Location Awareness Dissemination via MANET

By

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CERTIFICATION OF APPROVAL

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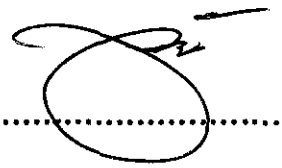
CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgement, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.



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KU MUHAMMAD ZAHID BIN KU KHALIF

ABSTRACT

The purpose of this research is to study on Mobile Ad Hoc Networks (MANETs) that can be used as awareness dissemination for road users. The first phase of the project involves a study on the project area where we identify ad hoc network as medium and the main study in developing this project. We also use Android apps as a simulation in generating the output. The final phase involves implementing the system physically on both real mobile and static nodes. The aspects explored are the capabilities and consistency required to be successful in the notifying and disseminating message, the environment that driver in, the car vs. the road identity that is shown through the general appearance of the driver, and the values in cultivating awareness among road users. We are finding that simple and user-friendly interface application does help a lot for road users; we hope to find how one enhances their danger awareness around them.

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Chapter I INTRODUCTION

1.1 Background of study.

In the past few years, there has been a lot of research interest in MANETs, and especially in routing in this kind of networks. Due to the high cost and technological difficulty of setting up MANET testbeds, the majority of research is carried out in simulation. Simulation studies are usually based on highly simplified scenarios, where nodes move randomly in an open area, and rely on idealized models of radio propagation and interference. In recent years experiences with real world testbeds have led to an increasing awareness that results from such simple simulations are often not reliable. There is therefore now a lot of interest in the study of simulation scenarios that reflect the more complex situations that can be found in reality. Urban scenarios are hereby of primary interest, since town centers will probably be the first kind of environments in which MANET will be deployed (urban mesh ad hoc networks are already being deployed in major cities such as San Francisco).

In this paper, we investigate the use of MANETs in traffic environment either in the city or an urban. Node movements are restricted to streets and open areas in the town, and their speeds are adjusted to the typical speed of people in an urban environment, be it pedestrians, cyclists or slowly moving cars. We also do an effort to account for different possible usages of the network, modeling different kinds of data traffic, ranging from an interactive short messaging service (SMS).

Mobile Ad Hoc Networks (MANETs) are wireless mobile nodes that cooperatively form a network without infrastructure. Because there is no coordination or configuration prior to setup of a MANET, there are several challenges. These challenges include routing packets in an environment where the topology is changing frequently, wireless communications issues, and resource issues such as limited power and storage. The leading way to research solutions to these difficult MANET challenges is simulation.

In the proposed simulation environment, we first study how general properties of the MANET such as network connectivity and node interference are affected by the presence of the urban structure, and compare this to the open space case. Then, we investigate how different strategies for routing are affected by the specific

characteristics of such an environment. Specifically, we try to understand the effectiveness of using proactive components versus using a purely reactive approach. To this end, we choose the simulator in producing the system by using Android's application.

First, we explain our model for simulation of the MANET technology. Next, we provide a short description of the two nodes system architecture. Then, we provide simulation results, and derive conclusions about properties of MANET in the project, and the usefulness of MANET technology. Finally, we discuss related work and draw conclusions.

1.2 Problem Statements

In order to provide excellent awareness among road users at a minimal cost, in this paperwork it will procedures a system that are safe, efficient, and reliable. In addition, the system is capable enough to overcome the message dissemination among users in a bad weather. Right now, there is still no existing system that provides the location awareness dissemination via ad-hock. The existing system awareness can only reach road users through radio, internet, message board along the road and etc. When the system fails, it can cause road user difficulties in getting information about what is happening in front of them. If this situation continues to happens, they will not only be wasting time and money, which jeopardizes their overall efficiency and reliability of the existing system. Also, undue to traffic jammed could lead drivers to become more aggressive on the road that could cause an accident. A new research on ad-hoc network, Mobile Ad Hoc Networks (MANETs) may surpass the current awareness system efficiency and reduce the traffic crashes. I propose to research the feasibility of MANET system. I will investigate the accuracy, efficiency, and safety of MANETs as well as implementation issues.

1.3 Scope of Study

The scope of this project is to study and develop a simulation of an ad-hoc based network in dissemination of message awareness to road users especially vehicle drivers. This project will be using network simulators and traffic simulators which will be integrated to be the proof of concept for this project. The application is accessible with smart phone usage. Environment content is targeted for road users especially car drivers.

1.4 Objectives

The objectives of this study are:

1. To enable communication among temporarily assembled user terminals without relying on the conventional communication infrastructure (MANET).

Generally, the awareness system that happens around us was based only on the conventional techniques such as message board and radio. However, this study aims to enhance the existing of ad-hoc network to overcome this problem by implementing the MANET mechanism in the communication and dissemination message.

2. To enhance current location awareness system efficiency.

An awareness system can be transmitted and disseminated among user by physical interaction or one-way communication. An interactive awareness system allows a user to request a data and also reply the message received (two-ways communication).

3. To create awareness among road users especially car drivers on road condition through their mobile.

Nowadays, the usage of smart phone is booming. By taking the chances on this condition, the application of this project can be interactive, usable and affordable for targeted users.

Chapter II LITERATURE REVIEW

2.1 Overview of MANET

A MANET is a network in which the mobile wireless nodes can communicate with each other without need of any centralized routing device. The nodes itself behave as a routing device. A typical MANET network consists of Router with multiple hosts and wireless communication device. Simply referred to as mobile 'node'. A MANET is an autonomous system of mobile nodes. The system may be operating in isolation. Mobile node equipped with wireless transmitter and receiver to communicate with each other by mean of using routing protocols. Since the mobile nodes are wireless the movement of mobile nodes referred to dynamic change of network topology. Figure 1 shows how the communication occur in the mobile nodes in a MANET network, if the node are within the radio range of each other they can communicate directly otherwise they communicate by using intermediate nodes and deliver the source node generated packet to the sender node.

Due to wireless nature of nodes, topology of network changes very quickly and the routing protocol has much more impact in the performance of MANET networks. MANET routing protocol help the cause very much by providing the self-configure, self-heel and self-optimize and also provide low cost and easy installation because the node are mobile and there is no need of wire or wire infrastructure to communicate the mobile nodes devices with each other which make MANET network more cost effective. Some of the MANET applications are Intelligent Transportation System, Home Automation, Wireless Internet Access and Community Network.

Routing protocol is classified into three categories. Proactive, Reactive and Hybrid protocols. The Reactive Protocols are on- demand routing protocol e.g. Ad hoc Distance Vector (AODV) and DSR (Dynamic State Routing) etc. in which routes are only generated when it is needed which will not generate lots of traffic overhead but delay is huge due to route finding when required by nodes. Proactive protocols such as Optimized Link State Routing (OLSR) make the routes available as before its being needed, it makes the routes available on advance which will increase lots of traffic overhead but delay will be minimum. Hybrid protocols are the combination of Reactive and Proactive protocols. The proactive scheme is used for intra- zone communication and reactive scheme is used for inter-zone. The hybrid routing

protocol has got both the advantages and disadvantages of reactive and proactive protocol.

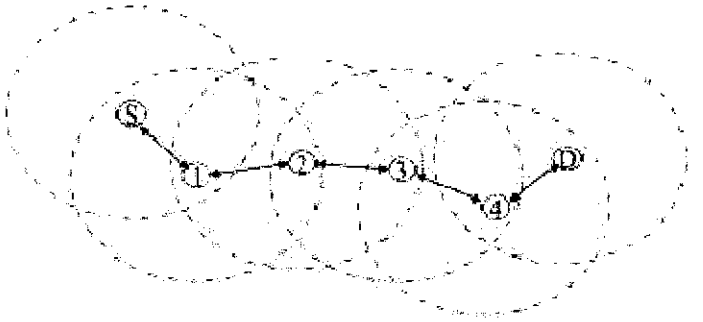

Figure 1: Inter node communication in mobile ad hoc network

2.2 The MANET Technology

A MANET is a collection of mobile platforms (e.g., a router with multiple hosts and wireless communications devices) – herein simply referred to as "nodes" -- that can dynamically be set up anywhere and anytime without using any pre-existing network infrastructure. The nodes may be located in or on airplanes, ships, trucks, cars, perhaps even on people or very small devices, and there may be multiple hosts per router. It is an autonomous system in which mobile nodes connected by wireless links are free to move randomly. The system may operate in isolation, or may have gateways to and interface with a fixed network. In the later operational mode, it is typically envisioned to operate as a "stub" network connecting to a fixed internetwork.

2.3 MANET Architecture

The nodes in a MANET can be classified by their capabilities. A Client or Small Mobile Host (SMH) is a node with reduced processing, storage, communication, and power resources. A Server or Large Mobile Host (LMH) is a node having a larger share of resources. Servers, due to their larger capacity contain the complete DBMS and bear the primary responsibility for data broadcast and satisfying client queries. Clients typically have sufficient resources to cache portions of the database as well as storing some DBMS query and processing modules.

In a MANET, each node has an area of influence. This is the area over which its transmissions can be heard. A LMH will initially have a larger area of influence as it generally has a more powerful battery. As the power level decreases, the area of influence of any node will shrink because the power available to broadcast is reduced. Network nodes may operate in any of three modes that are designed to facilitate the reduction in power used:

- Active Mode (or Transmit Mode): This is the mode using the most power. It allows both the transmission and reception of messages.
- Doze Mode (or Receive Mode): The CPU is capable of processing information and is also capable of receiving notification of messages from other nodes and listening to broadcasts.
- Sleep Mode (or Standby Mode): The CPU does no processing and the node has no ability to send/receive messages. The node is inactive. This mode allows a node to turn itself off for short periods of time without requiring power-up or re-initialization.

A node with no remaining power, or one that is off, is not currently a part of the network and cannot be reachable by any other node. Nodes can become disconnected from the entire network. When moving back in range of other nodes, they will become re-connected. Conversely, a node may be reachable by several LMHs or SMHs.

There are two approaches to providing network connectivity in a MANET:

1. ***Hierarchical network architecture***: This approach partitions the whole network into sub-networks. Each of the sub-network themselves then dynamically elects a node among themselves which acts as gateway to the other sub-network. This builds a hierarchy among the nodes and the hierarchy can be one-tire or multiple tier one. The advantages of this approach are:

- Easy mobility management procedures.
- Better manageability.

2. ***Flat-routed architecture***: In this approach all the nodes are identical in terms of responsibility, and there is no concept of special gateways. The advantages of this approach are:

- Increased reliability / survivability due to no single point of failure and alternative routes in the network.
- Optimal Routing
- Reduced use of wireless resources.
- Better load balancing property
- All nodes have one type of equipment.

2.4 Traffic Types in MANET

The traffic types in MANETs are as follows:

- Peer-to-Peer: Communication between two nodes that are within one hop. Network traffic is usually consistent.
- Remote-to-Remote: Communication between two nodes beyond a single hop but which maintain a stable route between them. This may be the result of several nodes staying within a communication range of each other in a single are or possibly moving as a group. The traffic is similar to standard network traffic.
- Dynamic Traffic: This occurs when nodes are dynamic and moving around. Routes must be reconstructed. This results in a poor connectivity.

2.5 Characteristics of MANET

MANET has the following features:

- ***Autonomous Terminal***: In MANET, each mobile terminal is an autonomous node, which may function as both a host and a router. In other words, besides the basic processing ability as a host, the mobile nodes can also perform switching functions as a router. So usually endpoints and switches are indistinguishable in MANET.
- ***Distributed operation***: There is no background network for the central control of the network operations and so the control and management of the network is distributed among the terminals. The nodes involved in a MANET should collaborate amongst themselves and each node acts as a relay as needed, to implement functions e.g. security and routing.
- ***Multi-hop routing***: Basic types of ad hoc routing algorithms can be single-hop and multi-hop, based on different link layer attributes and routing protocols. Single-hop MANET is simpler than multi-hop in terms of structure and implementation, with the cost of lesser functionality and applicability. When delivering data packets from a source to its destination out of the direct wireless transmission range, the packets should be forwarded via one or more intermediate nodes.
- ***Dynamic network topology***: Since the nodes are mobile, the network topology may change rapidly and unpredictably and the connectivity among the terminals varies with time. MANET should adapt to the traffic and propagation conditions as well as the mobility patterns of the mobile network nodes. The mobile nodes in the network dynamically establish connectivity among themselves as they move about, forming their own network on the fly. Moreover, a user in the MANET may not only operate within the ad hoc network, but mat require access to a public fixed network (e.g. Internet).
- ***Fluctuating link capacity***: The nature of high bit-error rates of wireless connection might be more profound in a MANET. One end-to-end path can be shared by several sessions. The channel over which the terminals communicate is subject to noise, fading, and interference, and has less bandwidth than a wired network. In some scenarios, the path between any pair of users can traverse multiple wireless links and the link themselves can be heterogeneous.

➢ ***Light-weight terminals***: In most cases, the MANET nodes are mobile devices with less CPU processing capability, small memory size, and low power storage. Such devices need optimized algorithms and mechanisms that implement the computing and communicating functions.

2.6 Mobile ad hoc networks routing

There are hundreds of routing protocols which have been proposed for ad hoc networks. In MANET no fixed network topology is used. Therefore, mobile nodes adopt any runtime topology due to their own dynamic behavior. In addition, there exists not even single method for routing in MANET, as network is created at runtime.

MANET provides such kind of wireless communication in which the nodes are mobile. Furthermore, MANET also facilitates such atmosphere to the mobile nodes in which they can connect anytime anywhere in order to communicate among themselves. Several new handheld devices have been introduced that have the facility to connect with other devices and can also communicate for exchanging data amongst them [15]. Successful delivery of data among various nodes is impossible without the routing protocols. So routing protocols for MANET is one of the challenging areas due to its dynamic and ad hoc nature.

Many routing protocols have been developed so far to compete with sudden changes that may arise due to nature of the networks. Route discovery, route maintenance and sudden change in the topology are the major barriers for routing protocols in MANET. Due to these problems several routing protocols have been developed that can meet the dynamic nature of ad hoc network. These different routing protocols are named as topology based routing. Further, in this chapter we focus on topology based routing protocols. These protocols and their types were extensively studied in order to judge about their suitability in VANET.

2.7 Topology based routing

Several MANET routing protocols have used topology based routing approach. Topology based routing protocols use link's information within the network to send the data packets from source to destination [16]. Topology based routing approach can be further categorized in to three groups:

- Proactive routing
- Reactive routing
- Hybrid routing

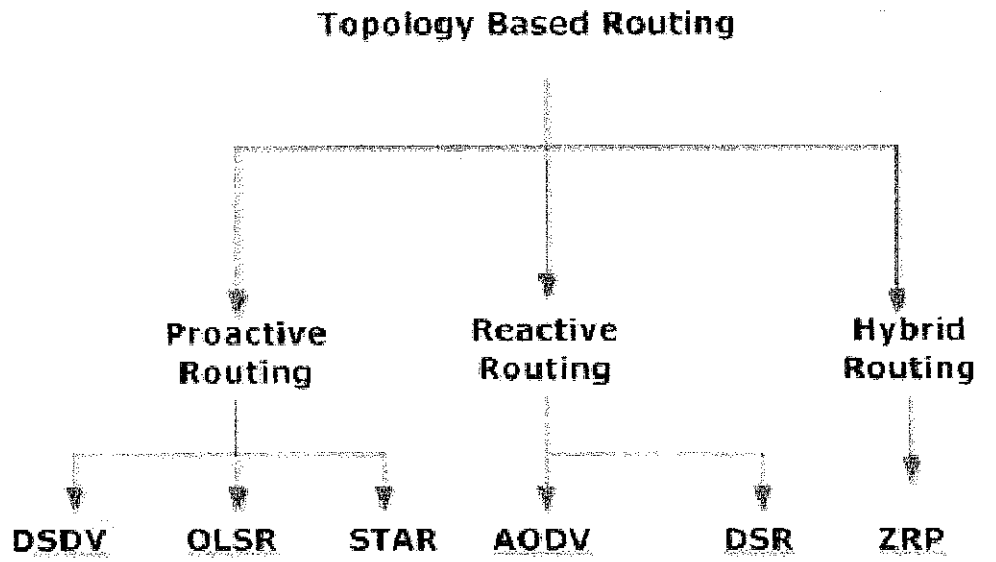

Figure 2: Topology Based Routing

2.7.1 Proactive Routing

Proactive routing protocols are mostly based on shortest path algorithms. They keep information of all connected nodes in form of tables because these protocols are table based [13]. Furthermore, these tables are also shared with their neighbors. Whenever any change occurs in network topology, every node updates its routing table. Strategies implemented in proactive algorithms are Link-state routing (e.g. OLSR) and distance-vector routing (e.g. DSDV). The working details for proactive routing protocols are as follows:

Destination Sequence Distance Vector Routing (DSDV) [13] use Distance Vector shortest path routing algorithm, it provides loop free single path to the destination. DSDV sends two types of packets "*full dump*" and "*incremental*". In full dump packets, all the routing information is send while in incremental only updates are send. It decreases bandwidth utilization by sending only updates instead of complete routing information. The incremental still increases the overhead in the network, because these incremental packets are so frequent that makes it unsuitable for large scale networks.

Optimized link state routing (OLSR) [13] maintains routing information by sending link state information. After each change in the topology every node sends updates to selective nodes. By doing so, every node in the network receive updates only once. Unselected packets cannot retransmit updates; they can only read updated information.

Source-Tree Adaptive Routing (STAR) is another link State protocol. In STAR, preferred routes to every destination are saved in each router. It reduces overhead on the network by eliminating periodic updates. There is no need of sending updates unless any event occurs. This protocol can be suitable for large scale networks but it needs large memory and processing because it has to maintain large trees for whole network.

Proactive based routing protocols may not be suitable for high mobility nodes because distance vector routing takes much bandwidth to share routing information with neighbors. Furthermore, size of the table is also quite big while discussing about large networks and in case of link state routing a lot of memory and processing may also be

required. As in VANET, nodes (vehicles) have high mobility and moves with high speed. Proactive based routing is not suitable for it. Proactive based routing protocols may fail in VANET due to consumption of more bandwidth and large table information.

2.7.2 Reactive Routing

"On demand" or reactive routing protocols were designed in such a manner to overcome the overhead that was created by proactive routing protocols. This is overcome by maintaining only those routes that are currently active [13]. Routes are discovered and maintained for only those nodes that are currently being used to send data packets from source to destination.

Route discovery in reactive routing can be done by sending RREQ (Route Request) from a node when it requires a route to send the data to a particular destination. After sending RREQ, node then waits for the RREP (Route Reply) and if it does not receive any RREP within a given time period, source node assumes that either route is not available or route expired [15]. When RREQ reaches the particular destination and if source node receives RREP then by using unicasting, information is forwarded to the source node in order to ensure that route is available for communication.

Reactive routing can be classified either as source routing or hop-by-hop routing. In source routing complete route information from source to destination is included in data packets. When these data packets are forwarded to other intermediate nodes in the network, each node takes route information from the data packet and stores it in the header of data packet. As a result, each intermediate node does not need to update all route information in order to send packet to the particular destination [13].

The main drawback of source routing is that it may not be suitable for large scale networks, where numbers of nodes are quite high and their behavior is highly dynamic such as VANET [14]. The first reason is that as numbers of nodes are larger in large scale ad hoc networks hence it may result in route failure. The second reason is that as numbers of intermediate nodes are increasing, thus network overhead may occur and route information in the header of each node may also increase.

Hop-by-hop reactive routing is better than on demand source routing as each data packet in it contains next hop and destination addresses. Thus intermediate nodes from source to destination contain the routing table information in order to send data packet to a particular destination. This can be quite helpful for accommodating sudden changes in network topology. Thus when topology changes nodes receives fresh routing table information and selects new routes accordingly. As a result these selected routes are now used to send data packets to destination. These types of routing protocols continuously update their routing information and carried knowledge of each neighboring node Therefore this type of reactive routing can be adopted in highly mobile ad hoc networks such as VANET [13].

Many reactive routing protocols have been proposed so far but in this section we briefly described about Ad Hoc on Demand Distance Vector Routing (AODV) [14] and Dynamic Source Routing (DSR) [8].Moreover we check the suitability of these protocols for VANET.

2.7.2.1 Ad Hoc on Demand Distance Vector Routing- AODV

Ad Hoc on Demand Distance Vector Routing (AODV) [14] is an example of pure reactive routing protocol. AODV belongs to multi hop type of reactive routing. AODV routing protocol works purely on demand basis when it is required by network, which is fulfilled by nodes within the network. Route discovery and route maintenance is also carried out on demand basis even if only two nodes need to communicate with each other. AODV cuts down the need of nodes in order to always remain active and to continuously update routing information at each node. In other words, AODV maintains and discovers routes only when there is a need of communication among different nodes.

AODV uses an efficient method of routing that reduces network load by broadcasting route discovery mechanism and by dynamically updating routing information at each intermediate node. Change in topology and loop free routing is maintained by using most recent routing information lying among the intermediate node by utilizing Destination Sequence Numbers of DSDV.

2.7.2.1.1 AODV Route Discovery

Route discovery is one of the most important characteristics of any protocol in wireless communication. The need for basic route discovery arises when a source node wants to communicate with any particular destination node in order to forward data packet. AODV uses route discovery by broadcasting RREQ to all its neighboring nodes. The broadcasted RREQ contains addresses of source and destination nodes in order identify those particular nodes for which route have been demanded. RREQ also contains source and destination nodes sequence numbers to maintain recent fresh route information from source to destination and vice versa. Moreover, RREQ also contains broadcast ID and a counter [14], which counts how many times RREQ has been generated from a specific node. When a source node broadcast a RREQ to its neighbors it acquires RREP either from its neighbors or that neighbor(s) rebroadcasts RREQ to their neighbors by increment in the hop counter. If node receives multiple route requests from same broadcast ID, it drops repeated route requests to make the communication loop free.

RREQ is generated from one source towards different destinations in order to reach at particular destination. If RREP is not received by the source node, it automatically setups reverse path to the source node. A reverse path is settled only when each node keeps the record of its neighbor from which it gets the RREQ. Reverse path is used to send a reply to source node, if any intermediate node does not satisfies the RREQ, moreover reverse path is settled for only the limited period of time [14].

All intermediate nodes stored the particular destination sequence number information and compare it with the RREQ destination sequence number. If RREQ sequence number is greater than or equal to stored sequence number of the intermediate node. Then the RREP is generated to source node following the same route from destination node to source node. This method is also known as the forward path discovery [14]. And in this way a route is discovered for two nodes that need to communicate.

2.7.2.1.2 AODV Route Table Management

Routing table management in AODV is needed to avoid those entries of nodes that do not exist in the route from source to destination. Managing routing table information in AODV is handled with the destination sequence numbers. The need for routing table management is important to make communication loop free. The following are characteristics to maintain the route table for each node [14, 13]:

- IP address of the particular destination.
- Total number of hops to the destination.
- Next hop: It contains information of those nodes that are used to forward data packets by using the current route.
- Destination sequence numbers.
- Active neighbors: Those nodes that currently using the active route.
- Expiration time: It contains information for the total time that route is being valid.

2.7.2.1.3 AODV Route Maintenance

When nodes in the network detects that a route is not valid anymore for communication it delete all the related entries from the routing table for those invalid routes. And sends the RREP to current active neighboring nodes that route is not valid anymore for communication [15]. AODV maintains only the loop free routes, when the source node receives the link failure notification it either start the process of rebroadcasting RREQ or the source node stop sending data through invalid route[14] . Moreover, AODV uses the active neighbor's information to keep tracking of currently used route

2.7.2.1.4 AODV Features

AODV reduces several problems that occurred in proactive routing protocols. AODV provide support by reacting at on demand needs for communication for such ad hoc network where large numbers of nodes. And this can help when the sudden change in topology happens.

AODV updates the information of active nodes in the routing table. This feature can help maintaining the routing tables with the related number of entries. And Nodes only have the information of currently active routes for communication.

AODV reduces flooding of messages in the network as compared to proactive routing protocols so AODV reduces the network overhead. AODV also minimizes the route redundancy and large memory requirements.

AODV eliminates the loop-free routes by using destination node sequence numbers [14]. If the route become invalid for a particular communication then the source node resend the RREQ with the greater [15] destination sequence number in order to rebuild the route. Another advantage of AODV is that it uses the broadcast route discovery method to control network overhead.

Respond to the link failure in the network [14], also one of the important properties of AODV. Link breakage is maintained by keeping the information of the neighbors that are using the currently active route. When link failure occurs, neighboring nodes response to affected source nodes for the local movement and provides quick response for new route.

Another important characteristic of AODV is that it can be applicable for the large scale ad hoc networks as compared to Hybrid or Proactive routing protocols.

2.7.2.2 Dynamic Source Routing DSR

2.7.2.2.1 Introduction of DSR

Dynamic Source Routing protocol (DSR) [8], designed for multi-hop wireless ad hoc networks. This protocol consists of two operations "Route Discovery" and "Route Maintenance" that makes it self-configuring and self-organizing. DSR routing protocol manage the network without any centralized administrator or infrastructure. In route discovery this protocol discovers for the routes from source node to destination. In DSR, data packets stored the routing information of all intermediate nodes in its header to reach at a particular destination. Routing information for every source node can be change at any time in the network and DSR updates it after each change occur [8]. Intermediate routers don't need to have routing information to route the passing traffic, but they save routing information for their future use.

2.7.2.2.2 DSR Route Discovery

In DSR route discovery, when a node want to send a packet to another node normally it stored routing information in the header of the packet. The routing information in DSR is in the form of "sequence of nodes". This routing information had been learned by every node. If no routing information is available, source node use the "route discovery" mechanism to find the appropriate route to reach destination. The whole process to find the route is called route discovery. The route discovery mechanism can be better defined with the figure 3 as an example. Basic purpose to develop DSR was to reduce the overhead on the network and designing self-organizing and self-configuring protocol to support MANET.

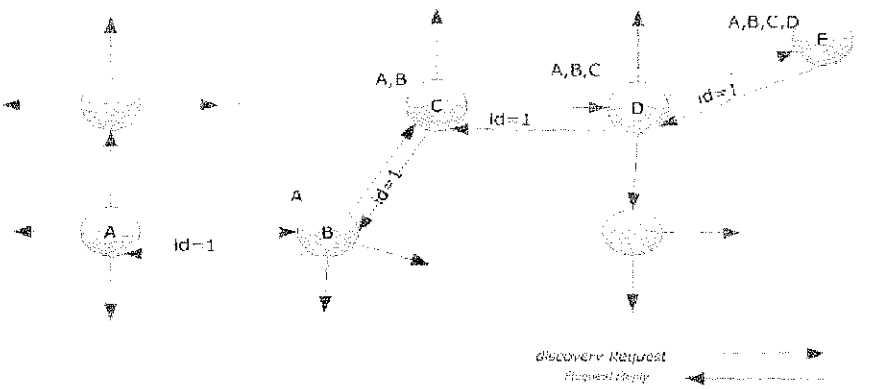

Figure 3: DSR Route Discovery [8]

In figure 3, node "A" starts discovery process to find the route to node "E". So node "A" called initiator and node "E" is called target. When route discovery starts, initiator sends "discovery request" to nodes that are within its wireless range. The discovery request contains initiators, target's and route information. In the start, route record is set to empty by the initiator. When any node receives the discovery request, it checks the target information. If receiver is not target itself it add it's information to the route record and forward the discovery request to all nodes in the wireless range. But when the target node receives the discovery requests it send the request reply with final route information containing the complete intermediate path. The target node can send the request reply using its route cache or by reversing the order or discovery request. Thus in this way DSR discover the route from source to destination.

2.7.2.2.3 DSR Route Maintenance

In DSR when any node sends a packet using source route, it also has the responsibility for its delivery confirmation. If we consider the above scenario again, we can explain route maintenance mechanism as follows:

If node A transmit a packet to node E, through node B,C and D. Node A will retransmit the packer until it receive delivery confirmation from packet C. Same like A, B will retransmit until confirmation from C, C will retransmit until confirmation from D and D will retransmit until it receive confirmation from E. This retransmission process continues for a limited numbers called "maximum number of attempts".

In case, if a node retransmits a packet for maximum number of attempts and there is no acknowledgement received yet the node will send error message to the source node. Then source node can use another route from route cache to send packet or it can start route discovery again. This simple mechanism DSR used in route maintenance

2.7.2.2.4 DSR Features

The two most important features of DSR protocol are route discovery and route maintenance that make this protocol self-configuring and self-maintaining. In DSR protocol, there is no need of periodic updates to send over the network about neighbors or link state information. This reduces overhead on the network by eliminating the periodic updates send on the network. The both operations of DSR are on demand basis [8].

A node may save more than one route for the same destination. In DSR it is carried out by listening to passing traffic, or by saving the additional routes when attempts for single route discovery. This property make DSR to use cache route in case of one route broke down, there is no need of route discovery as alternative routes are already available to the destination [8].

Another important property of DSR routing protocol is network type flexibility. A packet using DSR routing protocol can reach its destination even when the intermediate nodes are using different type of network. DSR make it possible that nodes with different network types can participate in ad hoc networks, DSR protocol consider them as Ad hoc Network [8].

2.7.3 Hybrid Routing

Hybrid routing combines characteristics of both reactive and proactive routing protocols to make routing more scalable and efficient [13]. Mostly hybrid routing protocols are zone based; it means the number of nodes is divided into different zones to make route discovery and maintenance more reliable for MANET.

Haas and Pearlman [12] proposed a hybrid routing protocol and named it as ZRP (Zone routing protocol).The need of these protocols arises with the deficiencies of proactive and reactive routing and there is demand of such protocol that can resolve on demand route discovery with a limited number of route searches. ZRP limits the range of proactive routing methods to neighboring nodes locally; however ZRP uses reactive routing to search the desired nodes by querying the selective network nodes globally instead of sending the query to all the nodes in network. ZRP uses

"Intrazone" and "Interzone" routing to provide flexible route discovery and route maintenance in the multiple ad hoc environments.

Interzone routing performs route discovery through reactive routing protocol globally while intrazone routing based on proactive routing in order to maintain up-to-date route information locally within its own routing range [12]. The overall characteristic of ZRP is that it reduces the network overhead that is caused by proactive routing and it also handles the network delay that is caused by reactive routing protocols and perform route discovery more efficiently.

The drawback of ZRP is that it is not designed for such environments in which the nodes behavior is highly dynamic and rapid changes in topology such as VANET.

In other words we can say this routing protocol is specifically designed for such networks where nodes are not highly mobile and network size is depend on limited number of nodes. Pure proactive or reactive routing protocols can be suitable to some extent in a highly dynamic environment like VANET as compared to Hybrid routing.

2.8 Conclusion

AODV and DSR both behave differently in different network conditions in delay and throughput. DSR outperform AODV in less stressful condition where there are smaller number of node and lower load and mobility. AODV on the other hand outperform DSR in more stressful condition where high number of nodes generate high load and greater mobility exists. DSR generates consistently low routing load than AODV.

If both protocols can use the congested - related metrics to evaluate route instead of emphasizing the hop - wise shortest route and remove 'aged' packets from the network then both protocol can perform well in more stressful network condition.

Chapter III METHODOLOGIES

3.1 Research Methodology

This research was conducted in order to study and understand more about the location awareness concept in MANET application. The location aware definition, type of location aware implemented in MANET system and its contribution towards the use of the application is clearly observed in order to come out with a new project within the scope. The objective of the research is also to ensure that the chosen topic is appropriate for the development of application later on, which is a new feature named scheduling planner to be incorporated with the Android app.

In order to gather all the information that is related to the project, the method of qualitative research is used. There are two main types of research methodology; quantitative methodology and qualitative methodology. Quantitative methodology is the type by which researchers test the significance of the hypothesis, in other words to answer the questions: How much? Is there a relationship? Quantitative methods tend to be systematic and use numbers. However, qualitative methodology is the type by which researchers are depending on the observations and descriptions. It is subjectively and descriptive, no numbering facts. This kind of method is used to assess knowledge, attitudes, behaviors, and opinions of people depending on the research topic. Researcher, in this type of method uses his or her opinion and experience which are not allowed to be used in quantitative method at all. Since the quantitative method does not involve numbers or statistics, it is suitable for this project research.

3.2 Process Model of System Development: Iterative Model

The incremental, or iterative, development model breaks the project into small parts. Each part is subjected to multiple iterations of the waterfall model. At the end of each iteration, a new module is completed or an existing one is improved on, the module is integrated into the structure, and the structure is then tested as a whole.

The system is tested at the end of each iteration, and the test feedback is immediately incorporated at the end of each test cycle. The time required for successive iterations can be reduced based on the experience gained from past iterations. The system grows by adding new functions during the development portion of each iteration. Each cycle tackles a relatively small set of requirements; therefore, testing evolves as the system evolves. In contrast, in a classic waterfall life cycle, each phase (requirement analysis, system design, and so on) occurs once in the development cycle for the entire set of system requirements.

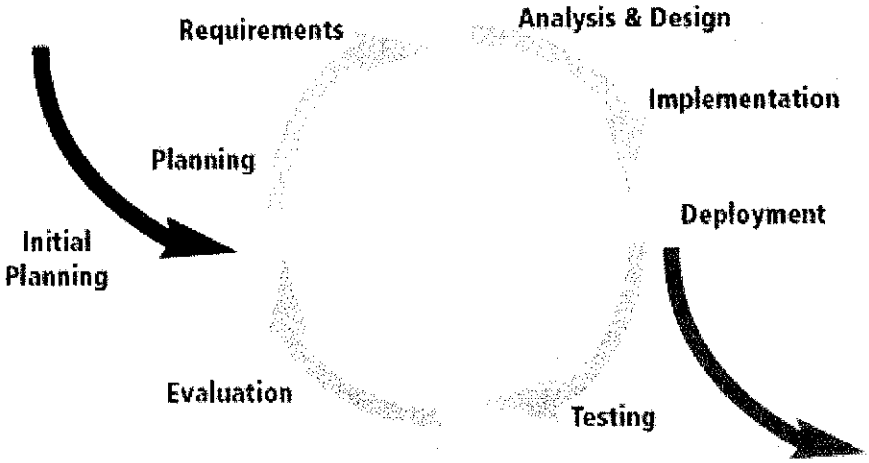

Figure 4: Iteration development model

3.2.1 Definition Study / Analysis

During this phase research is being conducted which includes brainstorming about the background study which is the subject of ad hoc network.

3.2.2 Basic Design

In this stage, by identifying the good routing design gives the idea on designing the development of the system. Once the plan for the software development has been laid, the next step involves formulating the basic design of the software on paper. It involves the flow chart of the system design and testing beds environment.

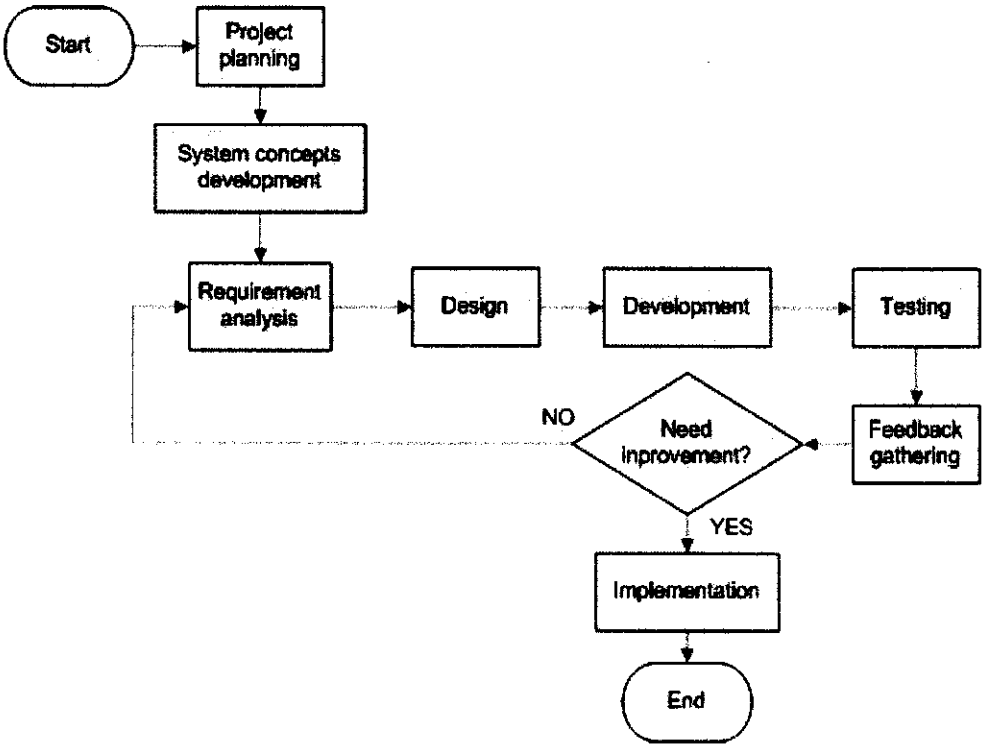

Figure 5: Project flowchart

3.2.3 Technical Design / Detail Design

After the basic design gets approved, the next step is focusing more on elaborating the technical design part. The functions of each of the part are decided and the engineering units are placed for example modules, programs etc.

3.2.4 Construction / Implementation

To simulate the project idea in proving the concept, codes will be written for both static and mobile nodes. The implementation on simulator gives first result on proving the project concept.

3.2.5 Testing

At this phase, the whole design and its construction is put under a test to check its functionality. If there are any errors then they will surface at this point of the process. In order to deploy the system efficiently, various platform have been used.

3.2.6 Evaluation

Based on the result achieved from the test from the simulation, a conclusion could be draw. This stage is essential to determine the efficient of the system and based on the evaluation done a better improvement to the system could be done.

3.3 TOOLS REQUIRED

NO.	TOOL	DETAILS
1	NS2	NS2 is a discrete event simulator targeted at networking research. Ns provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks.
2	Eclipse	Android development on Eclipse using the Android development tools plug-in. It offers insight into the salient features of an Android app.
3	Android SDK	Android is a software stack for mobile devices that includes an operating system, middleware and key applications. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. By using Android Apps, the simulation for both nodes can be done. In order to proof the MANET approach, the usage of Android mobile will be used as mobile node and the emulator in PC will be used as a static node.
4	Microsoft Project	Tool to build schedule for project planning.
5	Microsoft Office Visio Professional 2003	Tool used to design and model the system

Table 1: Tools Required

3.3 GANTT CHART

No.	Details / Month	Feb		Mar		Apr		May		Sept		Oct		Nov		Dec	
1	**Data gathering**																
2	Study on literature review																
3	Research on existing awareness system																
4	**Analyze Requirement**																
5	Define requirements																
6	Decide development platform																
7	**System Design**																
8	Design system architecture																
9	Design system flow																
10	Design user interface																
11	**Prototype Development**																
12	Integrate client-server																
13	Develop basic system functionalities																
14	**System Testing**																
15	Test prototype																

Table 2: Project Timeline

Legend: Progress

CHAPTER IV SYSTEM ANALYSIS & DESIGN

4.1 System Architecture

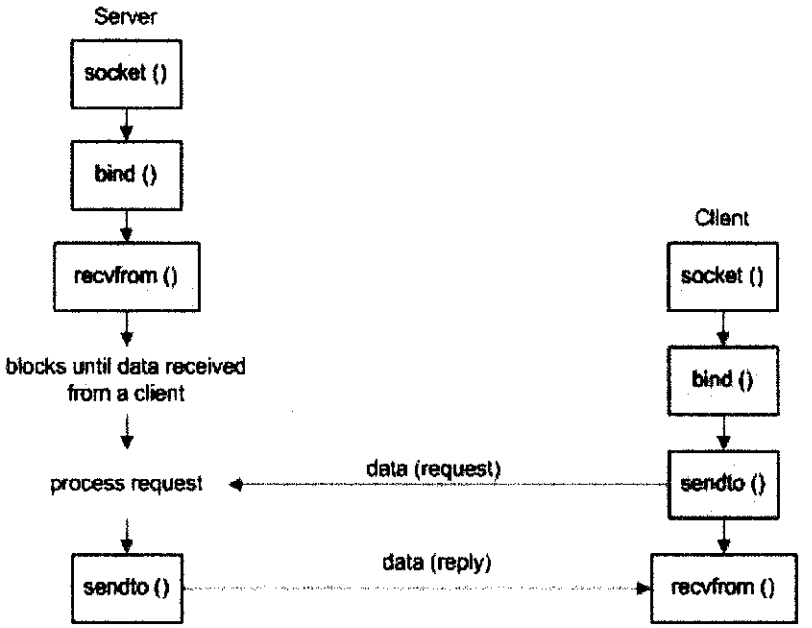

Figure 6: System Architecture

Figure 6 shown the system architecture of the project. By using socket programming, both nodes can be connected to each other in Android app.

The safer option in guaranteed the packet that will be sent is by using TCP connection. TCP is probably the most commonly used protocol, simply because it is used for so many applications such as HTTP, POP, SMTP, etc. TCP is a protocol which guarantees that the receiver will receive exactly what the sender sent. Figure 7 show how the TCP communication time diagram.

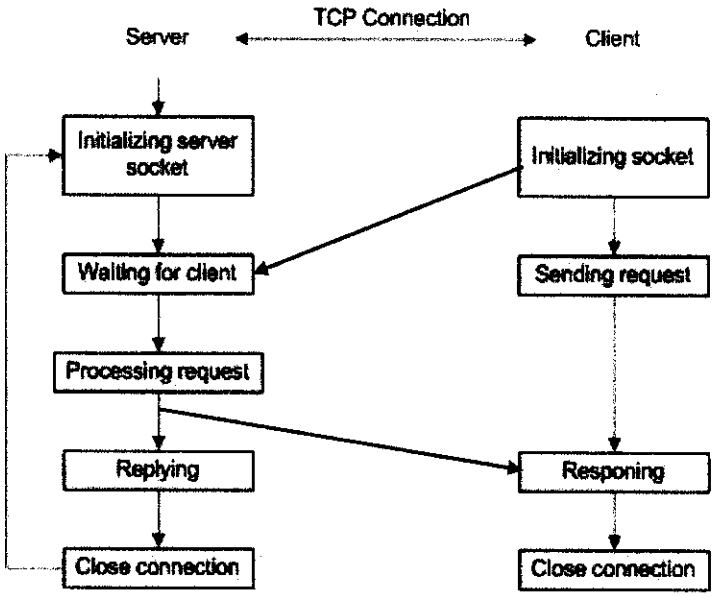

Figure 7: TCP Connection Time Diagram

4.2 Prototype

4.2.1 Interfaces

The interfaces of the prototype developed are based on the emulator for Android SDK and the screen of the mobile phones. The reason why the interfaces are shown based on both from emulator and mobile phone is to show the interfaces of the system via the developer's view during the development of the system. Figure 7 show the page of the emulator is the MyServer and the page screen from mobile phone is ServerClient. It is shown the home page of the system in Android phone. Then, from the current page, user needs to insert their message and click the button to send their message.

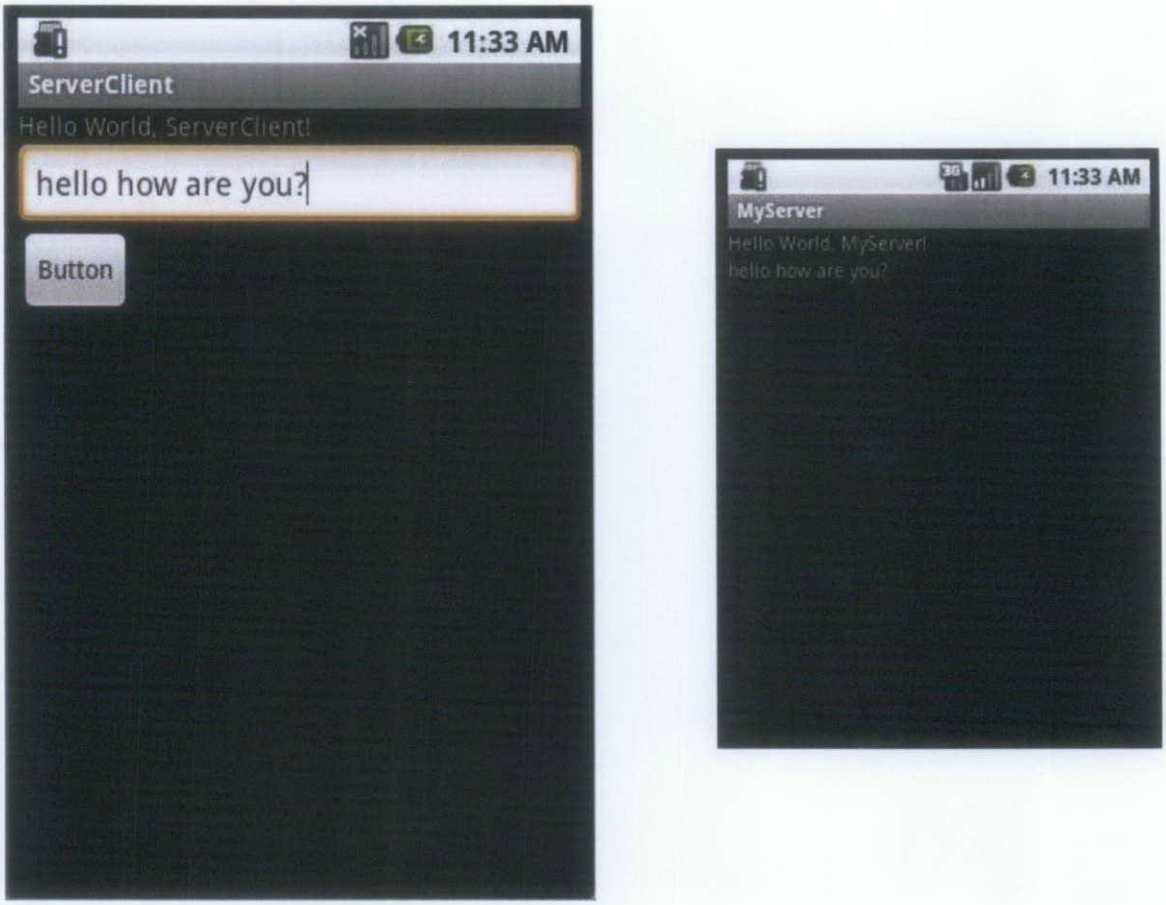

Figure 8: Prototype

Once the message has been sent, the other nodes that are around the radius will be receiving the message as well. The dissemination of message happens because of MANET technology.

CHAPTER V CONCLUSION & RECOMMENDATIONS

This project highlights a new location awareness system that uses the MANET technology. The design and development of this project with the stated new location awareness concept will be performed mainly through the methodology being described in this paper. The main contribution of this project is a prototype of the system program with helps from NS2 that provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks.

This project can be improve and enhance the awareness of road user especially drivers on what is happening around them. In addition, mobile apps do improve current location awareness and because of it interface and user friendly. Our visualization system enables better evaluation of potential in MANET technology. Thus the research on MANET should be

In the future, this kind of application would be interesting if it can also embed the system in vehicles. We can also develop the cross platform for this system and deploy to the cloud service like Google Chrome, Android Market and Apple Store. This kind of future work would be good to be done.

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