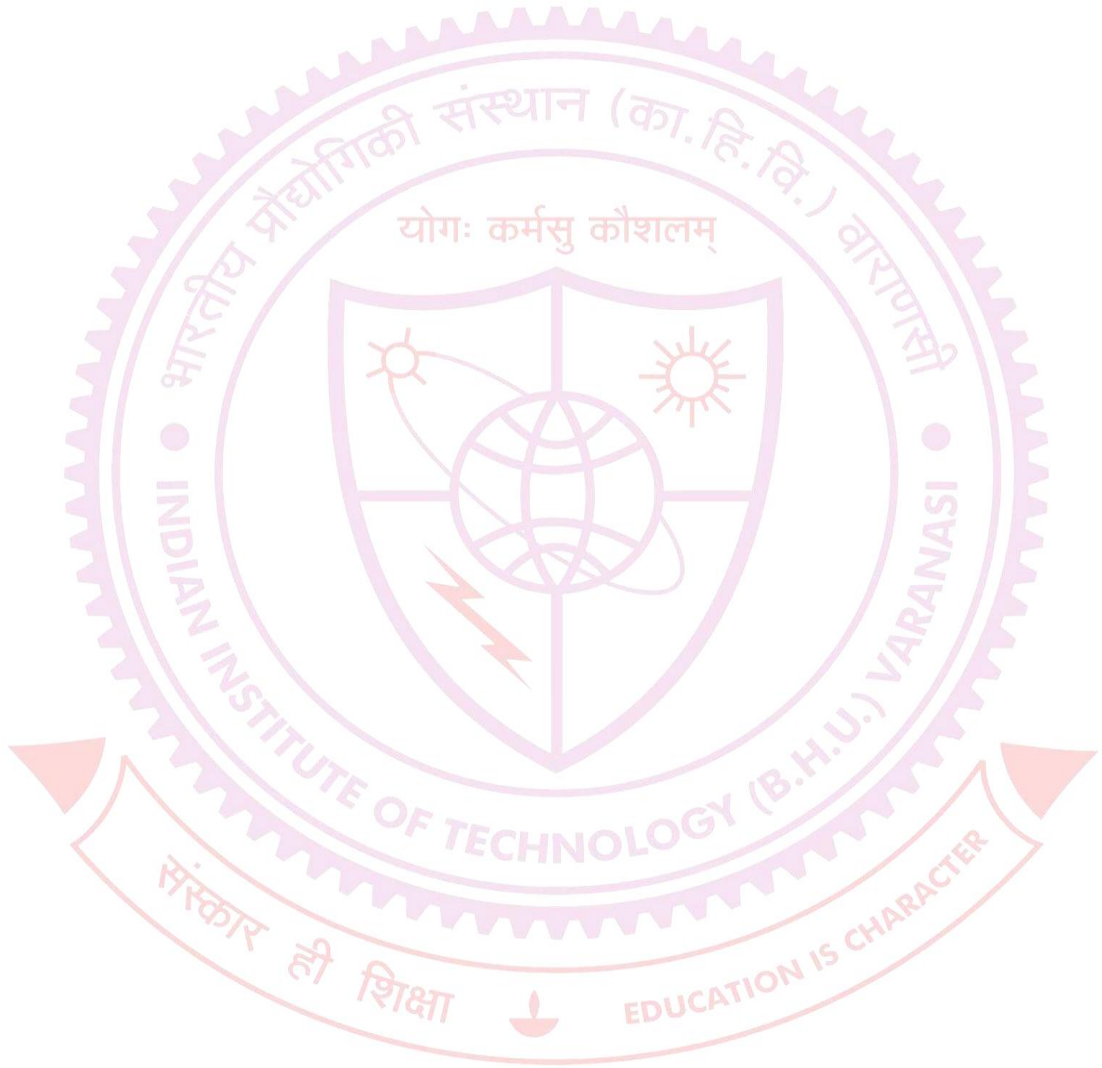


*Dedicated to the Almighty God  
&  
My beloved Family...*



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I, **Mr. Ashutosh Srivastava**, declare that I have pursued my research work under the supervision of **Dr. Suresh C. Gupta** from March 2011 to April 2016. I hereby supplicate my thesis entitled "**Performance Analysis of MANETs Routing Protocols with Disaster Application and Security Issues**" for the award of Ph.D. degree.

Date:

Place: IIT (BHU), Varanasi

**(Ashutosh Srivastava)**

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### CANDIDATE'S DECLARATION

I, **Mr. Ashutosh Srivastava**, certify that the work embodied in this Ph.D. thesis is my own bonafide work carried out by me under the supervision of **Dr. Suresh C. Gupta for a period of March 2011 to April 2016 at Department of Electrical Engineering, Indian Institute of Technology (Banaras Hindu University), Varanasi**. The matter embodied in this Ph.D. thesis has not been submitted for the award of any other degree/diploma.

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**Dr. Suresh C. Gupta**

Professor  
Department of Electrical Engineering

(Signature of Head of the Department with Seal)

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**Date:**

**Place: Varanasi**

**(Ashutosh Srivastava)**



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# PREFACE

Mobile Ad-Hoc Networks (MANETs) are infrastructure-less, dynamic, rapidly changing, decentralised, multi-hop arbitrary networks composed of bandwidth constrained wireless links and no centrally accessed routers or servers. Due to these properties, it has got potential applications in both civilian and military systems.

Mobility model is the pattern in which the nodes travel from a point to another in a network. It defines the location of a node at a particular time. Its also have an effect on the performance of routing protocols. The most common are Random waypoint mobility model, Manhattan Grid Model and Reference point group mobility model. The routing protocols in MANET are classified into two groups: single path routing protocols and multipath routing protocols. Single-path routing protocols are further classified into four groups namely proactive, reactive, hybrid and geographic routing protocols.

Simulation is the imitation of the operation of a real-world process or system over time. The act of simulating something first requires that a model is developed representing the essential functions or characteristics of the selected physical or abstract system or process. The model represents the system itself, whereas the simulation represents the operation of the scheme over time. Simulation is used in many contexts, such as simulation of technology for performance optimization, safety engineering, testing, training, education, etc. It can be used to show the eventual real effects of alternative conditions and courses of action.

Efficient communication and coordination among rescue teams are needed in the post-disaster mitigation process. Exchange of real-time information among responders and emergency management centres is crucial for saving lives. In such scenario, MANETs are suitable for providing communication mechanism, as they are easy to deploy and do not require elaborate infrastructure. The performance of a MANET system depends on mobility modelling.

Mobile ad hoc networks have more vulnerabilities than the traditional wired networks; due to their characteristics MANETs are easy targets of attackers which inject non-cooperative nodes into the network. Hence, the security issues are an important consideration, so it is important to develop an efficient intrusion detection system for protection against attacks. We propose and simulate a secure Digitally Signed Secure Acknowledgement Method (DSSAM) with the use of digital signature. Three parameters are considered viz, first secure acknowledgement, second node authentication and third packet authentication as an improvement on watchdog and twoack techniques with to overcome three weakness of watchdog namely Receiver Collision, Limited Transmission power and False identity problem. We have observed the performance of DSSAM and compared with two standard methods namely Watchdog and Twoack and reactive routing protocol DSR. The rate of detection of malicious behaviour is more for the proposed system. However, associated overheads are high. A tradeoff between performance and cost has been considered.

At the time of Post-disaster mitigation, process demands optimise and short way for covering all permanent check positions with obstacle avoidance. It also requires an exchange of real-time information among responders for saving lives. The communication between the layers or stages is considered to be provided by a MANET based network setup. Here mobility of MANET nodes between stages has been modelled with "SROA" (Shortest route with obstacle avoidance) shortest route from Source to destination covering all checkpoints (here in levels there are defined checkpoints) with obstacle avoidance principle.

We observe the performance of SROA and RWP mobility method with respect to average links broken.

The subject matter of the thesis has been divided into the following seven chapters:

- ❖ **Chapter 1** It is the introductory part of the research work, comprising of a general introduction of MANET. An overview of the simulation studies is detailed.



- ❖ **Chapter 2** Presents the fundamentals of MANET, routing protocols, mobility models and simulators.
- ❖ **Chapter 3** It explains the comparison of two popular simulation platforms NS2 and Qualnet for both proactive and reactive routing protocols.
- ❖ **Chapter 4** In this chapter, we provide the view and simulate a framework of the post-disaster mitigation management system using MANET consisting of three stages namely Disaster core location (incident-location), first aid treatment area and hospital area with two interfaces, one between the first and second layer and other between first and third layer. The relief ambulance provides the links. The co-ordination task is managed by a four-way movement.
- ❖ **Chapter 5.** We explain and simulate a secure Digitally Signed Secure Acknowledgement Method (DSSAM) with the use of digital signature. Three parameters are considered viz, first secure acknowledgement, second node authentication and third packet authentication as an improvement on watchdog and twoack techniques with to overcome three weakness of watchdog namely Receiver Collision, Limited Transmission power and False identity problem. We have observed the performance of DSSAM and compared with two standard methods namely Watchdog and Twoack and reactive routing protocol DSR.
- ❖ **Chapter 6** We propose and simulate SROA: Shortest route with obstacle avoidance method for MANET. It is access best possible short route with obstacle avoidance and applicable in every real time of mitigation scenario of people and vehicular moment. As we discussed previously, the communication between the layers or stages is considered to be provided by a MANET based network setup. In this chapter, we first observed the effect of variation in pause time on AODV, OLSR and ZRP. We observed

that as movement increases, the algorithms require more time to find the path for destination, so the average end to end delay is high. ZRP gives the best performance followed by OLSR and AODV. The end-to-end delay also decreases with pause time. In the second part, we calculated the average value for broken links and connected ties with each node for particular node speed. We have taken nodes speed from 1 to 10 m/s. For each node speed we have taken all transmission ranges and made the average ceiling value of broken links and connected links by taking SROA and RWP mobility method one by one. We observed that SROA performs better than RWP. This is because of the obstacle avoidance by SROA.

- ❖ **Chapter 7** This chapter concludes the thesis. The comparison study of MANET routing protocols with decisive application framework guides to choose proper routing protocols for MANETs. Analysis and conclusions may prove to be useful while selecting routing protocols for MANET applications.