentiality and users location privacy in VANETs [7]. The proposed framework consists of two mechanism called REACT and HARDY.

In REACT, before connections occurs the users register once through online RSU from their vehicle. After registration the users obtain a master key from trusted authority. Before communications occurs, the users send hello packet which contain username to the nearest RSU and with master key the communications begins. After receiving the message, the decryption will require the master key again.

In HARDY, after the users have registered, they need to obtain their master key from RSUs. The RSUs need to authenticate the users and as it is not possible for the users to send their password to RSU in plain text [7], they proposed that RSU will use HARDY to generate a sequence of encryption keys from the users passwords and uses them to safely transfer their master keys. The same keys are used for decrypting the messages. Their proposed system provides the RSU with secure connections.

2.7 A protocol with bandwidth utilization and fairness enhancment for mesh-backbone-based Vanets

Li-Ling Hung et al. [12] have proposed a protocol called BUFE-MAC (bandwidth utilization and fairness enhancements-medium access control). As vehicle with larger number of hops

has less opportunity to exchange data with the RSU [12], BUFE aims in increasing bandwidth utilization, maintaining fairness and avoiding collisions. This protocol aims to integrate the uplink and downlink transmissions. It also aims to increase the bandwidth so that every vehicle has the opportunity to exchange data keeping in mind to maintain fairness in transmission sessions.

To maintain balance uplink and downlink bandwidth, it is observed that the uplink bandwidth utilization closer to the IGW (Internet Gateway) is better than those way from the IGW. The same applies to the downlink bandwidth utilization [12]. So without dividing the uplink and downlink channels the same bandwidth can be used as a single bandwidth for transmitting more data providing improvement in network. This protocol supports the following mode: The mesh-backbone based and Infrastructure mode

The mesh-backbone based allows packet transmission from one vehicle to another. The infrastructure mode directly exchange data between vehicle and gateway. Their protocol reduces packet collision and also transmission delays.

2.8 An efficient data replication method for data access applications in Vanets

M.Akila et al. [17] have proposed a novel vehicle-platoon-aware data access solution (called V-PADA) to improve data replication for data access in VANETs. In this method the vehicles are organized in a group and sharing of data among the vehicles occurs inside the same platoon where part of their buffers is contributed to replicate data. When a vehicle leaves the platoon, it per fetches interested data and transfers its buffered data to other vehicles in advance so that they can still access the data after it leaves [17]. This method is proposed due to topologies changes which occur at any time, which results to frequent disconnections.

The Platooning protocol operates the following stages :

- Initial: This stage is where the vehicle enters the network [17].
- Join: This stage is when the vehicle meets other vehicles in a same direction. After it joins it sends a message to all the other vehicles so the other vehicles will know that a new vehicle has joined them.
- Quasi-split: This stage occurs when the vehicle reaches some curve point to its destination. The vehicle is split and if it returns back to its own platoon it proceed to

join stage else it enters the split stage

- Split: This stage occurs when the vehicle gets completely separated from its platoon. It sends a split message to all the other vehicles that it is leaving the platoon [17]. At the same time it transferred its buffered data to the nearby vehicles. Their proposed system brings a conclusion that it reduces false alarm and eliminate data redundancy.

This are the the four stages in which v-pada model work. When a vehicle enters any network it is called initail state. When a vehicle happens to go in the same direction with other vehicles in a network it is in join state. Whenever a vehicle reaches the place where it has to split from the group fue to road curve or speed og the vehicle it comes under quasi split. When the vehile leaves the group it come to split state.

2.9 An efficient privacy-preserving data-forwarding scheme for service-oriented Vanets

Xiaolei dong et al. [18] have proposed an algorithm Lite CA-Based public key cryptography to provide an efficient privacy-preserving data-forwarding scheme (EP2DF) for VANET [18]. It is also based on a technique called on-path onion encryption techniques which allow the messages to be re-encrypted again and again in multi-hop transmission from source to destination. This technique is divided in three parts- Key registration, Data forwarding, Data decrypting.

When a mobile unit enters a system, it first needs to register to Lite Certificate Authority (LCA) and obtain a private and a public key. During data forwarding phase, the public key is used to generate the packet with the cipher text by the service provider.

For data decryption the private key is require to obtain the sender message Lite CA-Based public key cryptography (PKC) is proposed to achieve the security goals that are confidentiality, authentication and privacy [18].. This novel reduces the cost of encryption and the key certificate management complexity. Based on authentication frameworks PCKS can be divided into three categories and to distinguish the various PCKs, concept of trust is introduced.

- Level 1: In this level the authority- the certificate management is aware of the user's private key and therefore can impersonate user at any time [18].
- Level 2: The authority is unaware of the user's private keys but still it can generate

fake keys.

- Level 3: The authority is unaware to the users private key thus frauds of the authority are detected. PCK provides the trust level 3 [18]

In their proposed system, their main advantage is that it can be proposed in large scale service oriented but complexity can be an issue while managing high keys. Sometimes it can also face impersonation attack.

2.10 Design and evaluation of a collaborative system for content diffusion and retrieval in Vanets

Cluadia et al. [15] have proposed IEEE 802.11p/WAVE (Wireless Access in Vehicular Situations) is a rising group of norms planned to bolster remote access in Vehicular Ad Hoc Networks (VANETs) [15]. Television of information and control parcels is relied upon to be pivotal in this environment. Both wellbeing related and non-security applications depend on television for the trading of information or status also, promotion messages. The greater part of the TV trafficis intended to be conveyed on a given recurrence amid the control channel (CCH) interim set by the WAVE draft standard. The rest of the time, vehicles change over to one of accessible administration channels (SCHs) for non-security related information trade. Despite the fact that TV in VANETs has been logically considered, related meets expectations neither consider the WAVE channel exchanging nor its impacts on the VANET execution. In this letter, another systematic model is intended for assessing the TV execution on CCH in IEEE 802.11p/WAVE vehicular systems. This model unequivocally represents the WAVE channel exchanging and processes bundle conveyance likelihood as an element of dispute window size and number of vehicles.

2.11 Reliability analysis of one-hop safety-critical broadcast services in Vanets

Xiaomin Ma et al. [19] have proposed four reliability metrics for one-hop broadcast communications in VANETs. In this paper an important issue called reliability in VANETs is discussed for safety broadcast services in one-hop communications. The four reliability metrics for one-hop broadcast communications which are introduced and evaluated in VANETs are: Packet Reception Rate (PRR), Successful Packet Delivery Ratio (PDR), Packet Delivery Probability (PDP), effective range (ER) [19].

The proposed model is connected to the assessment of Dedicated Short Range

Communication (DSRC) [19] for security basic message proliferation in parkway settings. DSRC in VANET incorporate crash evasion cautioning, path evolving partner, convergence coordination, movement sign/ signal infringement cautioning, street alert risk warning, port accident notice and so forth. The proposed model is connected to the assessment of Dedicated Short Range Communication (DSRC) for security basic message proliferation in parkway settings. DSRC in VANET incorporate crash evasion cautioning, path evolving partner, convergence coordination, movement sign/ signal infringement cautioning, street alert risk warning, port accident notice and so forth. To improve the reliability of broadcast, various protocols rely on one of the following conditions: Acknowledgement, Continuous push, Continuous push.

As it is mentioned, this paper is focused only on one-hop reliability of broadcast instead of multi-hop. This paper also describes the basic functionality of its reliability metrics.

This paper also improved reliability in case of emergency situation when ER does not need to have a large transmission range as the exchange of messages are critical only to those vehicles that are closed to each other. The potential approaches to enhanced dependability this condition the show administrations incorporate expanding the transmission information rate, picking bigger transporter sensing reach to relieve the shrouded terminal issue, utilizing greater again off window size to diminish the likelihood of simultaneous transmissions and presenting bundles transmissions redundancies and so forth.

CHAPTER 3
PRESENT WORK

3.1 Problem formulation

This study focuses on wireless vehicle communications (V2V). This study represents the improvement of data access in VANETs as it has provide the potential to support the growing number of wireless product that are now use in vehicles.

At the present scenario, cars and other vehicles are used by many people in every country. With the increase use of private transport and increase facilities the problems being confronted by modern society are the occurrence of accidents on the roads, the expenses and related dangers.

As per the survey conducted by World Health Organization 2013, India top the list of road deaths with an estimated rate of 105,725 followed by China with 96,611, Russia with 35,972, the US (42,642) and around 1.3 million lives in total were lost all over the world.

To enhance the vehicle and street wellbeing, activity productivity, accommodation and solace to both clients and travelers VANETs gives a remote correspondences between moving vehicles**.** Vehicles can communicate with others vehicles directly or can communicate with fixed equipment called the RSU. This type of communication allows vehicles to share informations of different kinds.

The thought behind appropriating and offering data between vehicles is to give wellbeing message to caution the drivers about anticipated that dangers in place would diminish the quantity of mishaps and to give travelers a lovely voyage.

The fundamental aspect behind the data replication algorithm in platoon(group) in data access management for vanet is to locate the best vehicle to place the replicated information so that the information cost in the group are reduced .

To improve the performance and reliability in data access management, some variables are formulated and better solutions are obtained to improve the data access management . the split is about to occur in the group, the group leader will take the responsibility of the replicating process. They leader knows the information of each vehicle ie memory size, neighboring nodes, data etc.

The group leader maintain the intra- replicating process, the member on obtaining the new replicating process will replicated the data with repect to the efficient buffer availabity, stability of the node, the more time to be in the group. This method will will improve the performance by increasing bandwidth utilization, data availabilty and less delay.

3.2 Objective of the study

The main objective of this study is to provide an efficient method to improve the data acess in VANET .This report represents on how the data can be access efficiently in VANETs providing the users safety guidance and also providing entertainment to passengers on journey.

This study also aims at enhancing the safety and efficiency of transportation system. Because of fast changes in system topology, the associations happening can be disengaged, this study will give strategies to give better information get to in this situations by presenting information replications and enhance execution in circulated frameworks the same number of data may just have constrained storage room and therefore can't reproduce all the information, for example, huge music documents or feature cuts. The specific aim of the study is to:

- Provide reliability for broadcast services for all the intended nodes to receive the broadcast messages within specified duration.
- Provide efficient and secure data access.
- Improve data availability.
- It also aims to increase bandwidth utilization, maintaining fairness and avoiding collisions and also tries to improve the performance.
- Reduces buffer and communication cost.

3.3 Research methodology

To begin with my study, I proceeded with an area of interest called VANET. Under this area I opted for data access. To obtain an objective I started with literature review on how to improve the availability of data access in VANETs. The aim of the literature survey was to study about various research papers related to data access techniques in VANETs and to obtain an objective that is defining a problem and understanding it.

A base paper was chosen after literature review which proposed a protocol called V-PADA (vehicle platoon aware data access) [17], an efficient data replication method for data access

in VANET. This protocol is defined for vehicles which are designed in a group to connect with each other and share data among the group. This provide efficient data access to the vehicles inside a group as the vehicle exchange their buffers so that transferring and sharing of data occurs among them. When a vehicle happens to leave the group, it pre-fetches important data and transfers it to other vehicle buffer so that the other vehicle can continue to access data even after a vehicle leave the group. This method was implemented using NS-2 and Groove Net Simulation.

The basic problem behind this protocol is that mobility of the vehicle should be known in advanced.

When a vehicle splits from the group due to road curves in the road layout and re-enters the group. There can be high chances of messages to be lost for certain issues like channel crush (interference or collision) which can results in false information about the splitting of vehicle. This problem arises as the moving vehicles are unstable. If vehicles are in straight road, the split method works effectively. The distance between the vehicle and its reference vehicle should not be that large as it can lead to prediction error. Every vehicle has its own reference vehicle for data access and splitting purpose too so that when splitting occurs a message is generated to the other entire vehicle that it is leaving the group. An algorithm is studied and analyze on these condition where it will improve the data accessibility in an effective way. In later part of this study, methods will be studied and applied to improve it. This protocol has used ‘”best location data replication algorithm “ for selecting the best node(vehicle) in a platoon .when a node is about to leave the platoon, the node should select the best location so that it can prefetch its data into the best location buffer so that data can be access efficienly by other nodes in the platoon.

To improve this algorithm ie to select the best location , the buffer size including the used and free buffer of all nodes in a platoon are known by the platoon leader. The platoon leader will anlaysize the buffer availability by tracking the stability of the nodes as any node can leave the platoon anytime. With buffer availabilty and stability of the node the best location can be chosen which can improve the algorithm. This study , to improve the above stated algorithm it uses cluster techniques.

Firstly it apllied clustering technique which uses both hop distance and number of nodes in a cluster to control the cluster structure. Secondly calculate direct trust prediction. After direct trust prediction select the cluster-head by using the algorith CH_ELECT. Lastly apply the advance scheme which utilizes a hash-table like interface of GHT where nodes can put and

get data based on their data type is used to minimize the storage cost and communication cost.

3.4 Algorithm for proposed method:

i. Apply clustering technique which uses both hop distance and number of nodes in a cluster to control the cluster structure.
ii. Calculate direct trust prediction.
iii. Now trusted clustering is done and cluster-head is selected by algorithm CH_ELECT
iv. In the fourth step the advance scheme which utilizes a hash-table like interface of GHT Where nodes can put and get data based on their data type is used to minimize the storage cost and communication cost.

The explaination is the algorithm is given below:

- Clustering technique: In this technique, the cluster are form depending on the hop- distance and no of nodes in a network to control the structure of the cluster.
- Direct trust prediction: The direct trust is figured utilizing the accompanying technique. The anticipated trust confirmation connected with particular parameter is signified as TFwdfor forward proportion, TDrpfor drop proportion and TFlsfor false infusion proportion at timet can be anticipated from their previouspstate qualities utilizing the accompanying comparisons of AR(p) model. The autoregressive model AR(p) is one of a gathering of straight expectation equations that endeavor to anticipate an outputYn of a framework based on the past yields (Y(n-1) , Y(n-2), … , Y1). This model has been utilized to foresee system activity, area of a hub etc

  The formula is:

$$T_{Fwd}(t) = K_1 + W_1 * \Sigma_{i=1}^{p} T_{Fwd}(t-i) + E_1(t)$$
$$T_{Drp}(t) = K_2 + W_2 * \Sigma_{i=1}^{p} T_{Drp}(t-i) + E_2(t)$$
$$T_{Fls}(t) = K_3 + W_3 * \Sigma_{i=1}^{p} T_{Fls}(t-i) + E_3(t)$$

  Where k1, k2, k3 are constant and for simplification iy can be ommitted for , w1, w2, w3 are weights, E1(t), E2(t), E3(t) are noice term with mean 0.

- Cluster head(CH): This are mobile nodes with the accompanying include obligation to keep up the best possible usefulness of the system: identify and

disconnect the malignant hubs; produce session key for secure correspondence and Warning message to made trouble; handle hub joining and enlistment; gather proposal trust from individuals

3.5 Flow chart of proposed method:

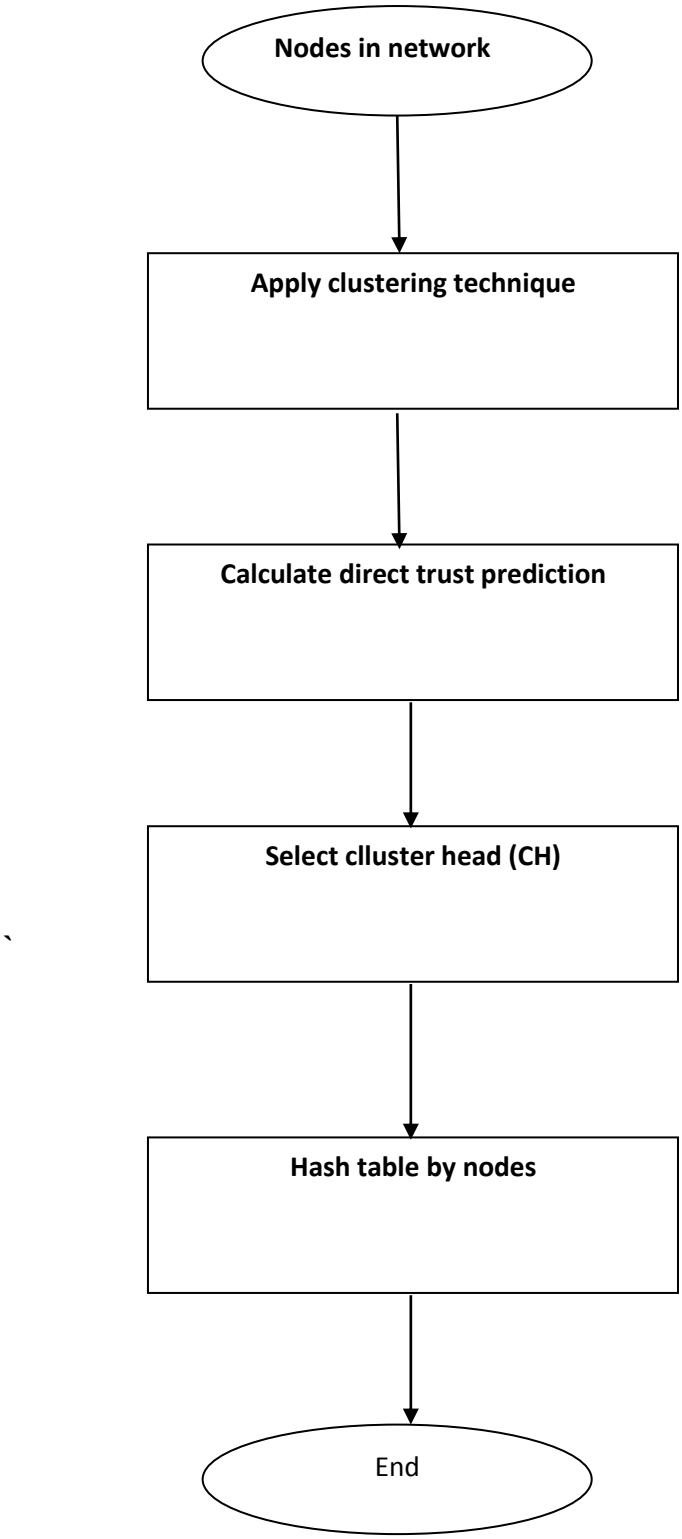

Figure 3.1 : Flowchart of proposed algorithm

Some routing techniques have been studied keeping in mind about the defined problems of vehicles encountering road ramps leading to lose of messages. To improve this problem, some techniques uses GPS, location based to obtain the direction of a vehicle.

Data should be replicated at the buffer of node which will be the most stable in the group. Stability becomes an important issue since stability will provide efficient and secure data access. Depending on the type of data ie audio, vedio etc data are replicated. If larger data size are accessed by the clients then the replication process are tansfered to the most stability node.

Considering nodes with different buffer size (node 1,2,3,4,5). If node 1 needs to split from the network then it should tranfers its data to the nearby nodes buffer so that data is avialable and accessed by other nodes are not disturb.

If node 3 is considered to be the most stable node in the group then the data are replicated according to its buffer availabilty. If buffer is less as compared to the tranfered data then it should be replicated to the next most stable node in the group:

Consider ,buffer availability = a

Data tranfered= b

Then a> b (a shoud always be greater then b)

If the above statement is true then the data is transfered to the most stable node providing effective data scheduling and availability.

If a<b , data needs rto be transfer to the next stable node by considering its available buffer.

In this way data are accessed efficiently.

CHAPTER 4
RESULTS AND DISCUSSION

To achieve better performace in data access management, clustering technique is applied where data avialability increases, mimimize the time for communication and the buffer cost and communication cost is decreased.

To improve the data access management for vanet , the above procedure is followed: 3 cases are considered to check the performance of each parameter ie data availabilty, time, buffer capasity. The execution is done using MATLAP.

In every cases nodes are alloted to different clusters with referenc to distance(hops) and nodes in network. In this , I have considered 3 clusters with the accessing from node to node the results are obtained. All this cases, the final output are compared with best location data replication and thus shows better performance. All this 3 cases can reduced the cost of buffer and cost of communication.

Case 1: communication within a clusters

In this case, the communication are done within nodes inside a cluster . This is a graph depicting different nodes available in a network.

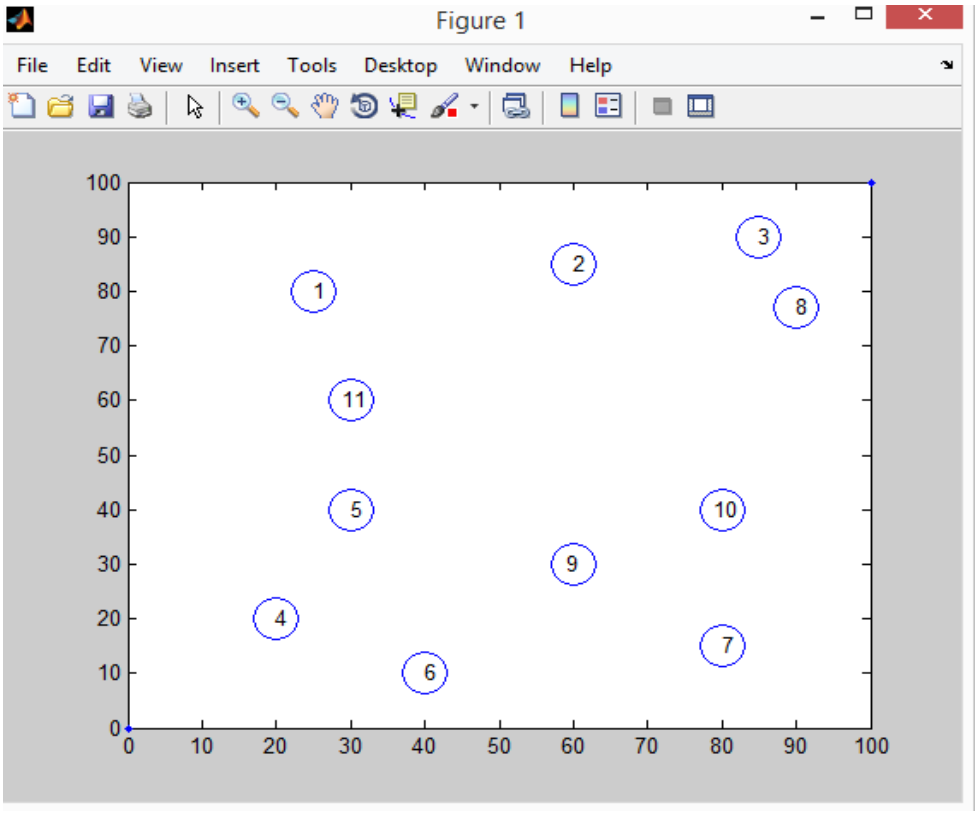

Figure 4.1: Nodes in a network (before clustering)

This graph defines the type of cluster present in the network. Node 2,3,8 belong to a cluster called “blue”, 1,11,10,7 belong to another cluster called “green” and 4,5,6,9 belong to cluter called “red”. This graph shows the communication taking place within a cluster ie blue cluster. In each cluter , there is cluster header represented as CH and it is the most stable node within the cluster. Each cluster have a cluster header and this cluster headers are the most stable node.

Here the communication is between node 2 and 3. As 3 is the CH , communication between this node provide most reliability. There can be another communication from 2 to 8. The communiction can be direct or it can also transfer the data through CH is from node 2 to node3 and lastly the final destination node 8.

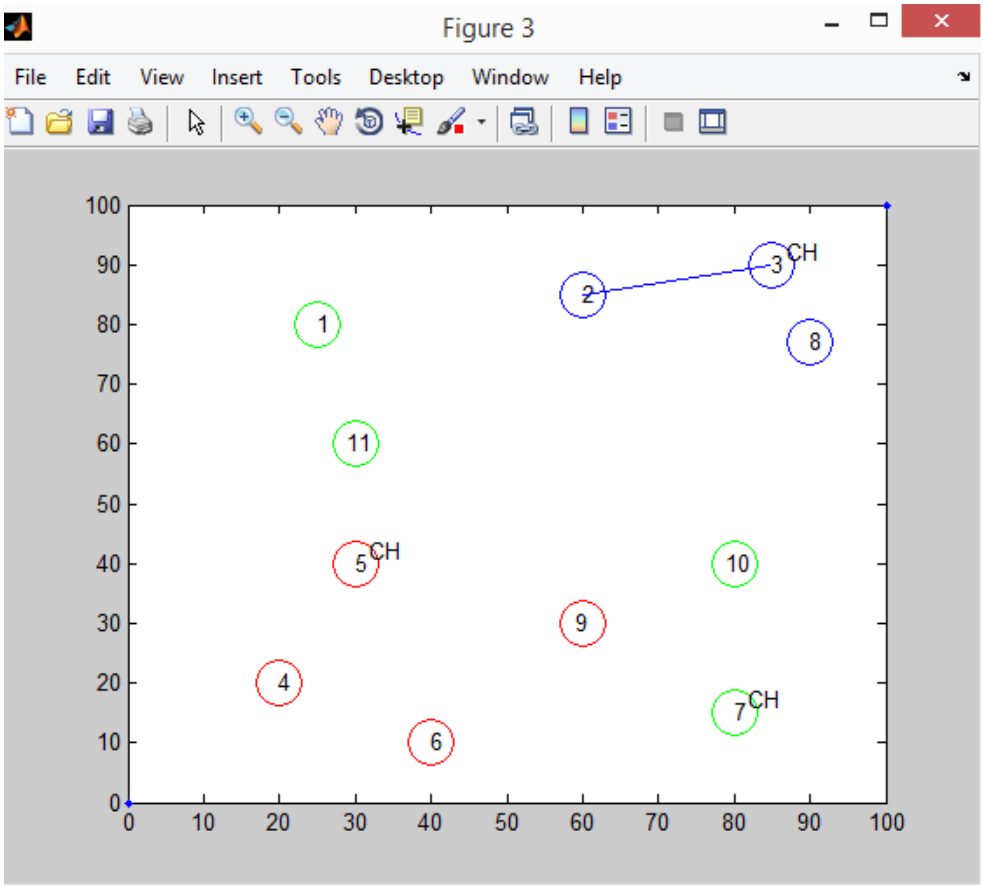

Figure 4.2 : Nodes in differerent cluster (communication in blue cluster)

The output graph to check the comparison: (method 1- previos method, method 2- proposed method). Communications within the cluster provide more relaibility and better peformance as the minimum time is used for accessing data, data availabilty increases and less buffer storage is used as compared to previous work.

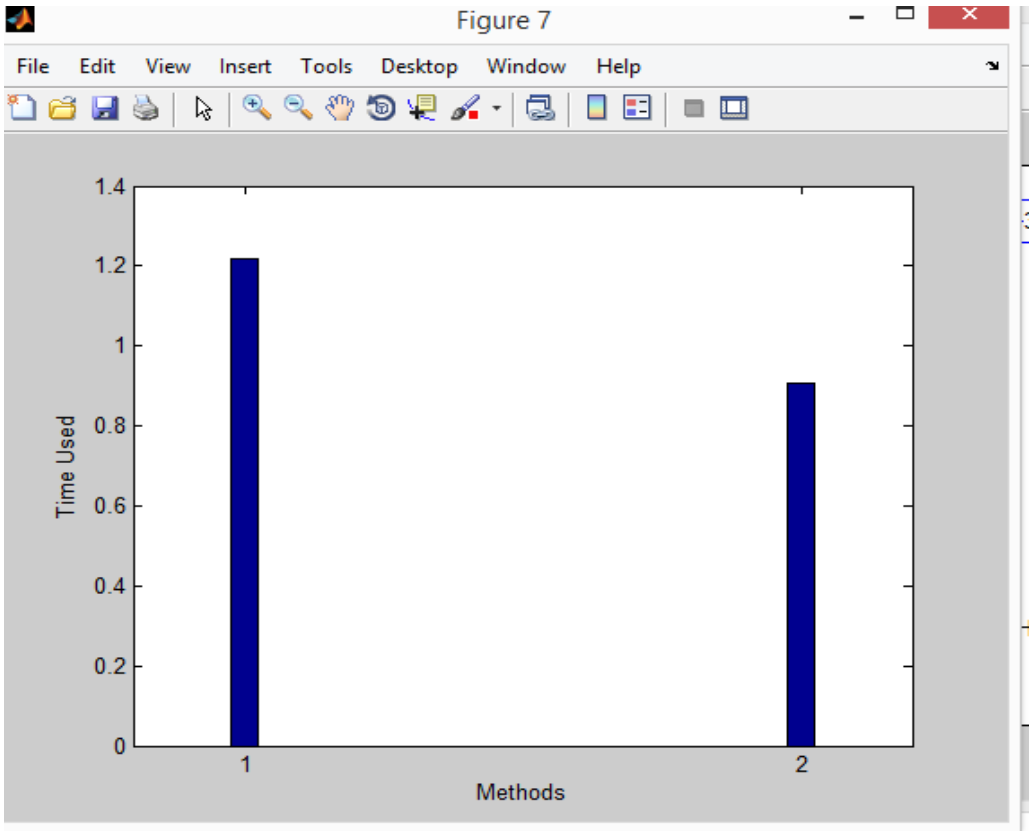

Figure 4.3 : Comparisons of methods (time)

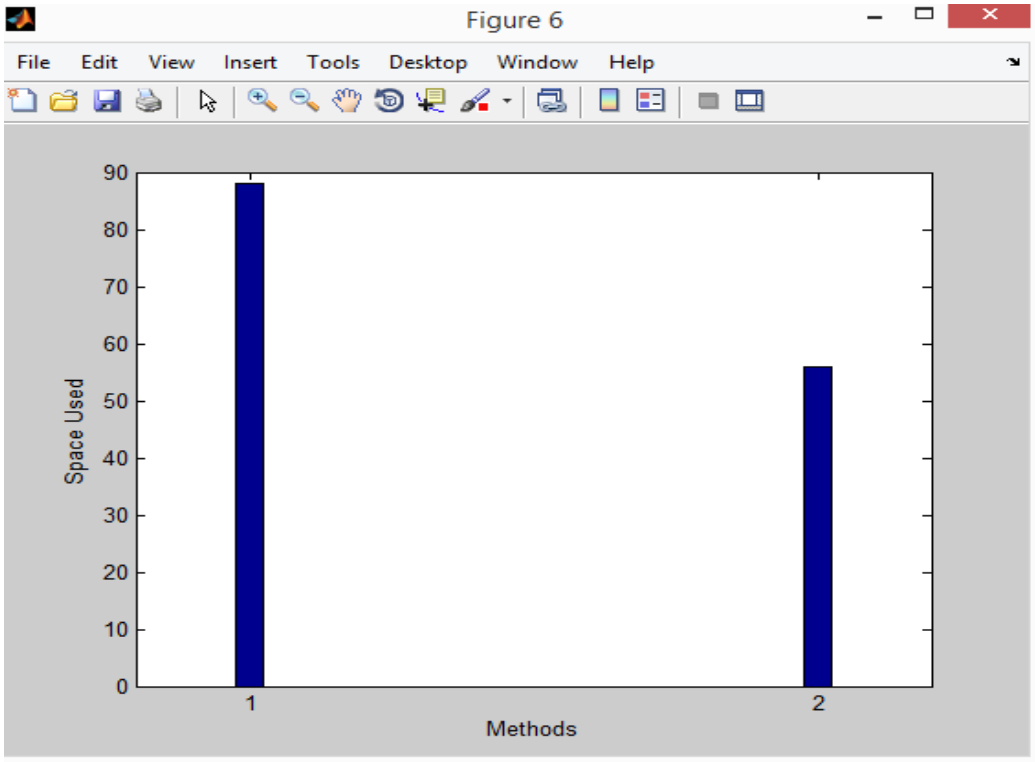

Figure 4.4 : Comparisons of methods (space)

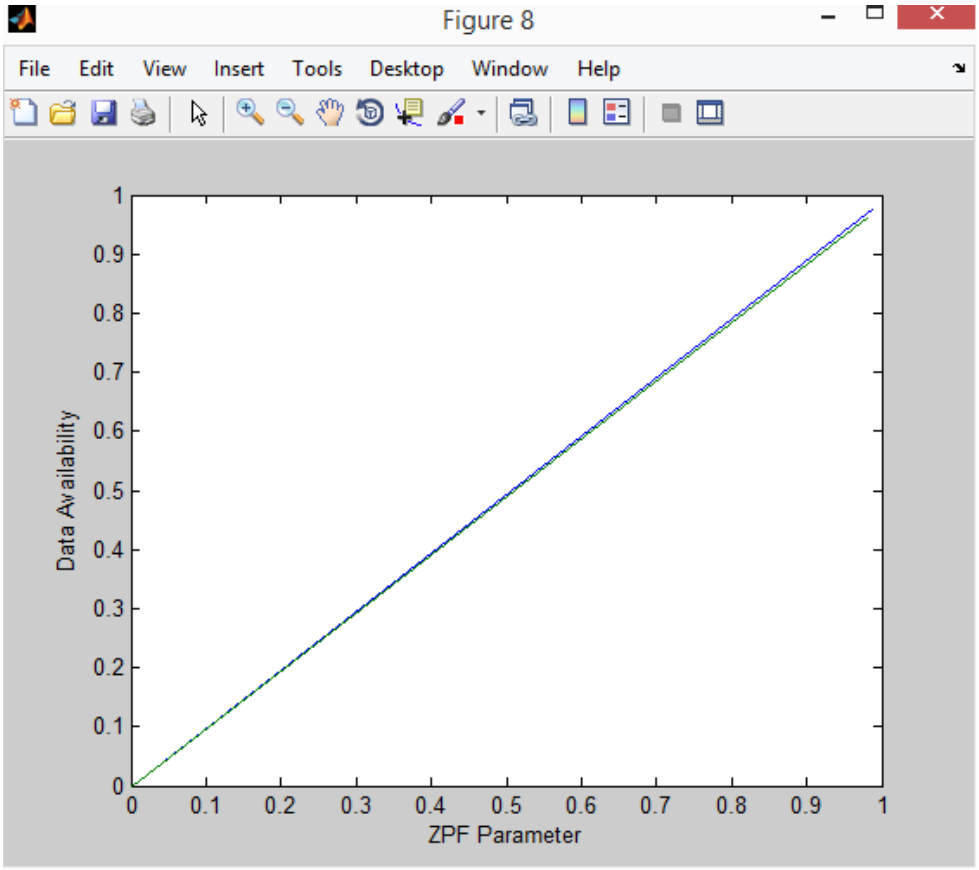

Figure 4.5 : Comparisons of methods(data availability)

In case 1 communication , as compared to the previous method time used by proposed method is mininised . the buffer avilability is also compared and the proposed model has used less space ie the required data are stored, thus minimised the buffer cost. The avialability of data also increases.

Case 2: communications with nearest cluster

In this case, the communication are done with the nearest cluster .The results are as given accordingly

The graph (figure 4.6) depicting different nodes available in a network. Below, is the network where communication takes place to the nearest cluster (figure 4.7). Cluster red to cluster green. Communication is from node 5 to node 7. Since both of the nodes are CH, it will directly communication. If it is to communicate with node 10 then it will pass the communication through 7 which is the CH (figure 4.8) for better data access.

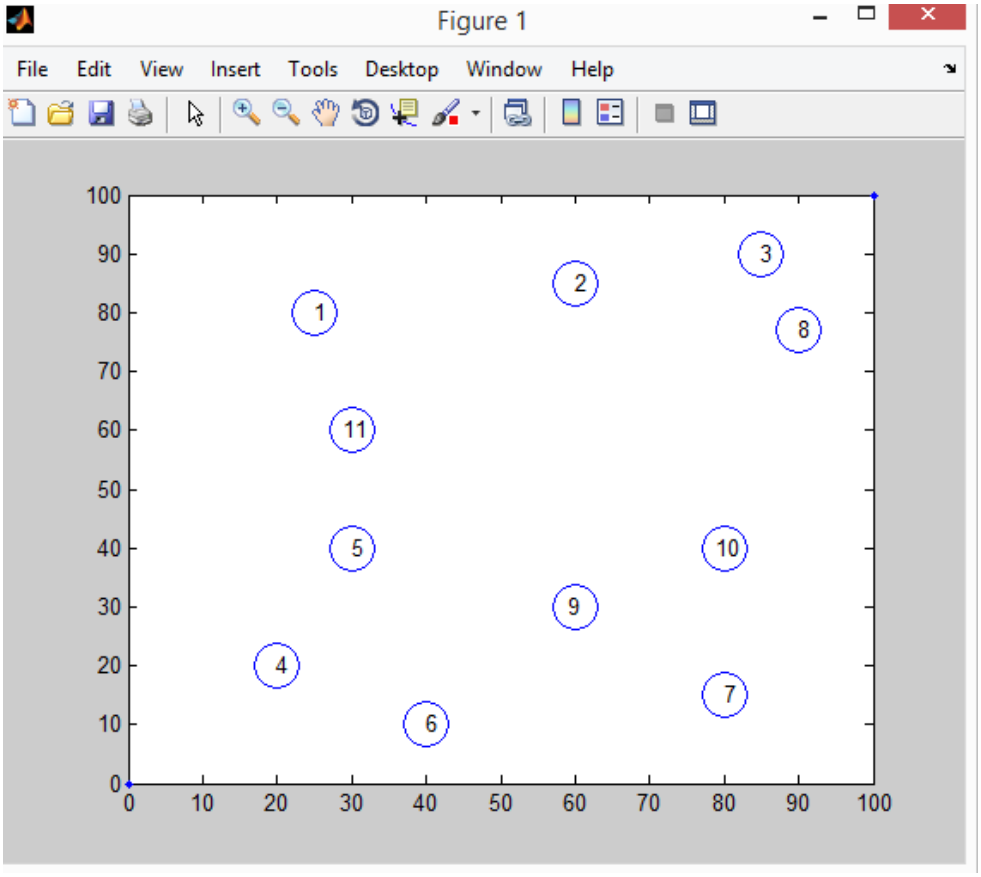

Figure 4.6 : nodes in a network

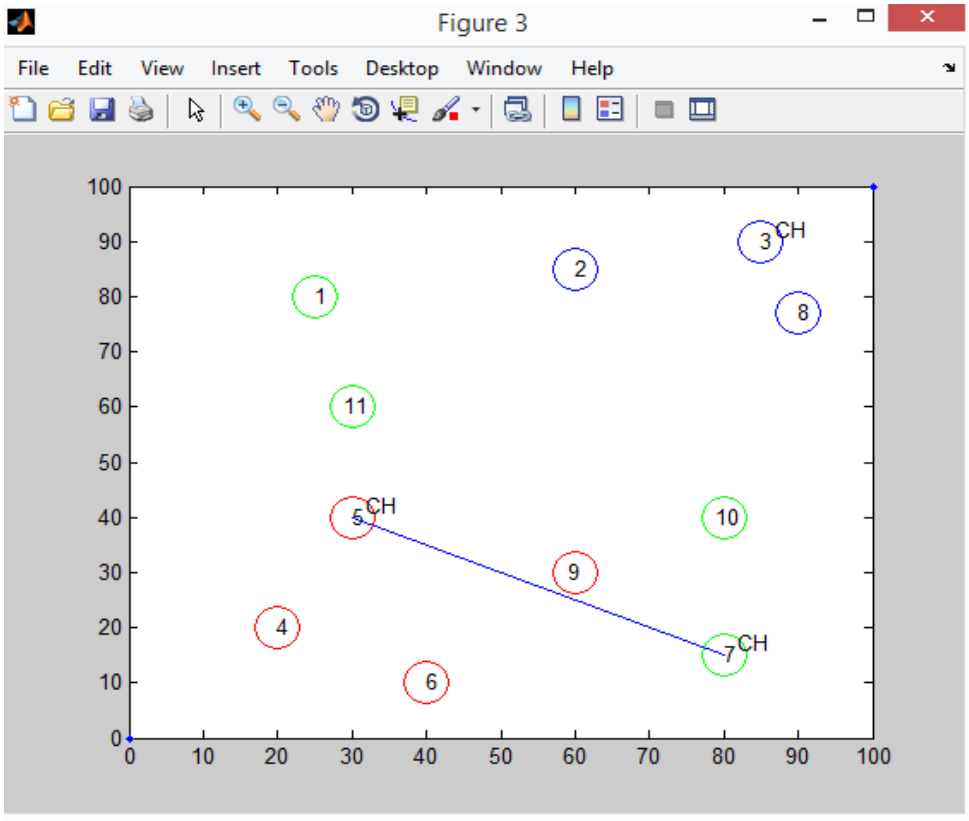

Figure 4.7 : communication with nearest cluster (node 5 to 7)

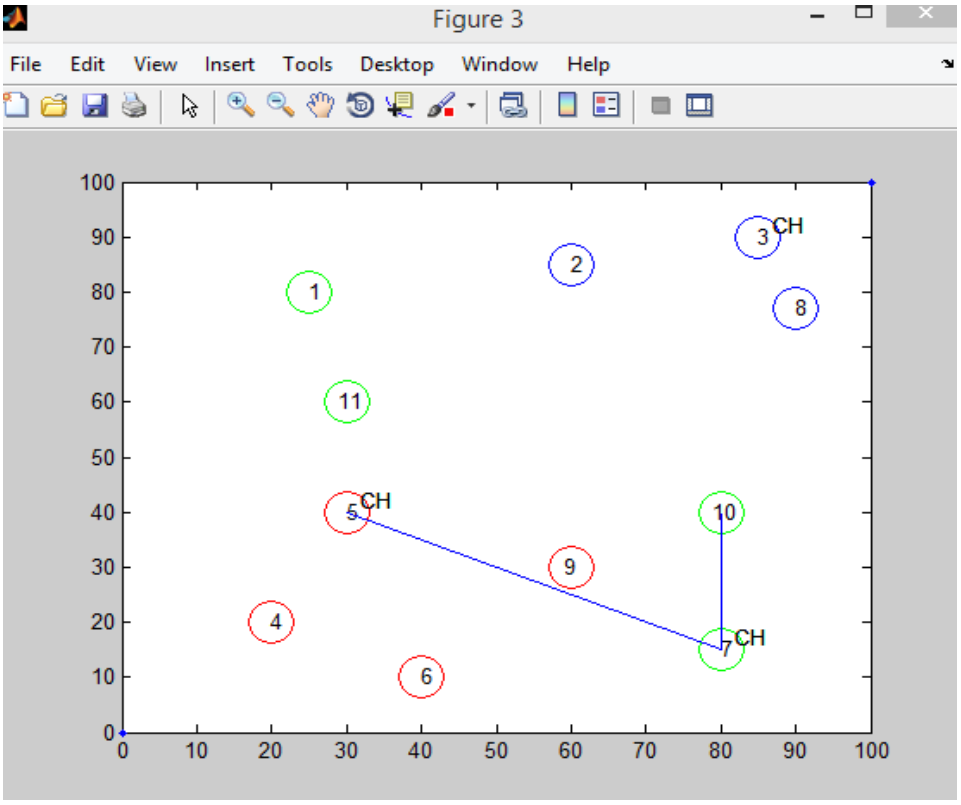

Figure 4.8: Communiation with nearest (node 5 and 10 through CH 7)

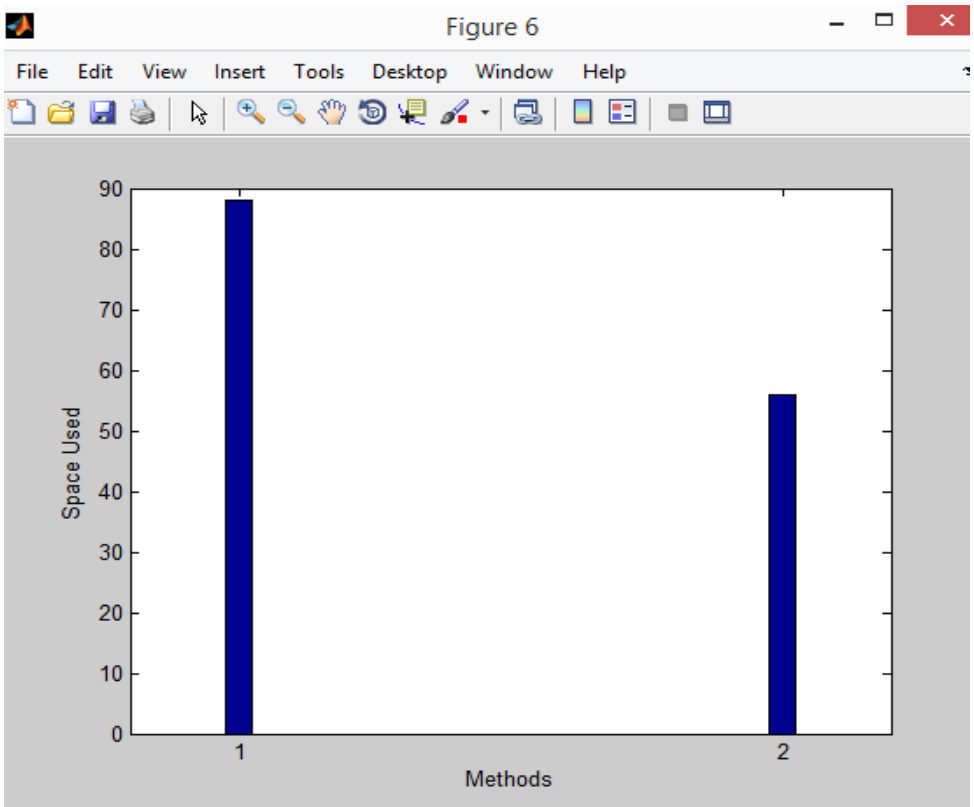

Figure 4.9 : Comparisons of methods(space)

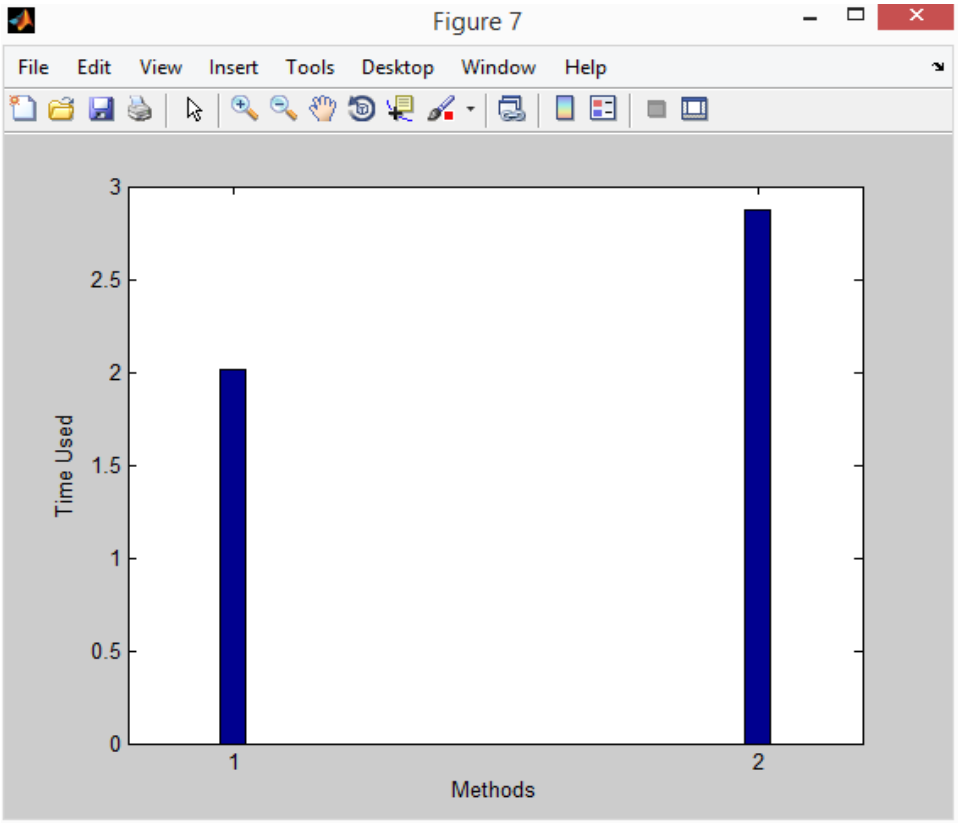

Figure 4.10: Comparisons of methods(time)

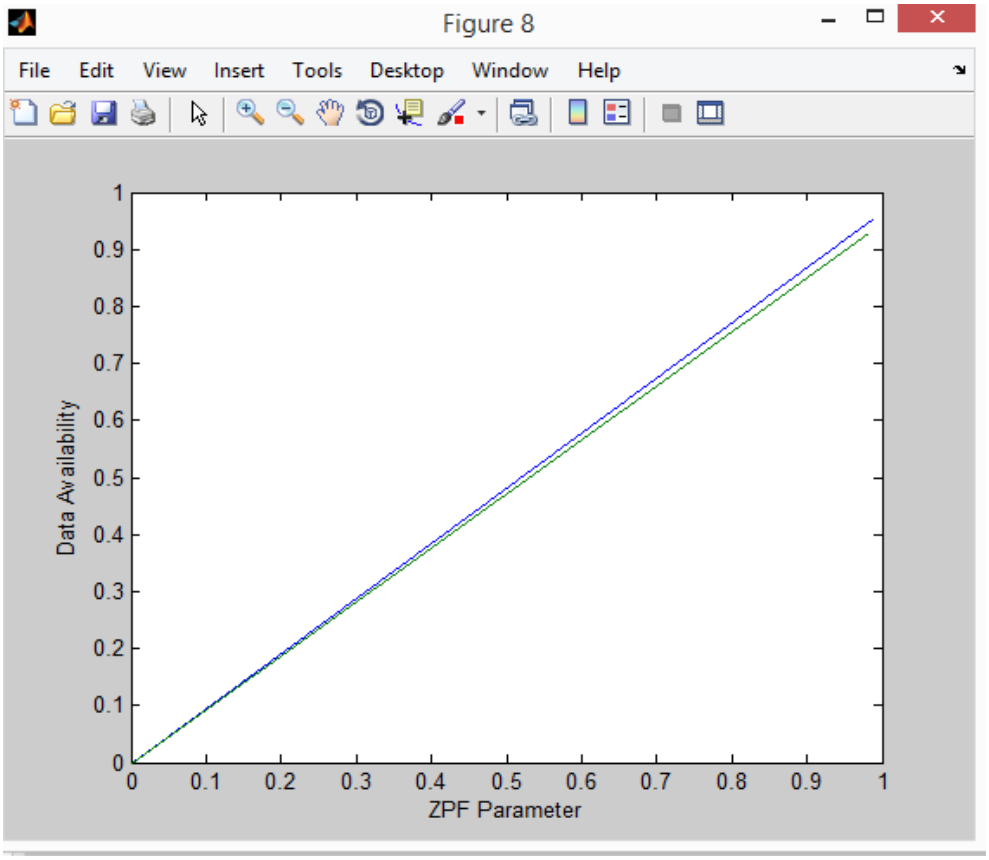

Figure 4.11: Comparisons of methods(data availability)

Communications with the nearest cluster somehow perform but time taken is more as compared to previos method, as compared with case 1, case1 performs better then case 2 in every parameter ie time used, buffer and data availability.

One of the drawbacks in case2 is that time taken is more ase compared with previous work bu only interms of few seconds. The data availabilty increases and less buffer storage is used.

Case 3: communication done in farest cluster

In this case, the communication are done with farest clusters. Below is the graph depicting different nodes available in a network before clustering occurs.

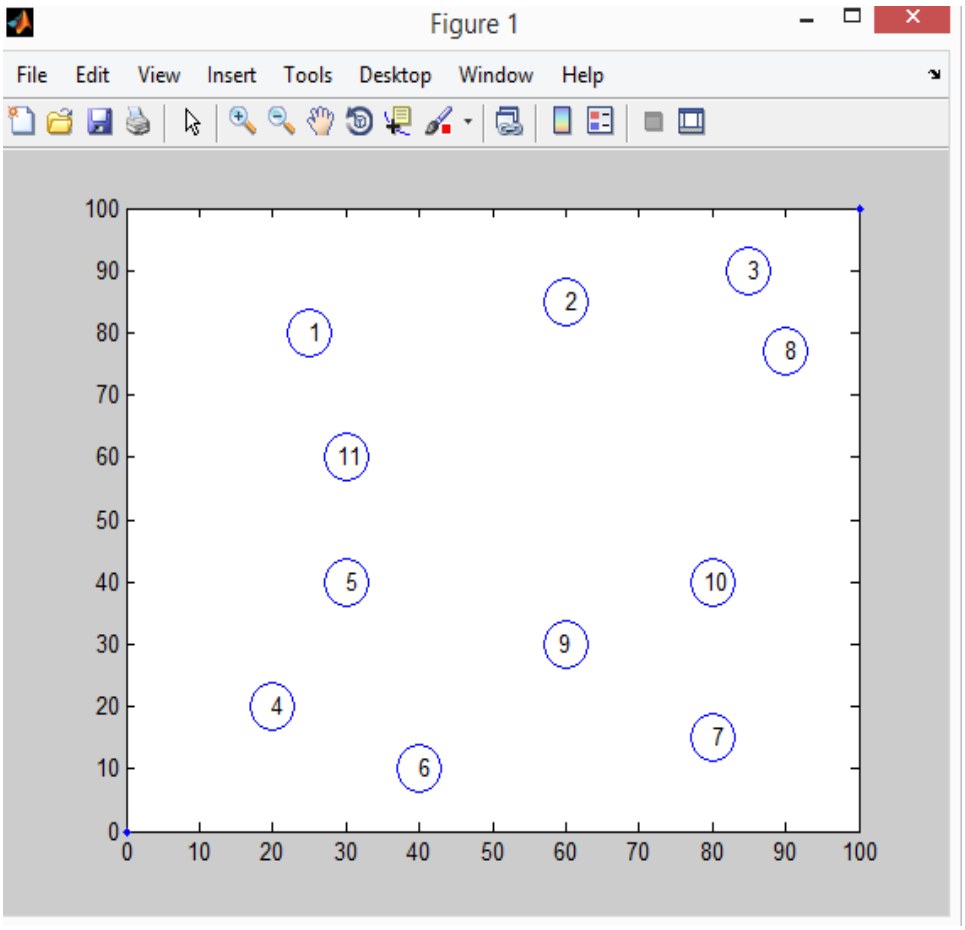

Figure 4.12 : Nodes in network

Again below, is the network where communication takes place to the farest cluster (figure 4.13). Cluster blue to cluster red. Communication is from node 3 to node 6. In this communication node 3 has to travel through green cluster as it is the most reliable. Node 3 has to reach CH of cluster green ie 7 and travel to destination cluster ie red . in red cluster it has to first reach CH ie 5 as its the most stable node and at last reaches the final node ie 6.

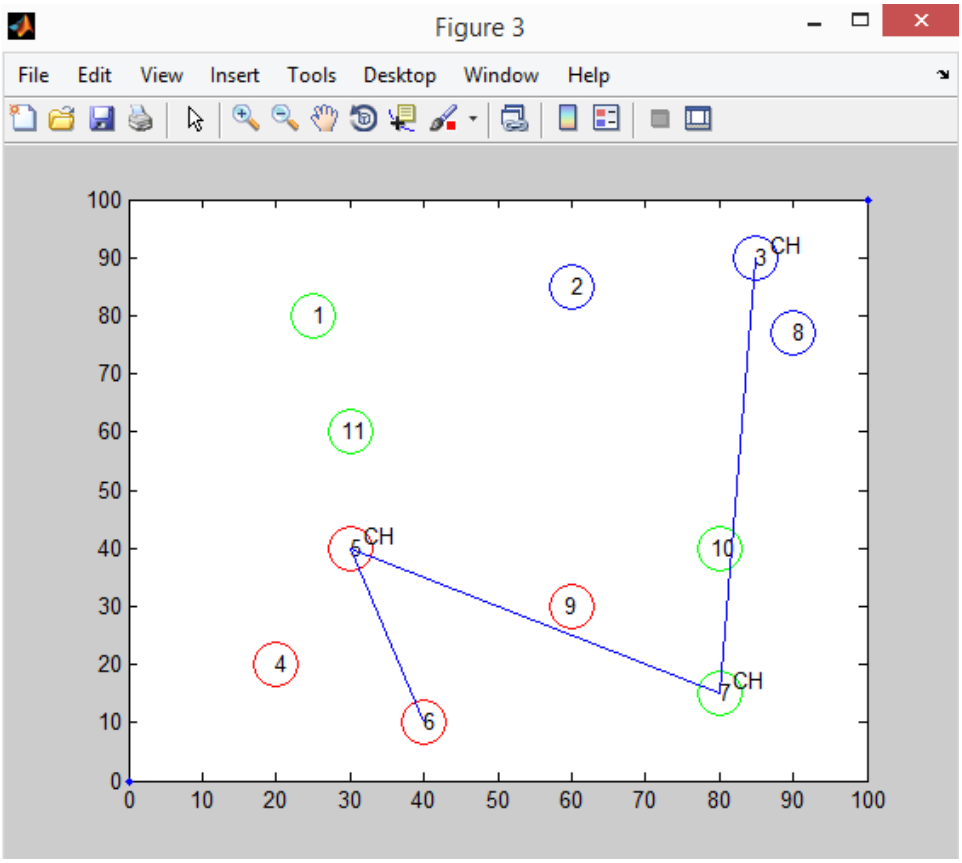

Figure 4.13: Communication with farest node (node 3 and node 6)

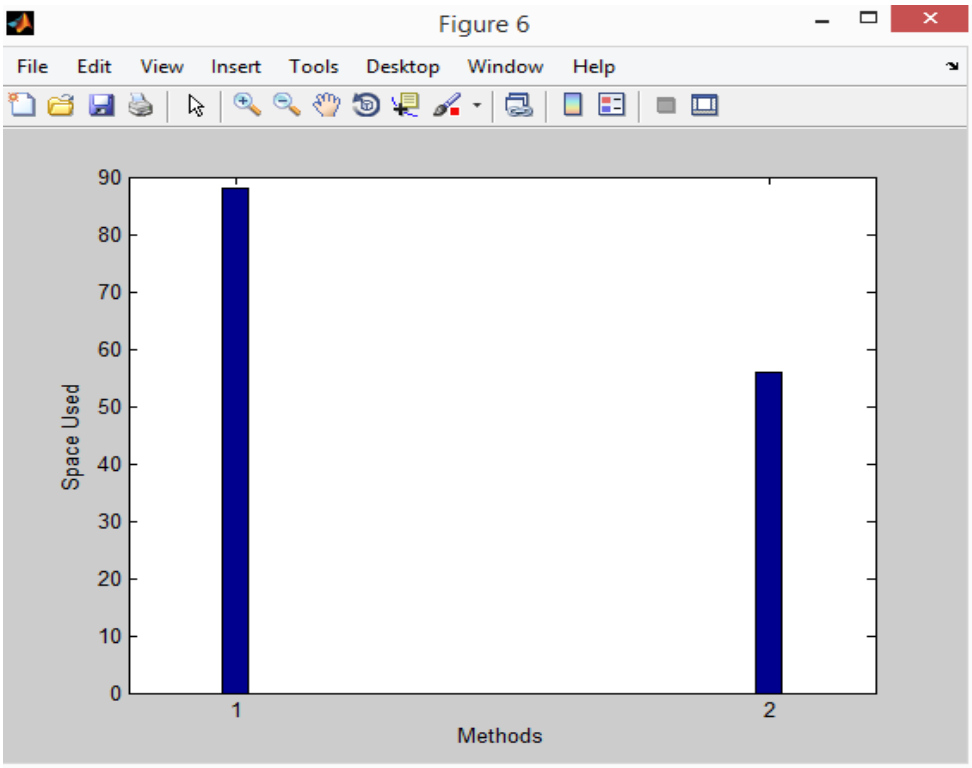

Figure 4.14 : comparisons between methods(space)

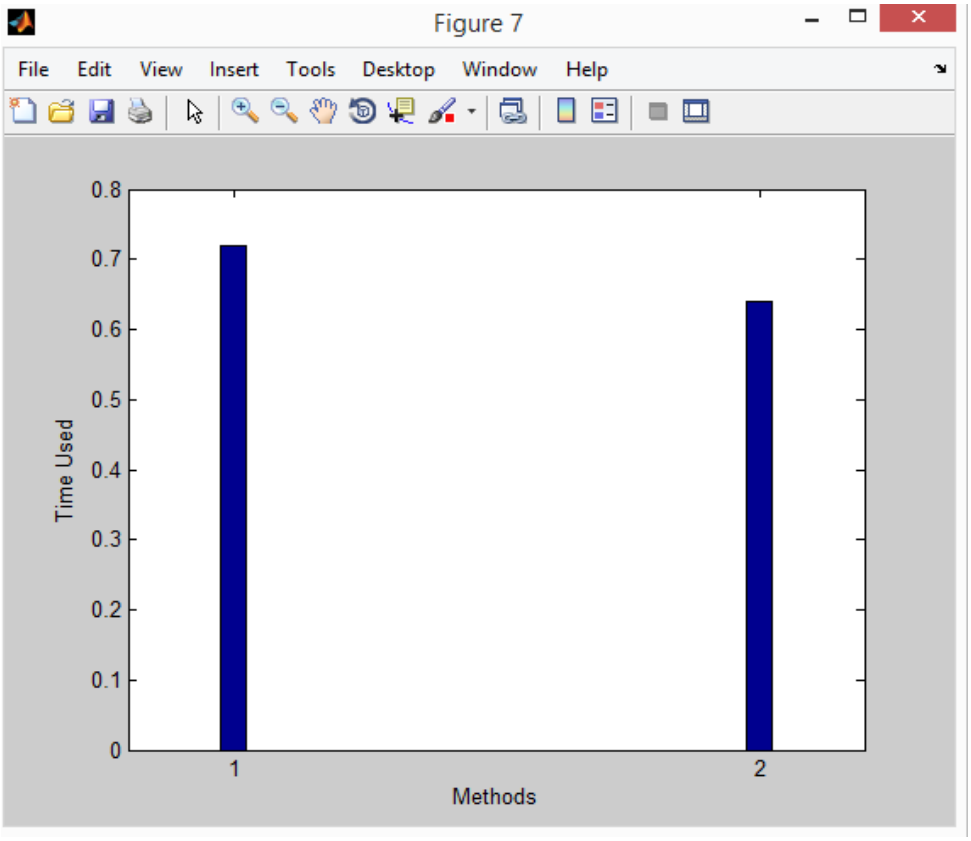

Figure 4.15 : comparisons of methods(time)

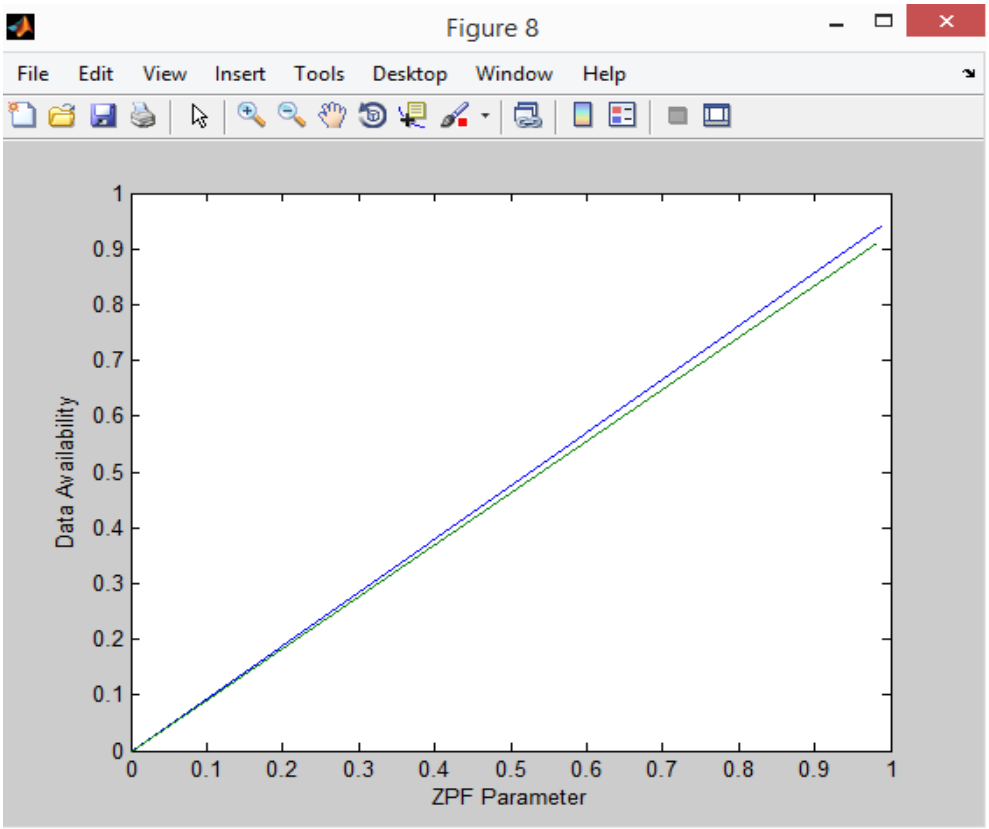

Figure 4.16 : comparisons of methods(data availability)

Graphical output of case3 are presented in figure (4.13, 4.14, 4.15). The Communications with the farest node also increase the peformance: data accessing time is and buffer usage is minimised also increses the data avilability.

Basic introduction to MATLAP

MATLAB is an state dialect and intuitive environment for numerical calculation, visualization, and programming. Utilizing MATLAB, you can dissect information, create calculations, and make models and applications. The dialect, instruments, and implicit math capacities empower you to investigate numerous methodologies and achieve an answer speedier than with spreadsheets or conventional programming dialects, for example, C/C++ or Java. You can utilize MATLAB for a scope of utilizations, including sign handling and interchanges, picture and feature transforming, control frameworks, test and estimation, computational.

It has powerful built-in routines that enable a very wide variety of computations. It also has easy to use graphics commands that make the visualization of results immediately available. Specific applications are collected in packages referred to as toolbox. There are toolboxes for signal processing, symbolic computation, control theory, simulation, optimization, and several other fields of applied science and engineering. Some basic features are given below:

Commands use in MATLAP for managing session:

MATLAB provides various commands for managing a session. The following table provides all such commands:

Command	Purpose
clc	Clears command window.
clear	Removes variables from memory.
exist	Checks for existence of file or variable.
global	Declares variables to be global.
help	Searches for a help topic.
lookfor	Searches help entries for a keyword.
Quit	Stops MATLAB.
Who	Lists current variables.
Whos	Lists current variables (long display).

Figure 4.17 : MATLAP commands for managing sessions

Input and output commands:

MATLAB provides the following input and output related commands:

Command	Purpose
Disp	Displays contents of an array or string.
Fscanf	Read formatted data from a file.
Format	Controls screen-display format.
Fprintf	Performs formatted writes to screen or file.
Input	Displays prompts and waits for input.
;	Suppresses screen printing.

Figure 4.18: MATLAP commands for I/O

Commands for plotting:

MATLAB provides numerous commands for plotting graphs. The following table shows some of the commonly used commands for plotting:

Command	Purpose
axis	Sets axis limits.
fplot	Intelligent plotting of functions.
grid	Displays gridlines.
plot	Generates xy plot.
print	Prints plot or saves plot to a file.
title	Puts text at top of plot.
xlabel	Adds text label to x-axis.
ylabel	Adds text label to y-axis.

Figure 4.19 : MATLAP commands for plotting

Chapter 5
CONCLUSION AND FUTURE SCOPE

In my dissertation, I first gave a description of vehicular Adhoc networks, classified data dissemination/access techniques. Later, describes the related work that is the literature review and the problems of vehicle-roadside data access. I presented works related to data access by various researchers and academicians.

The objective of this study is to provide data efficiently to users in VANETS providing reliability in data access management. The proposed method also provide efficient and secure data access. The papremeter like buffer capacity, stability of node and time used for communication are kept into account to increse the performance. The proposed study has procided better accuracy regarding the cases discussed in data access management.

For future reference, methods can be studied to provide better data access in hilly area. The use of technology assets like GPS can also be studied to define the node mobiity.

Ch apter 6

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Chapter 7

APPENDIX

ABBREVIATIONS

A	
AU	Application Unit
ACK	Acknowledgement
B	
BUFE	Bandwidth utilization and fairness enhancement
C	
CCH	Control channel
CH-ELECT	cluster head election
D	
DSRC	Dedicated short range communication
G	
GPS	Global positioning system
GPRS	General packet radio system
M	
MAC	Media access control
MANET	Mobile adhoc networks
O	
OBU	On board unit
R	
RSU	Road side unit
V	
VANET	Vehicular adhoc network
V2V	Vehicle to vehicle communication
V2I	Vehicle to infrastructure communication