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A MAC PROTOCOL FOR COGNITIVE WIRELESS BODY AREA SENSOR NETWORKING

[1]Dr. A.P.Adsul, [2]Shradha Baldota, [3]Samruddhi Kahane
[4]Pratik Kasat, [5]Parimiti Wase

Joseph Mitola III and Gerald reQ. Maguire,
Jr.Royal Institute of Technology

ABSTRACT

The increasing use of wireless networks and the constant miniaturization of electrical devices have empowered the development of Wireless Body Area Networks (WBANs). Wireless Body Sensor Networks (BSNs) in healthcare systems operate under conflicting requirements. These are the maintenance of the desired reliability and message latency of data transmissions, while simultaneously maximizing battery lifetime of individual body sensors. In doing so, the characteristics of the entire system, including physical, medium access control (MAC), and application layers have to be considered. In this paper, a Cognitive Radio based Medium Access Control (CR-MAC) protocol for Wireless Body Area Sensor Networks (WBASN) that utilizes cognitive radio transmissions proposed. The CR-MAC protocol prioritizes the critical packets access to the transmission medium by transmitting them with higher power while transmitting lower priority packets using lower transmission power. At the receiver, a higher priority packet experience collision only when there are more than one critical packet transmission at the same time slot while non critical packets experience collision when there are more than one transmission at the same time slot. This work makes known the AODV as well as the CR-MAC protocols. Moreover reveals the comparison between the AODV protocol and the CR-MAC protocol.

Keywords: WPANs, WBAN, MAC, QoS, Cognitive Radio

1. Introduction

In WBANs various sensors are attached on clothing or on the body or even implanted under the skin. The wireless nature of the network and the wide variety of sensors offer numerous new, practical and innovative applications to improve health care and the Quality of Life. The sensors of a WBAN measure for example the heartbeat, the body temperature or record a prolonged electrocardiogram. Using this WBAN we use the Wireless Body Area Sensor Networking, in which sensors are developed. A typical wireless body area network (WBAN) comprises of a number of wireless sensor nodes and a body gateway. It is a distributed system with various hardware configurations and operating systems. The middleware layer bridges between applications and the underlying networking/RTOS protocol stack so as to simplify the application development, and make codes re-usable from one application to another.

The packets are sent on the basis of priority and comparison is to be done between the AODV and CR-MAC Protocol. As compared to AODV, CRMAC has reduced Delay, needs less Energy and the packet Delivery Ratio is more. As some networks have a need to give priorities to several packets on the network, so to overcome this problem this work supports for developing a protocol named CR-MAC protocol. This CR-MAC protocol is used to give priorities. At the receiver, a high priority packet experience collision only when there are more than one Critical packet transmission at same time slot while Non-critical packets experience collision when there are more than one transmission at same time slot.

The contribution of this paper is to investigate the performance of the proposed Cognitive Radio-based MAC (CRMAC) protocol which can be employed in medical WBASNs. The performance of the CR-MAC protocol is analyzed through analysis of the Delay, packet delivery ratio and energy for packets.

2. Architecture Diagram

The Figure 1 shows that the data packets are sent from the sender and the nodes are divided on the basis of priority. The packets having higher priority are the Critical packets and others are Non-Critical packets. The packets are transmitted on the basis of their priority.

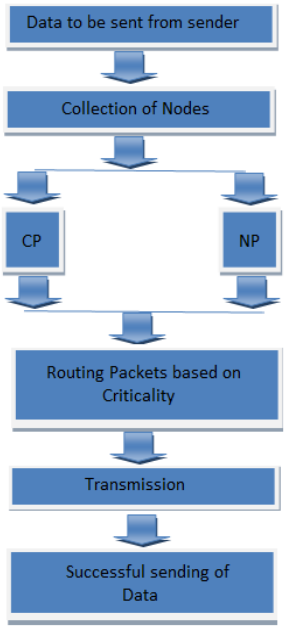

Figure 1: System Architecture

3. System Implementation and results

The system is implemented with the protocol such as AODV and CR-MAC. The protocol evaluation is done on basis of various parameters such as delay, packet delivery ratio and energy. The Results are comparison graphs of AODV and CRMAC protocol based on the parameters delay, packet delivery ratio and energy.

3.1 CR-MAC Performance Evaluation-

CR-MAC Performance Evaluation is based on the three parameters Delay, Energy and Packet Delivery Ratio.

Delay-

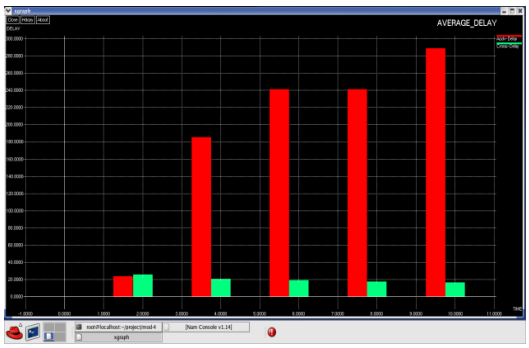

Figure 2: Delay of 50 nodes in AODV and CR-MAC

The Delay bar graph shown above is of AODV (red in colour) and CR-MAC (green in colour) with 50 nodes. The graph is Time Vs Delay. In CR-MAC delay is less.

Energy-

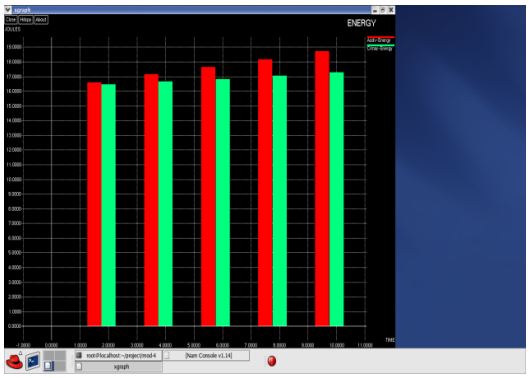

Figure 3: Energy of 50 nodes in AODV and CR-MAC

The Energy bar graph shown above is of AODV (red in colour) and CR-MAC (green in colour) with 50 nodes. The graph is Time Vs Joules. In CR-MAC the required Energy to complete the process is less.

Packet Delivery Ratio (PDR)-

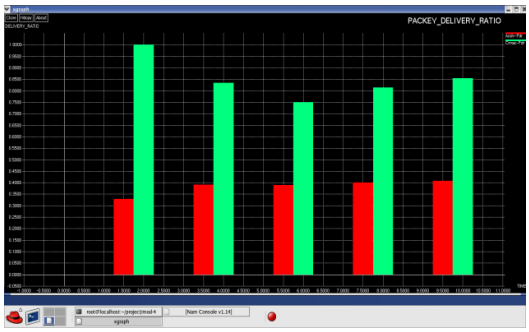

Figure 4: PDR of 50 nodes in AODV and CR- MAC

The Packet Delivery Ratio graph shown above is of AODV (red in colour) and CR-MAC (green in colour) Protocol with 50 nodes. The graph is Time Vs Delivery Ratio. In CR-MAC Delivery Ratio is more.

The Graphs will conclude that the CR-MAC Protocol has reduced Delay, consumes less Energy and Packet Delivery Ratio is more as compared to AODV Protocol. The CR-MAC will send the packets based on the priorities of the packet.

4. Conclusion-

In this protocol, critical traffic is transmitted using higher transmission power and non-critical traffic is transmitted using lower transmission power. As the number of packet retransmission exceeds a certain value, non-critical packet throughput declines sharply and its packet rejection rate increase dramatically due to the increased number of backlogged packet of both critical and non-critical traffic. The CR-MAC Protocol has reduced Delay, consumes less Energy and Packet Delivery Ratio is more as compared to AODV Protocol.

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References

[1] Highly Reliable Energy-Saving MAC for Wireless Body Sensor Networks in Healthcare Systems (IEEE Journal On Selected Areas in Communications, 27(4):553 -565, May 2009.)AUTHORS- Begonya Otal, Luis Alonso, Member, IEEE, Christos Verikoukis, Senior Member, IEEE

[2] MAC layer design for UWB LDR systems: PULSERS proposal (Workshop on Positioning, Navigation and Communication 2007 WPNC'07, pages 277 -2837, March 2007.)AUTHORS- I. Bucaille, A. Tonnerre, L. Ouvry, and B. Denis.MAC layer design for UWB LDR systems: PULSERS proposal

[3] Dual-mode real-time mac protocol for wireless sensor networks: a validation/simulation approach (International Conference on Integrated Internet Ad Hoc and Sensor Networks, 138(2):2, May 2006.172) AUTHORS- T. Watteyne, I. Augt'e-Blum, and S. Ubt'eda.

[4] A Wireless Sensor Networks MAC protocol for real-time applications (International Conference on Integrated Internet Ad Hoc and Sensor Networks, 12(2):111-122, November 2006.)AUTHORS- E. Egea-Lopez J. Vales-Alonso A. S. Mart?nez-Sala J.Garc?a-Haro P. Pavon-Marino M. V. Bueno Delgado

[5] Cognitive Radio: Brain-Empowered Wireless Communications (IEEE Journal on Selected Areas in Communications, 23(2):201 -220, February 2005.) AUTHOR-Simon Haykin, Life Fellow, IEEE

[6] Analysis of the Performance of IEEE 802.15.4 for Medical Sensor Body Area Networking (IEEE Conference on Sensor and AdHoc Communications and Networks, pages 16 -24, October 2004.) AUTHORS- Nicholas F. Timmons, William G. Scanlon

[7] IEEE 802.15.4:Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (WPANs)IEEE, October 2003.)AUTHORS- N. Golmie, D. Cypher, O. Rebala

[8] Cognitive Radio: Making Software Radios More Personal (IEEE Personal Communications, 6(4):1318, August 1999.)

AUTHORS- JosephMitola III and Gerald reQ. Maguire, Jr.Royal Institute of Technology