A Review MAC Layer Protocol for Powered Wireless Sensor Network

Sachin Barasker
M. Tech. Scholar
Digital Communication
PCST, Bhopal (M.P.)

Mr. Jitendra Mishra
Associate Professor & HOD
Department of Electronics & Communication
PCST, Bhopal (M.P.)

ABSTRACT

The current age of technology incorporated the impact the sensor network. The efficiency of energy is major role in sensor network. The process of power used battery. Now most of authors followed the location based and heretical based protocol for minimization process of energy factor in wireless sensor network. In consequence of efficient energy and route cost minimization one is very famous MAC layer protocol is call radio frequency MAC layer protocol. In the process of improvement of RF-MAC protocol one protocol are available such are called as DCF. Basically, DCF protocol is a combination of two different frame protocols for the processing of energy saving mode and cost.

Keywords: Sensor, WSN, MAC, RF-MAC, HE-MAC.

INTRODUCTION

Wireless sensor networks (WSNs) are widely used in various areas, such as infrastructure monitoring systems, smart grid systems, smart home systems, and internet of things (IoT) systems. Conventional nodes in WSNs are frequently battery operated, and their lifetime is constrained by the capacity of their battery. Due to the limitations in device size and weight, the capacity of the battery of IoT devices is limited, and the network protocol design has to consider the energy constraint. Energy harvesting (EH) is the process of opportunistically receiving energy from the surrounding environment, such as solar, piezoelectric, thermal, and radio frequency (RF) to extend a device's lifetime. Combining EH technology with WSNs is of significant interest due to the potential advantages to eventually achieve self-sustained WSNs with infinite lifetimes, which is why research in wireless powered sensor networks (WPSNs) is rapidly growing. In RF based EH technology, a node converts ambient RF signals or transferred RF power into electricity [1]. There are two types of wireless power transfer (WPT) technologies, which are near-field WPT technologies and far-field WPT technologies. Among WPT based EH technologies, far-field RF based EH schemes have received the most interest due to its clear advantage, which is the capability to harvest energy continuously and stably in many kinds of radio environments. Therefore, far-field RF energy transfer (ET) and EH are the main parts of wire-less self-sustained energy charging technologies. However, the fundamental limitation of far-field RF based EH technologies is the high attenuation over longer distances. Although far-field RF based EH technologies can provide significant benefits, due to the limitations in practical deployment, far-field RF based EH technologies have not been implemented in commercial products yet. However, recent improvements in low cost directional antenna technologies and low power consuming RF circuit/device technologies have been developed. Based on the recent improvements in technologies, commercial products will be available. WPSNs are the most widely applied application for far-field RF based EH technologies, which can be implemented to supply energy to WPSNs composed of a large number of nodes. In addition, wireless body networks are another attractive application for far-field RF based EH technologies[2-3]. In the rest part of described the literature survey in section II, problem domain in section III, HE-MAC system model in section IV. Finally discussed the conclusion in section V.

II. LITERATURE SURVEY

Taeyoung Ha, Junsung Kim and Jong-Moon Chung al. [1] HE-MAC scheme for WPSNs is discussed, which is based on a harvest-then-transmit and modified EDCF mechanism. HE-MAC efficiently coordinates data transmission of nodes and the RF ET pattern of HAPs, where they operate in the same radio band. First, HE-MAC's modified EDCF protocol was analysed based on Markov chain modelling. Then, based on the obtained steady-state probabilities of the Markov chain, RF ET for additional harvested energy was maximized while the QoS constraint is satisfied. Based on the simulation results, the performance of HE-MAC was shown to be superior compared to the other two representatives EH protocols RF-MAC and DOS for the number of nodes between 4 and 10.

Manxi Wang, Haitao Xu and Xianwei Zhou al. [2] they have discussed a cooperative dynamic game-based model that maximizes the network utility considering the SINR requirements and energy variations, achieved by cooperatively optimal allocation of the information transmission power. In the discussed game model, the researched wireless sensor networks are powered by the RF energy sources. The energy variations are considered as the system state of the wireless sensor networks, and the sensors can control their information transmission power based on the grand coalition solutions and the non-cooperative Nash equilibrium. Based on the simulation results, it can be seen that their discussed model can achieve optimal power control.

Boris Bellalta, Luciano Bononi, Raffaele Bruno and Andreas Kassler Et al. [3] they first describe the three key scenarios in which next-generation WLANs will have to operate. they then review the most relevant amendments for each of these use cases focusing on the additional functionalities and the new technologies they include, such as multi-user MIMO techniques, groupcast communications, dynamic channel bonding, spectrum databases and channel sensing, enhanced power saving mechanisms and efficient small data transmissions. they also discuss the related work to highlight the key issues that must still be addressed. Finally, they review emerging trends that can influence the design of future WLANs, with special focus on software-defined MACs and the internet working with cellular systems.

Henrique Moura, Gabriel V. C. Bessa, Marcos A. M. Vieira and Daniel F. Macedo Et al. [4] This paper described the architecture and a prototype of Ethanol, an SDN approach for the management and control of dense wireless networks. Ethanol extends the SDN concept to allow the programmability of wireless APs, by providing an API for QoS, security, mobility and virtualization of wireless networks. Besides improved QoS, performance and security, they argue that SDN-enabled APs will also be used for the creation of context and location aware services. they present the architecture of an SDN-enabled dense WLAN, as well as the methods, properties and events of the control API. Ethanol was evaluated on a prototype developed with cheap, off-the-shelf APs. The experiments indicated that the network performance can be enhanced by programmable APs, allowing an even distribution of clients among APs, the filtering of unwanted traffic, as well as the implementation of QoS policies specific to the wireless medium.

Aqsa Malik, Junaid Qadir, Basharat Ahmad, Kok-Lim Alvin Yau and Ubaid Ullah Et al. [5] They provide an overview of these techniques. they discuss the QoS features incorporated by the IEEE 802.11 standard at both physical (PHY) and media access control (MAC) layers, as well as other higher-layer proposals. they also focus on how the new architectural developments of software-defined networking (SDN) and cloud networking can be used to facilitate QoS provisioning in IEEE 802.11-based networks. they conclude this paper by identifying some open research issues for future consideration.

Vikas Bhandary, Amita Malik and Sanjay Kumar Et al. [6] The development of multimedia nodes has led to the creation of another intelligent distributed system, which can transfer real-time multimedia traffic, ubiquitously. Wireless multimedia sensor networks (WMSNs) are applicable in a wide range of areas including area monitoring and video surveillance. But due to unreliable error-prone communication medium and application specific quality of service (QoS) requirements, routing of real-time multimedia traffic in WMSNs poses a serious problem. The paper discusses various existing routing strategies in WMSNs, with their properties and limitations which lead to open research issues. Further, detailed classification and analytical comparison of discussed protocols are also presented.

Marjan Yazdani, Maryam Kamali, Neda Moghim and Mahdieh Ghazvini Et al. [7] In this paper, some discussed mechanisms are evaluated and according to their evaluated strengths and weaknesses, a new mechanism is discussed for TXOP determination in IEEE 802.11e wireless networks. The new algorithm considers data rate, channel error rate and data packet lengths to calculate adaptive TXOPs for the stations. The simulation results show that the discussed algorithm leads to better fairness. They determine the new TXOP adaptive to the network's traffic condition. Some of these protocols were investigated in this paper and their advantages and disadvantages were discussed. Considering the drawbacks, an algorithm was discussed that takes different effective factors into account for the TXOP determination. The simulation results showed that the discussed algorithm leads to better fairness and network throughput. Furthermore, packets' delay improves.

Naveed Farhana and Dr HSN Murthy Et al. [8] In today's life wireless network is being used everywhere in homes, offices, Universities, Shopping malls and as a hot spot etc. Due to its diversification and development, it is affecting the throughput and hence the quality of service. The aim of this paper is to provide the survey of QOS mechanism used by the previous researchers and also the open challenges are discussed based on their Research Articles. Finally, they also discuss trends and the scenarios for the wireless network and highlighted the key issues that must still be addressed, like contention aware transmission,

power requirements etc., for the performance of the wireless network and to improve the Quality of service.

Rashid Ali, Sung Won Kim, Byung-Seo Kim and Yongwan Park Et al. [9] they first summarized the IEEE 802.11 standardization activities in progress and presented an overview of resource allocation under the 802.11 MAC protocol. Subsequent sections defined the key elements and challenges to designing an efficient MAC-RA scheme for WLANs. Secondly, they outlined the expected features and challenges for IEEE 802.11ax in the design of MAC-RA. In the later sections, design considerations when devising efficient medium allocation were discussed through associated research work. Towards the entire HEW design, there remain many interesting research topics that require further investigation. The optimized intelligent collision resolution scheme for STAs in dense environments needs to be developed. The use of grouping STAs for contention under IEEE 802.11ah needs to be further investigated for dynamic communications scenarios. Similarly, splitting the dense networks into multiple collision domains to reduce collisions in the WLAN network can be a good topic for consideration.

Akram A. Almohammedi, Nor K. Noordin, A. Sali, Fazirulhisyam Hashim and Abdulmalek Al-Hemyari Et al. [10] In this paper, they present an improved 1-D and 2-D Markov chain models for both safety and non-safety applications concurrently, to analyse and evaluate the performance of HER-MAC protocol under non-saturated conditions, in which a buffer was added to hold the packets during traffic arrival when the channel is busy. Back-off freezing along with short retry limit were considered in their models to accommodate the IEEE 802.11p specifications to obtain an accurate system packet delivery ratio. The models' performance was evaluated based on TDMA and CSMA/AC access methods. The packet delivery ratio was the only metric chosen to evaluate the models' performance under different number of vehicles and contention window sizes. The simulation results have validated the analytical results of their models.

Taner Cevik, Alex Gunagwera and Nazife Cevik Et al. [11] the general architecture of WMSNs was presented along with challenges and issues associated with achieving efficient, error-resilient and energy aware WMSNs. MM sensors that have come along and those present today with their respective features were also reviewed, previous studies in the field were complemented, open research areas were pointed out, with the present applications of WMSNs already in operation. Prominent solutions to some of the challenges and issues that have been associated with WMSNs, progress in the field and some of the most promising studies in the area were also presented.

Abdelillah Karouit, Luis Orozco Barbosa, Fernando Ramírez-Mireles and Abdelkrim Haqiq Et al. [12] They define the power control scheme in such a way that the leader first chooses the lowest power to transmit its packets among N available levels whereas the followers re-transmit by randomly choosing a power level picked from $N-1$ higher distinct power level. Using a 3D Markovian model, they compute the steady state of the system and derive the average system throughput and expected packet transmission delay. Their numerical results show that the discussed scheme considerably improves the global performance of the system avoiding the well-known throughput collapse at high loads commonly characterizing most random channel access mechanisms.

Macha Sarada & Dr. Avula Damodaram Et al. [13] In the present studies the primary principles and techniques of designing multimedia streaming in IEEE 802.11 networks are provided for enhancing the performance. In the existing IEEE 802.11 standard implementation there are many new challenges that have to be fully studied in future research experiments. The open technical problems discussed require further research to find solutions for important challenges like scheduling between primary and alternate queues, and mapping of individua l frames to multiple queues for ac hieving graceful voice/video quality degradation.

Habib Azizi Et al. [14] Wireless networks have important roles in telecommunication especially in a long distance, therefore, the study of different wireless networks is more highlighted. In this paper, wireless networks such as WLAN, WiMAX and satellites are considered. Also, in recent years, the integration of these networks which are applied in different fields of telecommunication are increasing. These applications are used for different purposes, including architecture, QoS, coverage and hardware. Therefore, in this study, a brief review is done on recent works on these networks as well as their integration.

III. PROBLEM DOMAIN

The reason for this exposition is to limit the vitality utilization of remote sensor organizes amid the choice of group set out toward transmission of information for base station. Remote sensor hubs which are battery worked are utilized for distinguishing and gathering data from the territories where there is almost no extension for manual dealing with to energize or change batteries. These detecting hubs gather the data and pass them on to the system towards the sink for additionally

activities. For a superior working and a more extended lifetime for a detecting hub inside the system, we have to consider its vitality utilization as a main consideration of concern. During the time spent study found that some convention is exceptionally productive, for example, DCF and RFMAC. The DCF convention takes a shot at versatile way of energy utilization. What's more, the RFMAC convention in light of directional zone of sensor node. In the entire procedure some purpose of data is missing, for example, data connection between determination procedures of group head. Some issue talks about here in type of point.

- In RFMAC convention the group head hub change expends more vitality. Due to conveyance of hub the estimation of vitality is extremely troublesome.
- If the round-Trip Time is incrementing the lifetime of system is diminishes.

IV. HE-MAC SYSTEM MODEL

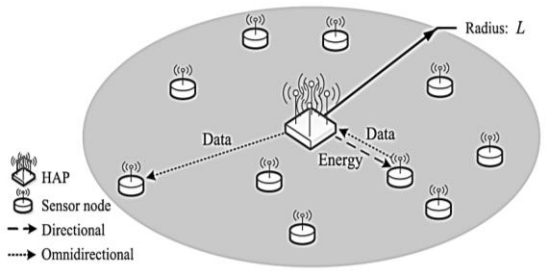

Figure 1: An overview of the WPSN system.

As shown in figure, a MISO system is considered where the HAP is equipped with NHAP antennas, and sensor nodes are equipped with a single antenna (i.e., $N_{node} = 1$), where N_{node} is the number of antennas of the sensor nodes. This network structure was considered as it is currently a commonly deployed model. In addition, each sensor node can buffer only one frame, and therefore, if a new frame is generated at a sensor node that already has a frame in its queue, then the newly generated frame will be discarded. Considering the requirement of frequency channel sharing in the given system model, the HAP and sensor nodes work in a half-duplex mode, hence it is assumed that data frame transmission and ET do not occur simultaneously. The HAP can transmit either data frames or energy pulses to sensor nodes, and sensor nodes can transmit a data frame to the HAP. Energy is transferred from the HAP to a sensor node with beamformed pulses to increase the efficiency of ET. In order to avoid collision among frames and conserve energy of the sensor nodes, the HAP and sensor nodes transmit frames omnidirectionally for data communications. The omnidirectionally transmitted frame is used to update the network allocation vector (NAV) value of the neighboring nodes, and the sensor nodes that detect this message remain idle during the NAV duration.

The assumed network model is composed of n stationary identical sensor nodes, and sensor nodes are located on a circular area of radius L m, where the HAP is located at the center of the area. In addition, sensor nodes are uniformly distributed in a circular area of radius L. At each sensor, a data frame is randomly generated according to a Poisson process and its rate is Î» (in units of frames per second). In addition, a data frame is occasionally generated at each node. A qualities channel model with perfect CSI is assumed for the HAP and sensor nodes, where the CSI can be acquired through the RTS/CTS access mechanism.

V. CONCLUSIONS

In this paper study the process of energy saving in MAC layer for powered wireless sensor network. The sensor operates the tiny size battery and limited energy. The harvesting of energy is new area of Reacher in wireless sensor network. Various authors discuss about the radio frequency-based communication scheme for wireless sensor network. Some authors used DCF and improved DCF function for the processing of energy function. In future used optimization process for the improvement of powered based wireless sensor network.

REFERENCES

[1] Taeyoung Ha, Junsung Kim and Jong-Moon Chung "HE-MAC: Harvest-Then-Transmit Based Modified EDCF MAC Protocol for Wireless Powered Sensor Networks", IEEE, 2018, Pp 3-16.

[2] Manxi Wang, Haitao Xu and Xianwei Zhou "Cooperative Dynamic Game-Based Optimal Power Control in Wireless Sensor Network Powered by RF Energy", Sensors, 2018, Pp 1-10.

[3] Boris Bellalta, Luciano Bononi, Raffaele Bruno and Andreas Kassler "Next generation IEEE 802.11 Wireless Local Area Networks: Current status, future directions and open challenges", Computer Communications, 2015, Pp 1–25.

[4] Henrique Moura, Gabriel V. C. Bessa, Marcos A. M. Vieira and Daniel F. Macedo "Ethanol: Software Defined Networking for 802.11 Wireless Networks", IEEE, 2015, Pp 1-9.

[5] Aqsa Malik, Junaid Qadir, Basharat Ahmad, Kok-Lim Alvin Yau and Ubaid Ullah "QoS in IEEE 802.11-based Wireless Networks: A Contemporary Survey", arXiv, 2015, Pp 1-25.

[6] Vikas Bhandary, Amita Malik and Sanjay Kumar "Routing in Wireless Multimedia Sensor Networks: A Survey of Existing Protocols and Open Research Issues", Hindawi Publishing Corporation, 2016, Pp 1-25.

[7] Marjan Yazdani, Maryam Kamali, Neda Moghim and Mahdieh Ghazvini "A Fair Access Mechanism Based on TXOP in IEEE 802.11e Wireless Networks", IJCNIS, 2014, Pp 11-17.

[8] Naveed Farhana and Dr HSN Murthy "QOS in Wireless Network- Current Trends and Future Directions", IOSR, 2016, Pp 1-7.

[9] Rashid Ali, Sung Won Kim, Byung-Seo Kim and Yongwan Park "Design of MAC Layer Resource Allocation Schemes for IEEE 802.11ax: Future Directions", IETE, 2016, Pp 1-26.

[10] Akram A. Almohammedi, Nor K. Noordin, A. Sali, Fazirulhisyam Hashim and Abdulmalek Al-Hemyari "An Accurate Performance Analysis of Hybrid Efficient and Reliable MAC protocol in VANET under Non-Saturated Conditions", IJECE, 2017, Pp 999-1011.

[11] Taner Cevik, Alex Gunagwera and Nazife Cevik "a survey of multimedia streaming in wireless sensor networks: progress, issues and design challenges", IJCNC, 2015, Pp 95-114.

[12] Abdelillah Karouit, Luis Orozco Barbosa, Fernando Ramírez-Mireles and Abdelkrim Haqiq "Hierarchical Slotted Wireless Random Channel Access with Power Control", Hindawi Publishing Corporation, 2015, Pp 1-15.

[13] Macha Sarada & Dr. Avula Damodaram "Review of 802.11 based Wireless Local Area Networks and Contemporary Standards: Features, Issues and Research Objectives", Global Journal of Computer Science and Technology: E Network, Web & Security, 2016, Pp 41-47.

[14] Habib Azizi "A Brief Review on Wireless Networks", IRJET, 2017, Pp 329-334.