A

Major Project Report

on

SAFETY TRAFFIC SYSTEM USING VEMAC PROTOCOL IN VANET

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CERTIFICATE

This is to certify that the major project entitled *Safety Traffic System using VeMAC Protocol in VANET*, submitted by

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in partial fulfillment of the degree of *Bachelor of Engineering* in *Computer Engineering* has been satisfactorily carried out under my guidance as per the requirement of North Maharashtra University, Jalgaon.

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Abstract

Nowadays, there are large numbers of accidents take place on the road because lack of technology. Then road safety is become more important to prevent large numbers of increasing accidents. For this purpose the vehicular Ad hoc network (VANET) provide promising approach for improving road safety and other applications to the driver of vehicles. VANETs technology can make driving safe by enabling the variety of advanced road safety applications, It broadcast the safety messages to vehicle and road side units. The multichannel TDMA MAC protocol designed specifically for vehicular Ad hoc networks. The VeMAC decreases the probability of transmission collision caused by node mobility by assigning time slots to vehicles moving in opposite directions. As compare to Ad hoc MAC, the time slots assigned to the node on control channel much faster in VeMAC. Thus, VeMAC has improved rate of throughput in message transfer between vehicles. The IEEE 802.11p is improved amendment to IEEE 802.11 standard is used to add wireless access in vehicular environments for vehicular communication system. Here, sometimes the message passing between the vehicle and road side units create the collision while exchanging messages. Also delay between sender and receiver. So, here TDMA concept and VeMAC protocol is useful for implementation.

Chapter 1

Introduction

Introduction chapter will introduce the work, It will focus exactly on what is the area of project and explains what is actually be done in this work. All ideas about project work are cleared here.

The Sections of the chapter are organized as follows. Section 1.1 presents Background. Motivation is discussed in Section 1.2. Section 1.3 presents Problem Definition. Objective of the project is discussed in Section 1.4. Finally, Summary of the chapter is given in the last Section.

1.1 Background

Vehicular Ad-hoc Networks (VANET) are a technology that provides communication between vehicles or between a vehicle and Infrastructures or road side units i.e. RSU using wireless communication. A vehicle accident is likely to cause a serious tragedy. Therefore, the Vehicular Ad-hoc Networks system provides an essential information exchange protocol for communication between vehicles and or vehicles and infrastructures. However, a key exchange scheme based on the proposed general network for a high-speed communication environment which is not suitable for vehicles. In this system, the first communication from the Infrastructures passes only group keys and it updates the key value in the communication with the vehicle using Bloom filters to verify the proposed method. In the proposed system in Vehicular Ad-hoc Networks (VANET), dispersed operations are carried out in the Infrastructures or road side units i.e RSU. By reducing to a minimum the number of keys exchanged, more safe group communication can be realized. In proposed system, a message batch verification scheme that can verify multiple messages and handover authentication efficiently even for multiple communications with many vehicles [2].

Vehicular ad-hoc networks (VANET) have attracted considerable attentions recently as a promising technology for revolutionizing the transportation systems and providing broadband communication services to vehicles. VANET consist of entities including On-Board

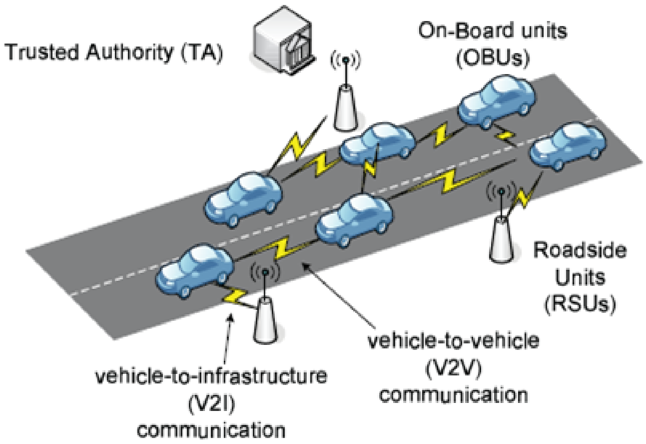

Figure 1.1: Overview of VANET

Units (OBUs) and infrastructures. Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure, which respectively allow OBUs to communicate with each other and with the infrastructures. Since, vehicles communicate through wireless channels, a variety of attacks such as for inserting wrong information, modifying and repeating the disseminated messages can be easily launched. A security attack on VANET can have severe harmful consequences to legitimate users. Consequently, ensuring secure vehicular communications is must before any VANET application can be put practically. A well-recognized solution to secure VANET is to deploy Public Key Infrastructure (PKI), and to use Certicate Repeal Lists (CRLs) for managing the revoked certicates. In PKI, each entity in the network holds an authentic certicate,and every message should be digitally signed before its transmission. A CRL, usually issued by a Trusted Authority (TA), is a list containing all the revoked certicates. In a PKI system,the authentication of any message is performed by rst checking if the senders certicate is included in the current CRL, i.e. checking its repeal status. Then, verifying the senderscerticate, and nally verifying the senders signature on the received message. The rst part of the authentication, which checks the repeal status of the sender in a CRL, may suffer long delay depending on the CRL size and the employed mechanism for searching the CRL.

To preserve the privacy of the drivers, i.e. to keeping the leakage of the real identities and location information of the drivers from any external Infrastructures or road side units i.e. RSU Infrastructures or road side units i.e. RSU snooper each OBU should be preloaded with a set of undefined digital certicates, where the OBU has to periodically change its undefined certicate to mislead attackers. Consequently, a revocation of an OBU results in revoking all the certicates carried by that OBU leading to a large increase in the CRL size [5].

The scale of VANET is very large. According to the United States Bureau of Transit Statistics (USBTS), there are approximately 250 million OBUs in the United States in 2005. Since the number of the OBUs are large and each OBU has a set of certicates, the CRL size will increase dramatically if only a small part of the OBUs are revoked. To have an recommendation of how large the CRL size can be, consider the case where only 110 OBUs are revoked, and each of this has 24,000 certicates. In this case, the CRL contains 2.5 million revoked certicates. According to the employed mechanism for searching a CRL, the Wireless Access in Vehicular Environments (WAVE) standard does not state that either a non-optimized search algorithm [6].

1.2 Motivation

Every year in the United States, about six million traffic accidents occur due to automobile crashes. In 2003 alone, these accidents accounted for 220 billion in damaged property, 2,790,000 nonfatal injuries, and 42,573 deaths. While different factors contribute to vehicle crashes, such as its mechanical problems and bad weather, driver behavior is considered to be the leading cause of nearly more than 90 percent of all accidents. The inability of drivers to react in time to emergency situations often creates a potential for chain collisions, in which an initial collision between two vehicles is followed by a series of collisions involving the vehicles that moving in the same direction. In emergency situations, a driver typically relies on the tail brake light of the vehicle immediately ahead to decide braking action. Under typical road situations, this is not the best strategy for collision avoidances. Driver reaction time typically ranges from 0.75 to 1.5 s. At a speed of 70 mph, this means that between 75 and 150 ft is traveled before any reaction occurs [5].

In dense traffic, the effects of cumulative reaction times, as one vehicle after another reacts to the vehicle ahead braking, can further exacerbate the situation. As a result, a single emergency event can often lead to a string of secondary crashes, creating a multi vehicle chain accidents. Chain collisions can be potentially avoided, or their severity lessened, by reducing the delay between the time of an critical event and the time at which the vehicles behind are informed about it. One way to provide more time to drivers to react in critical situations is to develop Intelligent Transportation System applications using emerging wireless communication technology. The primary benefit of such communication will be to allow the important information to be propagated among vehicles much quicker than a traditional chain of drivers reacting to the brake lights of vehicles immediately ahead. The protocol to be implemented as a part of the project helps such quick propagation and works positively to avoid the aforementioned chain collisions among vehicles.

1.3 Problem Defination

Vehicular Ad hoc network is the useful technology to improve the traffic safety because vehicular Ad hoc network (VANET) are created by applying the principles of mobile Ad hoc network. It is similar to the term inter vehicle communication because the focus is on the aspect on spontaneous networking rather than roadside units or cellular networks. The purpose of VANET is to enhancement and growth the safety on roads and also communication for vehicles and roadside units. VANET protocol is used for communication between the vehicle to vehicle, vehicle to infrastructure, traffic controlling and navigation.

The IEEE 802.11p is an approved amendment to the IEEE 802.11 standard to add wireless access in vehicular environments(WAVE), a vehicular communication system. This includes data exchange between high speed vehicles and between the vehicles and the roadside infrastructures. IEEE 802.11p standard delivers the safety messages but very low percentage of messages are successfully delivered.

To avoid the accidents intelligent broadcast protocol is implemented to provide the safety messages between vehicles and roadside units. This technique face the problem of storm broadcasting where the excessive broadcast packets are generated. It also creates the problem of message redundancy, generation of duplicate messages and higher message delivery latency causing the delay in message transmission but it can create the collision between two or more messages from vehicle to vehicle, vehicle to infrastructure and roadside units. The situation of collision detection and reduction in delay while transmission of messages in handled by VeMAC protocol.

VeMAC is used because VeMAC decreases the transmission collision of messages. By assigning the time slots to vehicles more another for opposite direction as compare to Ad hoc. So, VeMAC protocol is beneficial for faster forwarding the messages from sender to receiver without any collision and delay between the message. VeMAC is completely contention free protocol. This protocol support single-hop and multi-hop broadcast services uncontrol channel which provides smaller rate of access collision. In VeMAC these collision are reduce by assigning separate sets of time slots to cars moving is opposite direction and to roadside units. So, here the implementation of TDMA's VeMAC protocol is essential because TDMA allows several user to share the same frequency channel by dividing the messages in faster speed one after the another each using its own time slot. This allows the another vehicle and roadside units to share same frequency channel. so, here by implementing VeMAC protocol the vehicles and roadside units have proper time to send secure or safety messages without collision and provide the delay [3].

1.4 Objectives

The prominent objective which are sought after and their satisfaction is desired are listed below. The protocol that is to implemented should satisfy the basic objective of increasing vehicular safety, and at the same time cover up the following objectives as well.

- To develop a protocol for faster propagation of warning messages.
- To develop a protocol which meets the requirements of ITS applications.
- To develop a protocol which can be used in CCA application.
- To increase the highway safety by reducing the chain collisions.

1.5 Summary

In this chapter, an Introduction of the project topic with the Background, Motivation ,Problem Denition has been discussed. Objective of the project has been also discussed in this chapter. Next chapter presents System Analysis of the project.

Chapter 2

System Analysis

Systems analysis is the study of group of interacting entities, including computer systems analysis. The development of a computer-based information system includes a systems analysis phase which produces or enhances the data model which itself is a anchester to creating or enhancing a database. There are a number of dierent approaches to system analysis. When a computer-based information system is developed, systems analysis would constitute the development of a feasibility study, involving determining whether a project is economically, socially, technologically and organizationally feasible.

The Sections of the chapter are organized as follows. Section 2.1 presents Literature Survey. Proposed System of the project is discussed in Section 2.2. Section 2.3 describes Feasibility Study. Project Scheduling of the project is discussed in Section 2.4 and Section 2.5 describes Effort Allocation Finally, Summary of the chapter is presented in the last Section.

2.1 Literature Survey

Previous research works about warning messages have focused on three issues: medium access control, message dissemination protocols and collision prevention mechanisms. Authors considered a counter-based method to assign additional delays on top of the MAC back off, and used it as a rebroadcast suppression mechanism that reduced packet collisions. They also added a location-based method with the counter based method to make a better choice of the next hop forwarder. Some Authors also proposed a efficient IEEE 802.11 based Urban Multi-hop Broadcast protocol (UMB) which was designed to address the broadcast storm, hidden node and reliability problems of multi-hop broadcast in urban areas. They showed that this protocol had a very high success rate and efficient channel utilization. Some Authors also tried to achieve low-latency in delivering emergency warnings in various road situations. They designed an effective protocol, comprising congestion control policies, service differentiation mechanisms and methods for emergency warning dissemination [3].

2.2 Proposed System

In proposed system, each vehicle periodically broadcasts information about itself. When a vehicle receives a broadcasted message, it stores and suddenly forwards by re-broadcasting it. Warning messages should be propagated to all neighbors up to a certain number of neighbour hops, and our requirement are appropriately fitted by flooding based routing protocol. We profess that the warning packets sent by damaged vehicles can be received by all the surrounding vehicles of that damaged vehicles, and also this protocol gives more reliability in terms of coverage. The purpose is to provide the minimum set of specifications required to ensure inter operability between wireless devices that communicate in potentially rapid changing communication environments, also the situation in which assembly must be completed within the time limit which is much less than minimum allowed with VANET. The damaged nodes that send warning messages periodically (T-warning) to inform about their situation to the remaining vehicles, this damaged vehicle is included in warning advertisement system. These messages have the highest priority (AC3). Undamaged vehicles make the spreading of these warning packets and periodically send other messages with detail information such as their position, their speed, etc. These periodic messages have less priority (AC1) than warning messages and are not propagated by other nodes. With respect to warning messages, each vehicle is only allowed to propagate them once for each serial number, being that older messages are dropped.

2.3 Feasibility Study

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.

Three key considerations involved in the feasibility analysis are.

- **Economical Feasibility**
- **Technical Feasibility**
- **Social Feasibility**

2.3.1 Economical Feasibility

This study is carried out to check the economic impact that the system will have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

2.3.2 Technical Feasibility

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

2.3.3 Social Feasibility

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make familiar with it. His level of confidence must be raised so that, It is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

2.4 Project Scheduling

Following figure shows the schedule of the project. It gives the details of how much time is required to complete each and every phase of software engineering for this project.

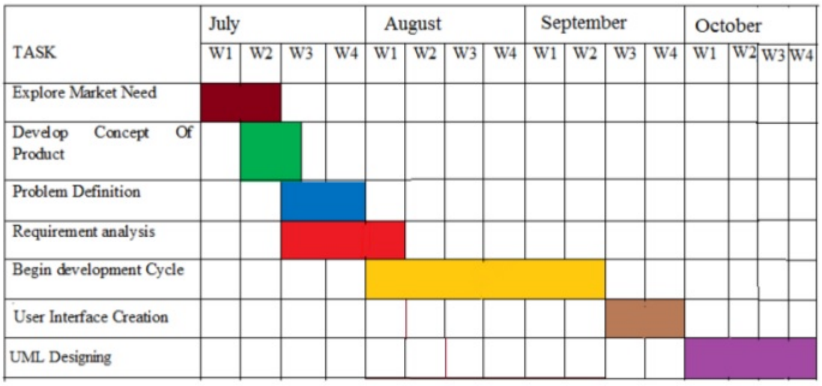

Figure 2.1: Project Scheduling

2.5 Effort Allocation

Table 2.1 illustrates the effort allocation. Identication of project, requirements gathering and study of existing system accounts 10 percent of effort. 15 percent of effort is normally applied to data modeling . Identication of functional and non-functional requirements, testing accounts 5 percent of project eort. Designing requires 30 percent of effort.

Work Tasks	Sunita	Kajal	Pournima	Shubham	Work
Identication of Project	Yes	Yes	Yes	Yes	10
Requirement Gathering	Yes	Yes	Yes	Yes	10
Study of Existing System	Yes	Yes	Yes	Yes	10
Identify Requirements	Yes		Yes		5
Designing(Data Architecture)		Yes			30

Table 2.1: Effort Allocation

2.6 Summary

In this chapter, Literature Survey, Proposed System, Feasibility Study, Project Scheduling and Effort Allocation of the project has been described. Next chapter presents System Requirement Specifications.

Chapter 3

System Requirement Specification

Understanding user requirements is an important part of information systems design and is critical to the success of interactive systems. It is now widely understood that successful systems and products begin with an understanding of the needs and requirements of the users. As specied in the ISO 13407 standard (ISO, 1999), user-centered design begins with a complete understanding of the needs and requirements of the users. The benets can include increased productivity, enhanced quality of work, reductions training costs, and improved user satisfaction [1].

The Sections of the chapter are organized as follows. Section 3.1 presents Hardware Requirements. Software Requirements of the project is discussed in Section 3.2. Section 3.3 describes Functional Requirements. Non-Functional Requirements of the project is presented in Section 3.4. Finally, Summary of the chapter is given in the last Section.

3.1 Hardware Requirement

- System : Pentium IV 2.4 GHz.
- Hard Disk : 40 GB.
- Monitor : 15 VGA Color.
- Mouse : 2 or 3 Button Mouse.
- RAM : 512 Mb.

3.2 Software Requirement

- Operating system : - Windows 7 Ultimate (32-bit)
- Networking Simulator : NS-2.

- Networking Tool : NAM simulator

3.3 Functional Requirement

Functional requirement denes a function of system and its components. A function is described as set of inputs, behaviour and outputs. The efficiency of the protocol will be proved by observing the network traffic generated and by testing the assurance that every vehicle in the platoon gets the warning message as fast as possible. Ultimately, the efficient technique of message propagation will help to reduce the collisions on the road.

3.4 Non-Functional Requirement

The non functional requirement defines how the system is supposed to be. The broadcasting technique should reduce the collisions on the roads and ensure a safe highway traffic scenario. Ultimately, the propagation of warning message should be as fast as possible in the platoon. Also, the unnecessary rebroadcasting of the messages should be mitigated to avoid redundant messages and consequently delivery latency.

3.5 Summary

In this chapter, Hardware Requirement, Software Requirement, Functional Requirement and Non-Functional Requirement of the project has been described. Next chapter presents System Design Specifications.

Chapter 4

System Design

System design provides the understanding and procedural details necessary for implementing the system recommended in the system study. Design is a meaningful engineering representation of something that is to be built. It can be traced to a customers requirements and at the same time assessed for quality against a set of predefined criteria for good design.

In Section 4.1 UML Diagrams are presented. Finally, Summary of the chapter is given in the last Section.

4.1 UML Diagrams

The Unified Modeling Language is a language that denes the industrys best engineering practices for the modeling systems. The goal of UML is to be a ready-to-use expressive visual modeling language that is simple and extensible.

A Use case diagram shows a set of use cases, actors and their relationships. Use case diagrams address the static use case view of a system. These diagrams are especially important in organizing and modeling the behaviour of the system.

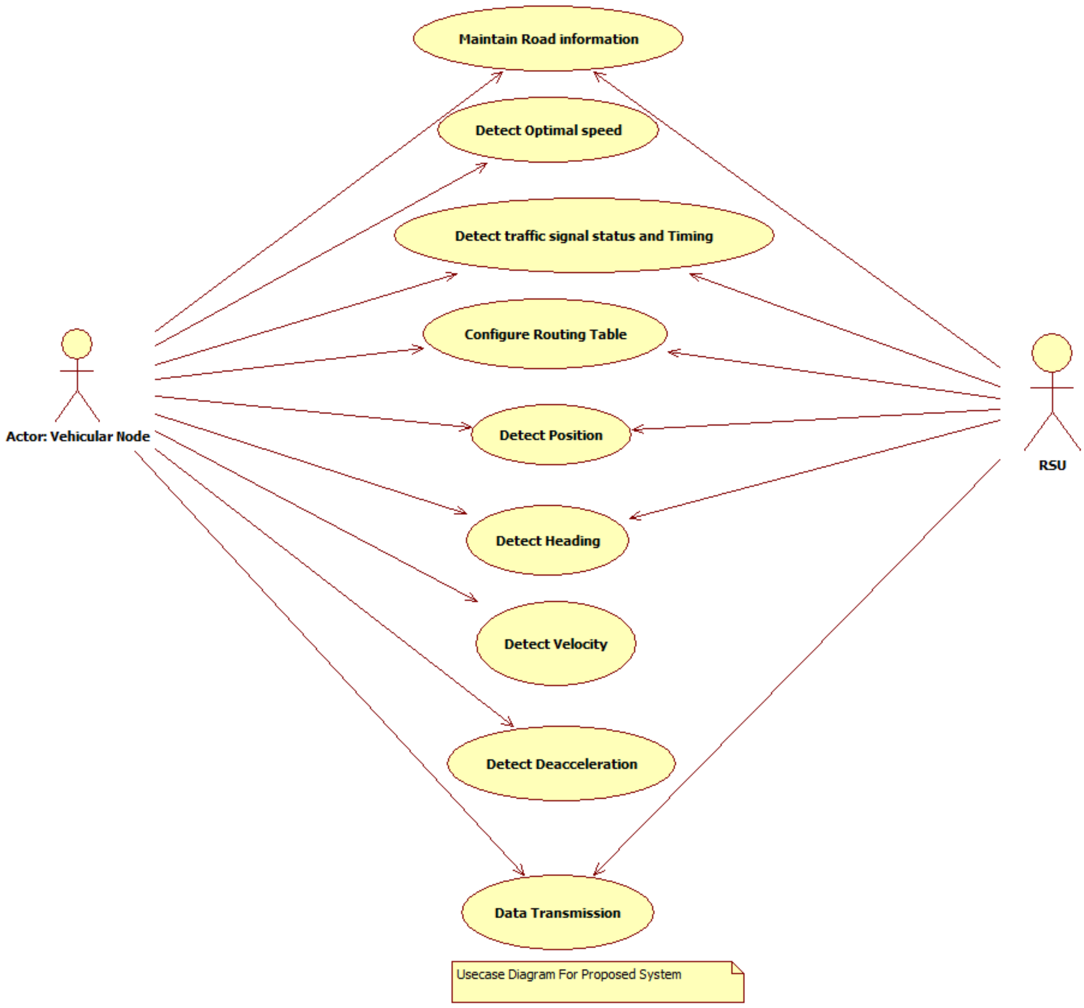

Figure 4.1: Use Case Diagram

A class diagram shows a set of classes, interfaces, collaborations and their relationships. Class diagram address the static design view of a system. Class diagrams are important not only for visualizing, specifying and documenting structural models but also for constructing executable systems.

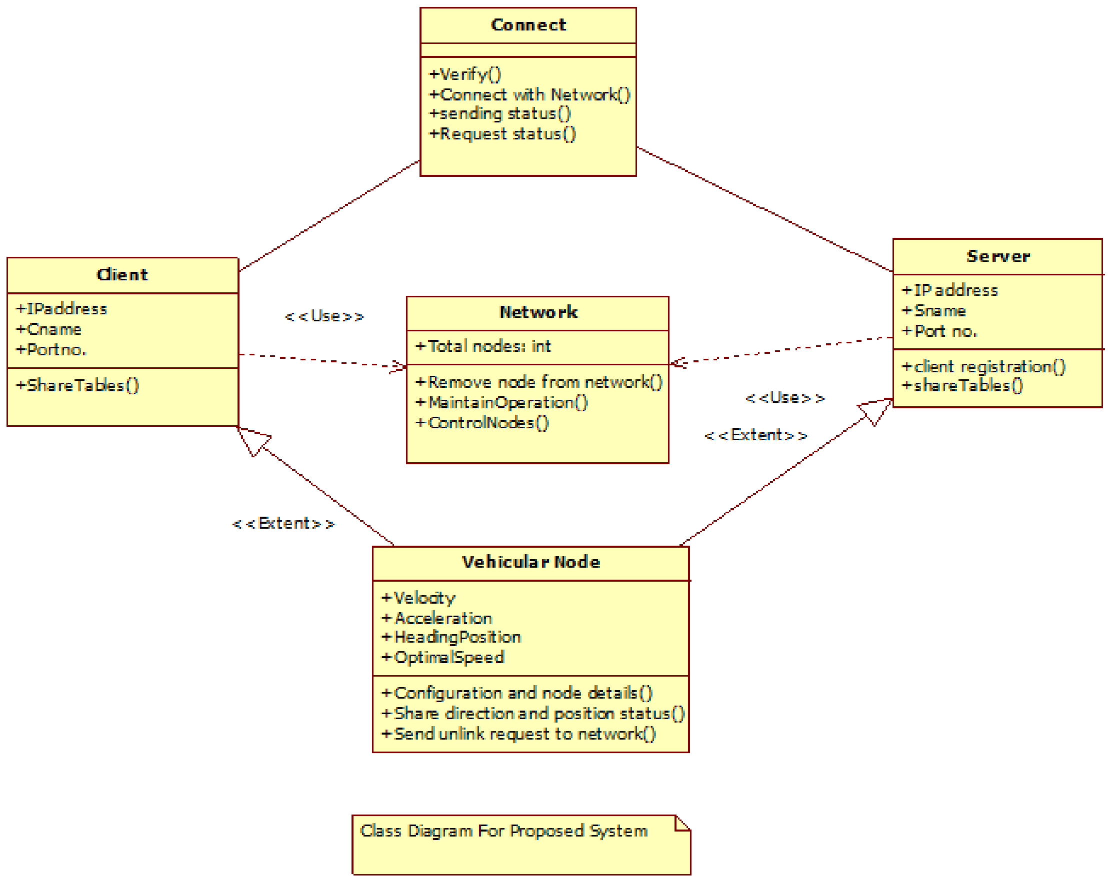

Figure 4.2: Class Diagram

A sequence diagram is an interaction diagram that emphasizes the time ordering of messages. Sequence diagram is isomorphic means that takes one and transform it into the other.

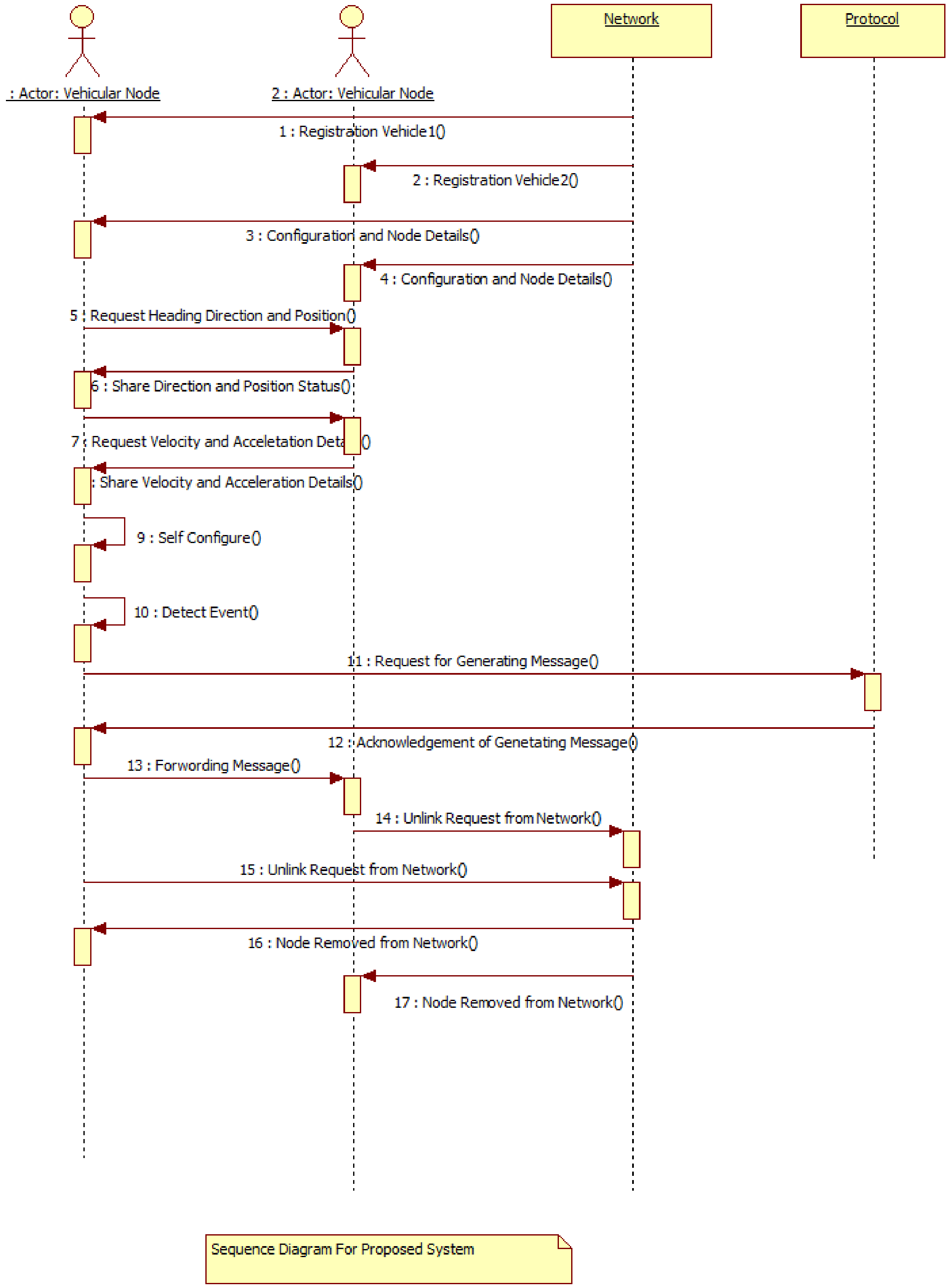

Figure 4.3: Sequence Diagram

Activity diagram contains following events :- 1.configure network 2.Detection 3.Detect position 4.Detect heading 5. Deacceleration 6. Detect traffic signal 7. Detect optimal speed.

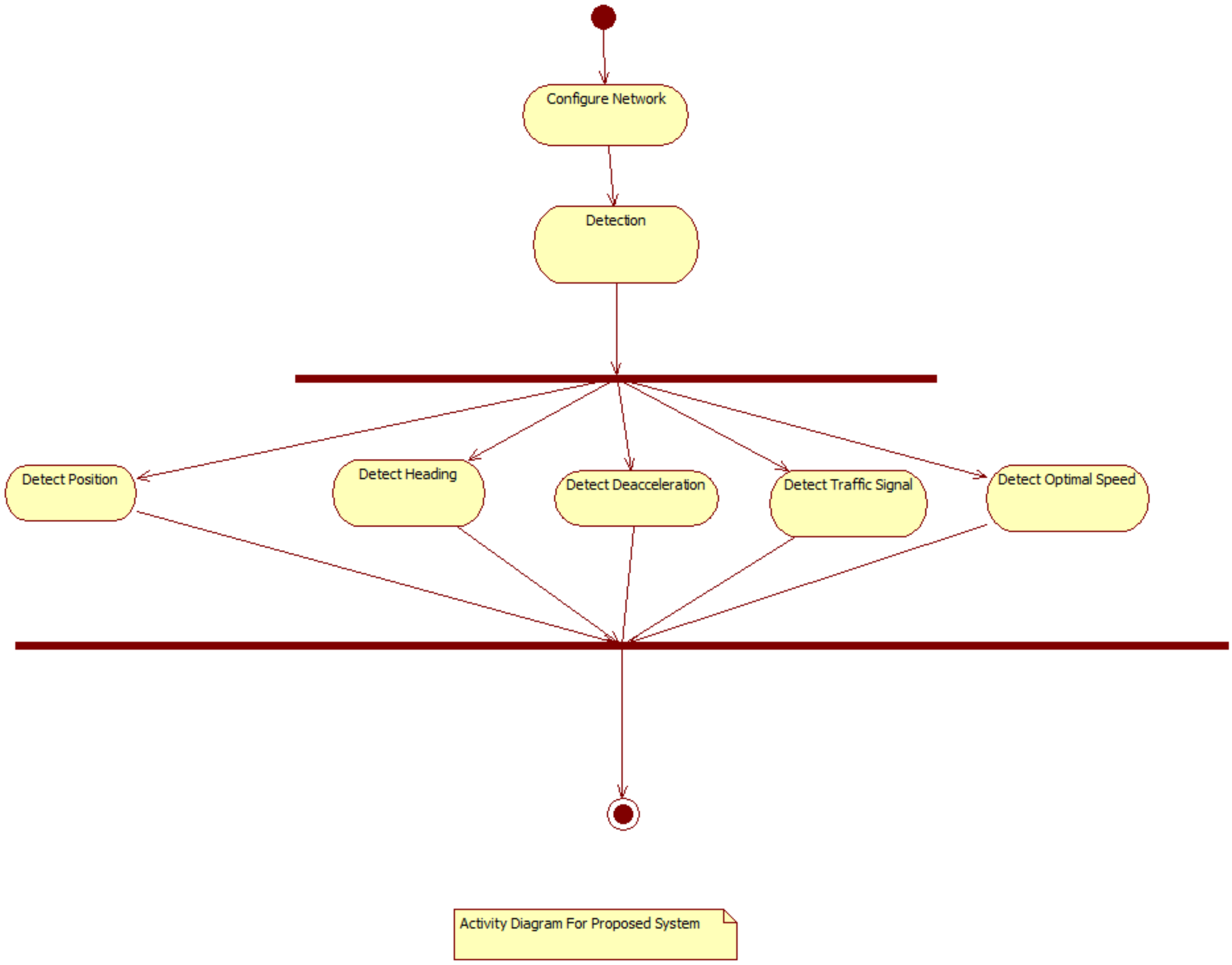

Figure 4.4: Activity Diagram

A component diagram shows the organizations and dependencies among a set of components. Component diagram address the static implementation view of a system. They are related to class diagram in that a component typically maps to one or more classes, interfaces or collaborations.

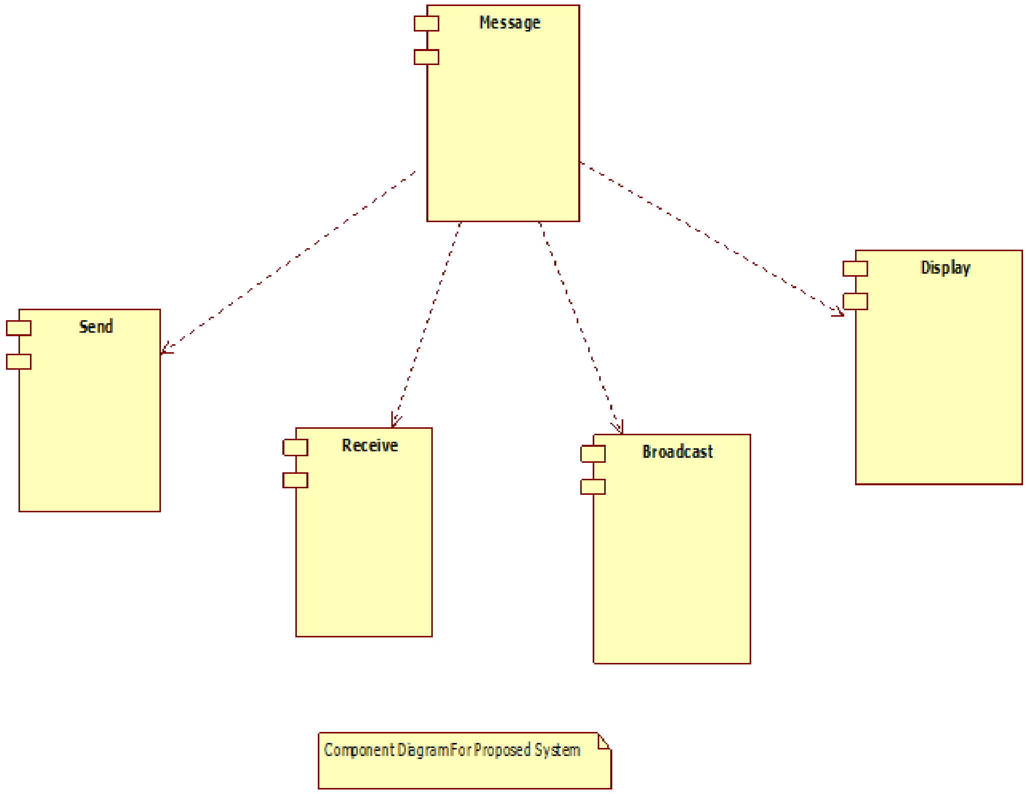

Figure 4.5: Component Diagram

A deployment diagram shows the conguration of runtime processing nodes and the components that live on them. Deployment diagram address the static deployment view of an architecture. They are related to component diagram in that a node typically encloses one or more components.

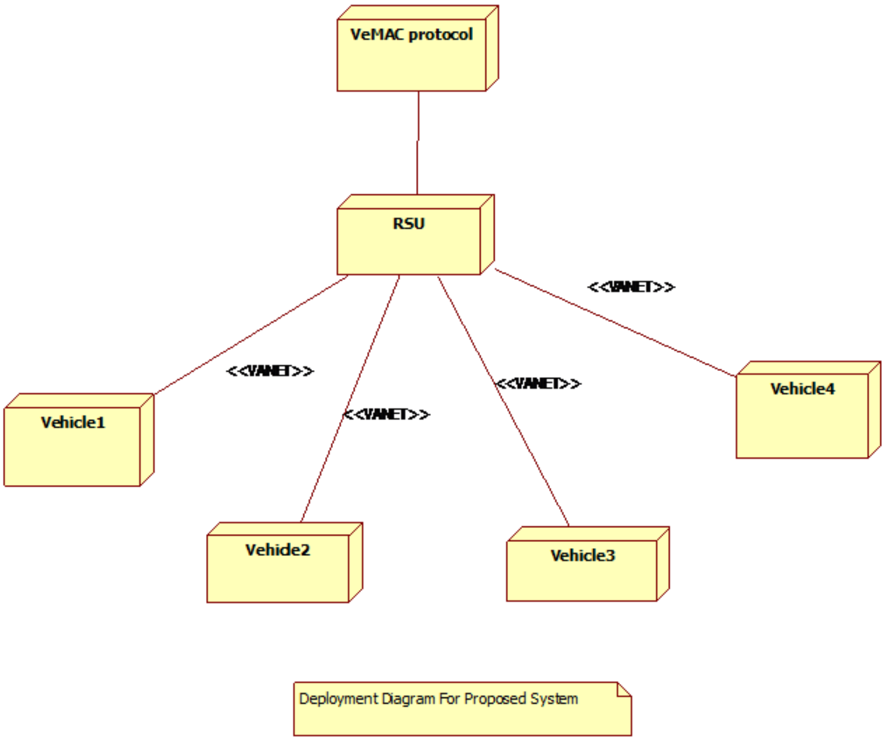

Figure 4.6: Deployment Diagram

4.2 Summary

In this chapter UML diagrams are presented. Next chapter presents conclusion of the project.

Chapter 5

Conclusion

5.1 Conclusion

The propagation delay is lower when density of node increases. Besides, the percentage of blind nodes highly depends on this factor. When the area increases, the system requires more time to inform the rest of the vehicles and the percentage of blind nodes highly depends on this factor, also. When the area is very small, the percentage of blind nodes is also very small. When there is a large area, the number of blind nodes also increases. Nevertheless, the total number of packets received per node decreases. The size of the packets sent does not affect the warning advertisement systems behavior. When we vary the priority of the packets sent by the undamaged nodes, the propagation delay of the system changes. The results demonstrated that to obtain the lowest possible propagation delay in our system, the best solution is to give less priority to the background traffic, while the warning messages must have the highest priority. The worst case scenario when all the messages (warning and normal) have the same priority. However, packet priority does not affect the percentage of blind nodes nor the total number of packets received.

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