

Quality of Service in Routing

Thesis Submitted to

Swami Ramanand Teerth Marathwada
University, Nanded - 431606 Maharashtra India

For award the degree of
Doctor of Philosophy
Electronics Engineering
under
Faculty of Engineering and Technology

By

Sangita Vishwas Kurumdkar

Under the Guidance of

Dr. Sangeeta M. Joshi
Guide

Dr. Laxman M. Waghmare
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Yashwanpur, Nanded-431606 (M.S.) INDIA.

June 2016

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Abstract

Wireless communication has become an integral part of our day to day life and with the advent of the technology of Internet of Thing (IOT), the infrastructure-less wireless communication became significant in many applications. In such cases, the network formations are usually ad-hoc in nature.

In a typical ad hoc network, routing protocol plays an important role. Quality of Service (QoS) can be defined as the ability of routing protocol to assign priorities to applications, users, data flow or to assign certain level of performance to a network. In view of the significance of QoS in improving the routing protocol and literature survey, it is decided to take up issues and concerns related to Quality of Service in Routing as a research work.

The primary aim of this research work is to develop a routing protocol for Mobile Ad hoc Networks with due considerations to QoS parameters like energy, end to end delay, packet delivery ratio, jitter, retransmissions, link break and throughput. Unique feature of this work is to study the multiple performance metrics viz. Energy, Delay and PDR simultaneously along with cross-layer approach as against the existing research, wherein, only one performance parameter is studied at a time i.e. without studying the effect of interdependence of performance parameters.


As a first step, towards the development of this protocol, rigorous study of basic AODV protocol for optimization of scenario metric parameters like density, node mobility, Speed, packet size, radio propagation characteristics, and topology is carried out. As a pre-requisite, Path loss exponent (n) is calculated by the empirical method.

In the second step, improved AODV (I-AODV) protocol is developed to overcome the limitations of basic AODV protocol. Significant improvement in Energy efficiency and reduction in delay is achieved in I-AODV protocol. Further, Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) are implemented using I-AODV protocol. UDP protocol gives the better performance for the specified scenario.

As a final step, I-AODV protocol is further modified to ID-AODV protocol, using directionality and dual sensing directional MAC protocol (DSDMAC) to obtain improvement in Packet Delivery Ratio (PDR). ID-AODV protocol shows significant improvement in the network performance. Further, its robustness is also verified satisfactorily by full factorial Design of Experiment (DOE) by which significant parameters and their interaction is quantified. Total of 960 experiments are formulated and conducted. This greatly facilitates the designer to generalize the model and estimate the performance of the network.

Certificate

This is to certify that, the thesis entitled "QUALITY OF SERVICE IN ROUTING", is a bonafide record of the research work carried out by Saugita V. Kurundkar under our supervision and guidance at Shri Guru Gobind Singhji Institute of Engineering and Technology, Nanded. This work is being submitted to Swami Ramanand Teerth Marathwada University, Nanded for the award of degree of Doctor of Philosophy in Electronics Engineering. The results contained in this thesis are original and have not been submitted to this or any other university for the award of any degree, diploma, associate-ship or any other similar title.



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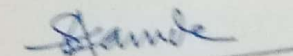
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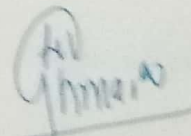


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Ph.D. Thesis titled

**Performance Optimization of Memristor:
A Nano scale Resistive Switching Device**

Submitted in partial fulfillment of the requirements of the degree of

Doctor of Philosophy

(Electronics Engineering)

By

Kirti Agashe

(Reg. No. EC-119061002)

Under the Supervision of

Dr. Nisha Sarwade

Dr. Sangeeta Joshi



(May 2017)

Department of Electrical Engineering

Veermata Jijabai Technological Institute

(Autonomous Institute Affiliated to University of Mumbai)

Mumbai – 400 019

Ph.D. Thesis titled

**Performance Optimization of Memristor :
A Nano scale Resistive Switching Device**

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VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

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Matunga, Mumbai - 400 019

Abstract

The nano scale Memristor, as introduced by Prof. Leon Chua in 1971, is a paradigm shift in the fundamental electrical circuit elements as well as in the next generation Non Volatile Memory (NVM). In 2008, Hewlett Packard research team made an attempt to demonstrate the first physical Memristor device termed as Resistive Switching Random Access Memory (ReRAM) with Pt/TiO₂/TiO_{2-x}/Pt structure.

Recently, significant research and commercial interest is observed in Memristor, due to its versatile applications in computational and logic circuits, artificial intelligence and neuromorphic systems and in ReRAM, as non volatile memory, due to its simple construction, high packaging density, high operation speed, low operational voltages, CMOS compatibility and multibit storage ability that can replace the most popular Flash memory which is facing scaling down challenges beyond 22nm.

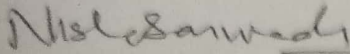
The major research issues are the optimization of device structures with variety of insulator / electrode materials and fabrication methodologies. Also the issues like post deposition annealing, unipolar switching, high forming voltages, stoichiometry control of insulators, endurance and variability need to be considered.

In the present research work, Metal-Insulator-Metal (MIM) and Metal-Insulator-Semiconductor (MIS) structures with different insulators / electrode materials are fabricated. Transition Metal Oxides such as Titanium oxide (TiO_x) and Zirconium Oxide (ZrO₂) and Rare Earth Oxides such as Neodymium oxide (Nd₂O₃) and Europium oxide (Eu₂O₃) are used as an insulating material whereas, Platinum, Aluminum and Silver are used as Electrode material. Optimization of process parameters like thin film growth temperature and Oxygen flow rate was carried out for MIS structures, using the advanced technique of Plasma Enhanced Atomic Layer Deposition (PEALD). In this research work, MIS ReRAM devices without the post deposition annealing have exhibited features such as low operational voltages, pronounced bipolar switching, satisfactory R_{OFF}/R_{ON} ratio, less power consumption, multi bit storage feature and compatibility with CMOS technology.

In years to come, as a next generation non volatile memory, ReRAM will be a part of radiation hardened space electronics applications. Present research work is therefore extended to explore the performance of the fabricated ReRAM devices after exposure to ⁶⁰Co gamma irradiation. An interesting and a significant correlation between structural changes in the material, surface morphology, weight percentage of anatase and rutile phase and its impact on bipolar resistive switching of the devices is observed after irradiating structures of Al/TiO₂/n⁺Si with ⁶⁰Co gamma radiation. This investigation will provide the necessary theoretical assistance for the use of such devices in radiation hardened space electronics in near future. This research work is funded by the Indian Nanoelectronics User Program (INUP) and The Inter-University Accelerator Centre (IUAC), New Delhi.

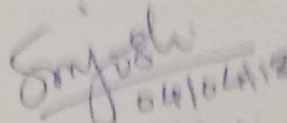
CERTIFICATE

This is to certify that **Kirti Satish Agashe** (Roll No: 119061002), Ph.D. student in Electronics Engineering has submitted a thesis titled "**Performance Optimization of Memristor: A Nano scale Resistive Switching Device**" and submitted a report on the same to our satisfaction.



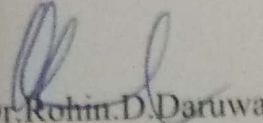
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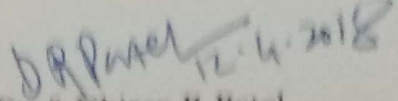
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