HYBRID MAC STRATEGY EXPLOITING MARKOV CHAIN MODEL FOR IOT ENABLED INTRA-VEHICULAR HEALTH MONITORING SYSTEM

MAHIMA KARIM

MASTER OF SCIENCE

UNIVERSITI MALAYSIA PAHANG

SUPERVISOR'S DECLARATION

We hereby declare that we have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Science.

Md. Arafatur Rahman

DR. MD. ARAFATUR RAHMAN
SENIOR LECTURER
FACULTY OF COMPUTER SYSTEMS & SOFTWARE ENGINEERING
UNIVERSITI MALAYSIA PAHANG
LEBUHRAYA TUN RAZAK, 26300 GAMBANG, KUANTAN, PAHANG.
TEL: 09-549 2250 FAX: 09-549 2144

(Supervisor's Signature)
Name of Supervisor: Dr. Md Arafatur Rahman
Position: Associate Professor
Date: 25/11/2022

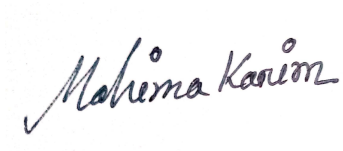
Suraya

DR. SURAYA BINTI ABU BAKAR
SENIOR LECTURER
FACULTY OF COMPUTING
UNIVERSITI MALAYSIA PAHANG
26600 PEKAN, PAHANG
TEL:09-424 4716

(Co-supervisor's Signature)
Name of Supervisor: Dr. Suraya Binti Abu Bakar
Position: Senior Lecturer
Date: 25/11/2022

STUDENTS'S DECLARATION

I hereby declare that the work in this thesis/project is my own for quotations and summaries which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.



(Student's Signature)
Name: Mahima Karim
ID number: MEG20003
Date: 23/11/2022

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Mahima Karim

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ABSTRAK

Rangkaian kenderaan yang dicipta dengan IoT telah membuka arena baharu untuk pengalaman pemanduan yang selesa dan lancar. IoT telah pun digabungkan dalam hampir setiap aspek kehidupan manusia sejak beberapa tahun yang lalu. Selama bertahun-tahun, ia telah menunjukkan perkembangan yang luar biasa dalam industri automotif. Dengan pertumbuhan eksponen penderia dan protokol komunikasi di dalam kenderaan, rangkaian dalaman kenderaan menjadi terlalu padat dan lebih kompleks dari hari ke hari. Ini menimbulkan banyak isu seperti-l QoS (Kualiti Perkhidmatan), kepadatan rangkaian, kehilangan paket, kelewatan penghantaran, pencerobohan, daya pemprosesan yang tidak memuaskan dan lain-lain. Masalah ini juga timbul bagi sistem pemantauan kesihatan kenderaan. Untuk mengatasi cabaran tersebut, adalah menjadi satu keperluan untuk membangunkan protokol komunikasi yang berkesan bagi menangani permasalahan. Dalam tesis ini, bidang tumpuan utama ialah penambahbaikan protokol MAC. TCP/IP adalah protokol komunikasi piawaian yang berasaskan kepada lima lapisan yang dapat memudahkan komunikasi antara peranti melalui internet. Protokol dan fungsi rangkaian yang ini diberi kuasa dalam setiap lapisan. Dalam penyelidikan ini, ia tertumpu sepenuhnya pada pengoptimuman lapisan MAC dalam kenderaan. Lapisan MAC hibrid adalah gabungan MAC-berasaskan-sejarah dan MAC-berasaskan-keutamaan yang menggabungkan ciri-ciri terbaik pada kedua-dua skim yang dicadangkan dalam tesis ini. Kecekapan sistem dinilai dengan mengira daya pengeluaran sistem menggunakan pengiraan rantai Markov yang dipertingkatkan serta melakukan simulasi ns-3 untuk situasi yang berbeza. Objektif penyelidikan ini adalah untuk menambah baik skalabiliti MAC dan mengurangkan trafik rangkaian dan isu kesesakan dengan menambah baik daya pemprosesan serta mengurangkan perlanggaran dan kelewatan. MAC Hibrid yang dicadangkan telah menunjukkan peningkatan yang ketara dalam pemprosesan berbanding MAC-berasaskan-sejarah dan MAC-berasaskan-keutamaan selain kecekapan dalam mengurangkan kelewatan dan perlanggaran dalam rangkaian.

ABSTRACT

Vehicular networks, coined with IoT, have opened a new arena of possibilities for a comfortable and seamless driving experience. IoT is already incorporated into almost every aspect of human life for the past couple of years. Over the years, it has also shown remarkable development in the automotive industry. With the exponential growth of sensors and communication protocols inside a vehicle, intra-vehicular networks are becoming overcrowded and more complex day by day. This raises many issues, such as degraded QoS (Quality of Service), network congestion, packet loss, transmission delay, intrusions, unsatisfactory throughput, etc. These problems are also apparent in vehicular health monitoring systems. To overcome such challenges, it is necessary to develop an elaborate communication protocol to address them. In this thesis, the main area of focus was improving MAC protocol. TCP/IP is a five-layer standardized communication protocol that facilitates communication between devices over the internet. Unique network protocols and functions are authorized for each of the five layers. In this research, the work is fully focused on optimizing the MAC layer in vehicles. A hybrid MAC layer is a history-based and priority-based MAC combining the best features of both schemes proposed in this thesis. Here, the efficiency of the system is evaluated by calculating the system's throughput using enhanced Markov chain calculation as well as doing ns-3 simulation for different conditions. The objective of this research is to improve MAC's scalability and mitigate network traffic and congestion issues by improving the throughput and reducing collision and delay. The proposed Hybrid MAC shows a significant increase in throughput compared to history-based MAC and priority-based MAC, as well as efficiency in mitigating delay and collision in the network.

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