International Journal of Electrical, Electronics and Mechanical Controls
ISSN (Online) : 2319-7501
Volume 3 Issue 2 May 2014
Manuscript ID : ISSN23197501-V3I2M3-052014

A NEW MULTI MAC APPROACH FOR POWER OPTIMIZATION IN WIRELESS SENSOR NETWORKS

Waleed Hadi Madhloom Kurdi, Amit Bindal

[1]*Department of Computer Science*
Maharishi Markandeshwar University
Mullana, India

[2] *Associate Professor*
Department of Computer Science
Maharishi Markandeshwar University
Mullana, India

ABSTRACT

The wireless sensor network is built of virtually interconnected nodes that can vary from a few to several hundreds or even thousands. Each such sensor network node has typically several parts: a radio transceiver with an internal antenna or connection to an external antenna, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, usually a battery or an embedded form of energy harvesting. The topology of the WSNs can vary from a simple star network to an advanced multi-hop wireless mesh network. In existing Mac protocol, each node will attempt to transfer the packets unaware of the mode. Each node will transfer packet to other nodes even though the destination node in sleep mode and in this Mac protocol, more than one node that are close to each other sense the same event and they need to transmit the data where these nodes are picked randomly. This results in collision and energy consumption. In the proposed approach, power consumption can be reduced by designing the power-aware communication protocols in the data link layer and more specifically in the Media Access Control (MAC) layer protocols. MAC protocols are needed to control access to a shared medium by defining how and when nodes may access the medium. The energy consumption in MAC protocols mainly happens when the node is just listening and waiting for a packet to be sent. Efficient MAC protocols have a great effect on the power consumption for wireless sensor networks as they affect the efficiency of controlling and exchanging data. In this proposed protocol, Sensor nodes have very short listening time which would reduce the energy that is required to communicate with other nodes by switching off the port for as long as possible.

Keywords - Power Optimization, Wireless Sensor Networks

INTRODUCTION

In mobile network, nodes involved in communication initially has hundred percentage of power once it started performing packet transfer, the battery power decreases tremendously, at one point the network disconnects because of empty battery backup of sender node or any other node in that network.

Power Optimization is one of the major area of research in wireless sensor networks. Recent advances in the computing and networking have enabled the WSNs to realize ambient intelligence, which is a vision by which environment becomes smart, friendly, context-aware, as well as responsive to human needs. A WSN is the network composed of sensor nodes in a sensor field to cooperatively monitor physical or environmental conditions such as temperature, humidity, vibration, or pressure. In WSN, the sink node collects data from sensor nodes within the sensor field. A sink node may also send queries, program updates, or control packets to sensor nodes. Sensor nodes detect events in the sensor field, perform local data processing and then transmit data to the base-station. A sensor node is composed of many hardware components. Transceiver is a major energy consumer component in a sensor node because communication is one of the most energy expensive tasks; as compared to data processing.

LITERATURE SURVEY

[1] One of the limitations of wireless sensor nodes is their inherent limited energy resource. Besides maximizing the lifetime of the sensor node, it is preferable to distribute the energy dissipated throughout the wireless sensor network in order to minimize maintenance and maximize overall system performance. Any communication protocol that involves synchronization of peer nodes incurs some overhead for setting up the communication. So here this work study various energy-efficient routing algorithms and compare among themselves. This work take into account the setup costs and analyze the energy-efficiency and the useful lifetime of the system. In order to better understand the characteristics of each algorithm and how well they really perform, this work also compare them with an optimum clustering algorithm.

[2] Development of energy efficient Wireless Sensor Network (WSN) routing protocol is nowadays main area of interest amongst researchers. This research is an effort in designing of energy efficient Wireless Sensor Network (WSN) routing protocol, under certain parameters consideration. Research report discusses various existing WSN routing protocols and propose a new Location Aware (LA) WSN energy efficient routing protocol. Results show a significant improvement in life cycle of the nodes and enhancement in energy efficiency of WSN

[3] Wireless sensor networks are employed in several applications, including military, medical, environmental and household. In all these applications, energy usage is the determining factor in the performance of wireless sensor networks. Consequently, methods of data routing and transferring to the base station are very important because the sensor nodes run on battery power and the energy available for sensors is limited. In this paper this work intend to propose a new protocol called Fair Efficient Location-based Gossiping (FELGossiping) to address the problems of

Gossiping and its extensions. This work show how our approach increases the network energy and as a result maximizes the network life time in comparison with its counterparts. In addition, this work show that the energy is balanced (fairly) between nodes. Saving the nodes energy leads to an increase in the node life in the network, in comparison with the other protocols. Furthermore, the protocol reduces propagation delay and loss of packets.

[4] The wide utilization of Wireless Sensor Networks (WSNs) is obstructed by the severely limited energy constraints of the individual sensor nodes. This is the reason why a large part of the research in WSNs focuses on the development of energy efficient routing protocols. In this paper, a new protocol called Equalized Cluster Head Election Routing Protocol (ECHERP), which pursues energy conservation through balanced clustering, is proposed. ECHERP models the network as a linear system and, using the Gaussian elimination algorithm, calculates the combinations of nodes that can be chosen as cluster heads in order to extend the network lifetime. The performance evaluation of ECHERP is carried out through simulation tests, which evince the effectiveness of this protocol in terms of network energy efficiency when compared against other well-known protocols

[5] Wireless sensor nodes can be deployed on a battlefield and organize themselves in a large-scale ad-hoc network. Traditional routing protocols do not take into account that a node contains only a limited energy supply. Optimal routing tries to maximize the duration over which the sensing task can be performed, but requires future knowledge. As this is unrealistic, this work derive a practical guideline based on the energy histogram and develop a spectrum of new techniques to enhance the routing in sensor networks. Our first approach aggregates packet streams in a robust way, resulting in energy reductions of a factor 2 to 3. Second, this work argue that a more uniform resource utilization can be obtained by shaping the traffic flow. Several techniques, which rely only on localized metrics are proposed and evaluated. This work show that they can increase the network lifetime up to an extra 90% beyond the gains of our first approach.

[6] Networking together hundreds or thousands of cheap microsensor nodes allows users to accurately monitor a remote environment by intelligently combining the data from the individual nodes. These wireless networks require robust routing protocols that are energy efficient and provide low latency. Starting from the basic idea of classical LEACH (Low Energy Adaptive Clustering Hierarchy), in this paper this work introduce some innovations in the algorithm giving origin to LEACH-B. LEACH- B presents a new strategy of cluster heads election and cluster formation. Our results show that LEACH-B optimizes system lifetime in a large range of situations and applications.

[7] Wireless sensor networks are used for structure monitoring and border surveillance. Typical applications, such as sensors embedded in the outer surface of a pipeline or mounted along the supporting structure of a bridge, feature a linear sensor arrangement. Economical power use of

sensor nodes is essential for long-lasting operation. In this paper, this work present MERR (Minimum Energy Relay Routing), a novel approach to energy-efficient data routing to a single control center in a linear sensor topology. Based on an optimal transmission distance, relay paths are established that aim for minimizing the total power consumption. This work study MERR by both stochastic analysis and simulation, comparing it to other possible approaches and a theoretically optimal protocol. This work find that MERR consumes 80% less power than conventional approaches and performs close to the theoretical optimum for practicable sensor networks.

[8] Wireless sensor networks consist of small battery powered devices with limited energy resources. Once deployed, the small sensor nodes are usually inaccessible to the user, and thus replacement of the energy source is not feasible. Hence, energy efficiency is a key design issue that needs to be enhanced in order to improve the life span of the network. Several network layer protocols have been proposed to improve the effective lifetime of a network with a limited energy supply. In this article, the work propose a centralized routing protocol called Base-Station Controlled Dynamic Clustering Protocol (BCDCP), which distributes the energy dissipation evenly among all sensor nodes to improve network lifetime and average energy savings. The performance of BCDCP is then compared to clustering-based schemes such as Low- Energy Adaptive Clustering Hierarchy (LEACH), LEACH-centralized (LEACH-C), and Power-Efficient Gathering in Sensor Information Systems (PEGASIS). Simulation results show that BCDCP reduces overall energy consumption and improves network lifetime over its comparatives

EXISTING TECHNIQUE

In existing technique, the protocol follows the *sleep/power down mode* approach. This approach minimizes the battery power consumption of the mobile node to a particular limit. The steps followed in this approach are as follows.

Step 1

The nodes participating in a network has two modes, *sleep* mode and *awake* mode.

Step 2

Initially all the nodes are *sleep* mode, only the nodes that are need to transfer the packet to destination node are in *awake* mode.

Step 3

Once the sender node starts sending packet to its neighbouring node, then it goes to *sleep* mode. The neighbouring node or adjacent node comes to *awake* mode to transfer the packet till it reaches the destination node.

Step 4

The nodes holding the packets and node going to receive the packet are in *awake* mode. All other nodes are in *sleep* mode.

CLASSICAL APPROACH

- The locations of the sensors nodes are not known or defined in advance, due to their deployment is random.
- The protocols designed for wireless sensor network should be self-organizing.
- The topology of the wireless sensor network changes very frequently due to node failure and addition or replacement

of nodes. Existing Mac Protocol will run only in one-phase.

- This divides time into frames and each frames is divided into active & sleep periods. The ratio of the active period to the frame length is called the duty cycle.
- Transfer occurs only in active mode.
- In existing Mac protocol, each node will attempt to transfer the packets unaware of the mode.
- Each node will transfer packet to other nodes even though the destination node in sleep mode and in this Mac protocol, more than one node that are close to each other sense the same event and they need to transmit the data where these nodes are picked randomly. This results in collision and energy consumption.

PROPOSED APPROACH

- The power consumption can be reduced and optimized by applying the algorithmic approach on multiple layers after fragmentation rather than single congestion based approach.
- Using Multi MAC protocols, the network is needed to control access to a shared medium by defining how and when nodes may access the medium.
- The energy consumption in MAC protocols mainly happens when the node is just listening and waiting for a packet to be sent.
- Efficient MAC protocols have a significant effect on the power consumption for wireless sensor networks as they affect the efficiency of controlling and exchanging data.
- There is the need to design a new Multi-Phase Mac to reduce energy consumption by reducing the Idle listening time & also reducing the probability of collision.
- In this proposed Multi-Phase Mac protocol, Sensor nodes have very short listening time which would reduce the energy that is required to communicate with other nodes by switching off the port for as long as possible.
- The listen period for the nodes in each phase is reduced in proportion to number of phases employed.
- This results in reduced energy consumption.
- The number of nodes associated with a phase is a fraction of the total nodes in the network.
- This results in less average traffic and a reduced change of collisions.
- By reducing the energy consumption in the nodes, the lifetime of nodes & network are increased.

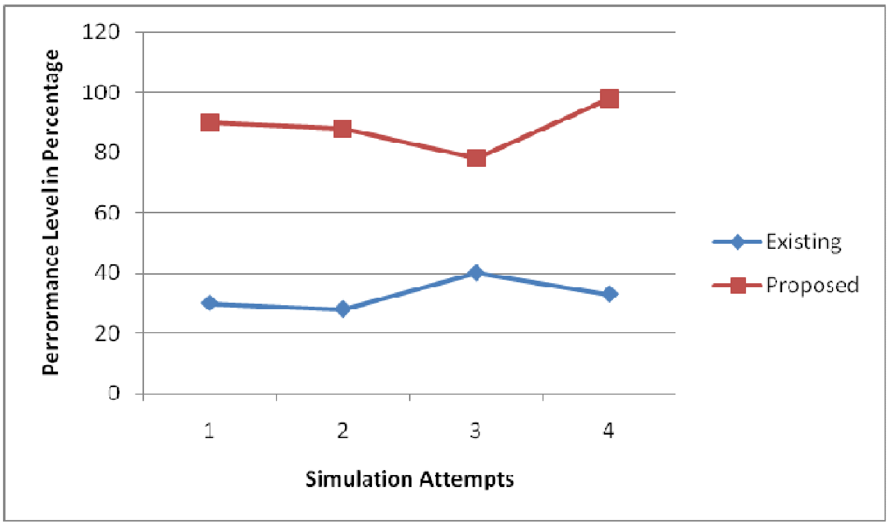

Figure 1 – Performance of the Existing and Proposed Approach

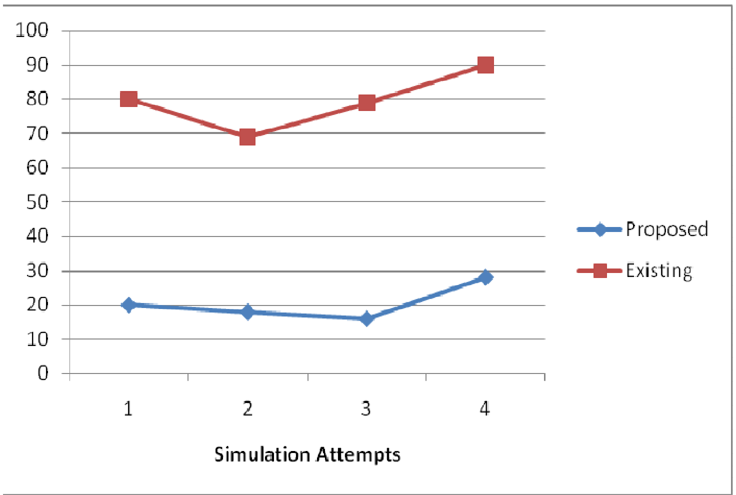

Figure 2 – Power Consumed in the Existing and Proposed Approach

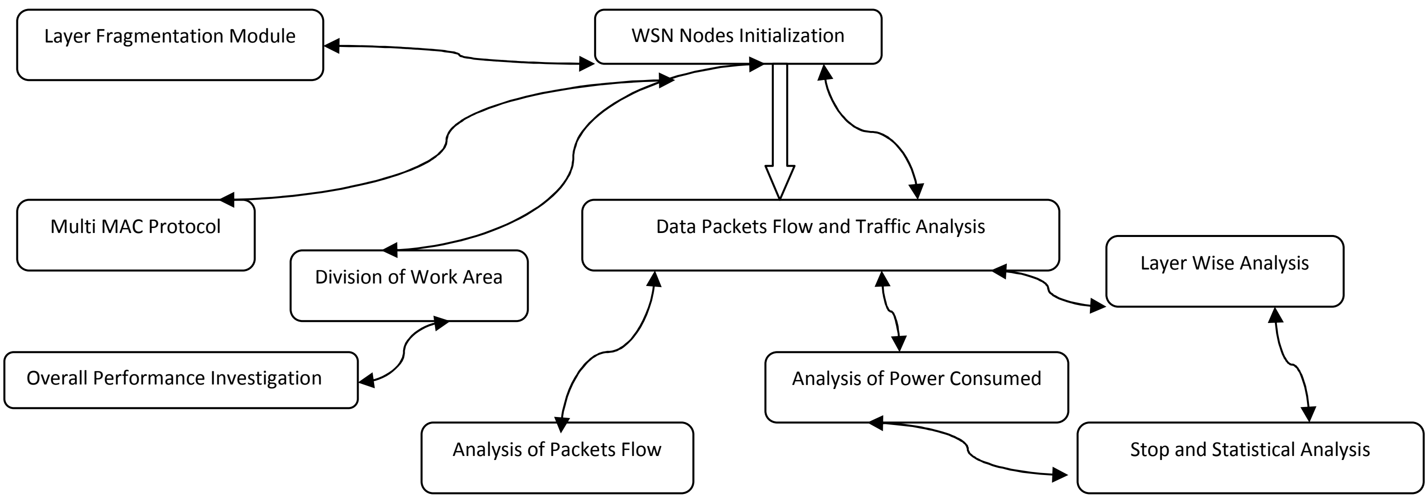

Figure 3 - Data Flow Diagram of the Existing and Proposed Approach

Algorithmic Approach - MultiLayered MAC

1. Initialization of the Power Level of the Sensor Nodes (Pi) on the specific area deployed WSN[n] {n : max. deployable sensor nodes}
2. Activate and Assign WA[x, y] {Max. deployable area}
3. Applying Fragmentation and the dynamic formation of the CH[i][WA(a)] {Integration of Cluster Head in the specific area}
4. Prune the Area WA[m]<=WA[m]
5. Implementation of Cuting into multiple layers L{i<=k} so that the congestion free flow of the data packets occur without any delay or overhead
6. In Each Layer L(i){k}, deploy WSN(j) in WA(a)
7. Fetch CHI(Cluster Head Information) -> WA(a) => WSN(n)
8. Analyze the Power Consumption C(m)=(PC)CH[n]
9. CP(Cumulative Power) => Cumulative Results of the Power Consumed and Optimized (C(m) => WA(m))
10. Detailed Investigation of the Results

CONCLUSION

In this power efficient routing technique, before transferring packets the routes are analyzed and the routes with minimum distance to the source node are utilized for transferring packets, so that power required to amplify the signal to the nodes far from the source node is reduced. This technique manages the battery backup for all nodes participating in a network.

REFERENCES

[1] Energy Efficient Routing Protocols in Wireless Sensor Network by Pawan Singh Faujadar, Indian Institute of Technology Kharagpur.

[2] Zaman, Noor, Abdul Raouf Khan, and Mohammad Salih. "Designing of energy efficient routing protocol for Wireless Sensor Network (WSN) Using Location Aware (LA) Algorithm."

[3] Norouzi, Ali, Faezeh Sadat Babamir, and Abdul Halim Zaim. "A novel energy efficient routing protocol in wireless sensor networks." *Wireless Sensor Network* 3, no. 10 (2011): 341.

[4] Nikolidakis, Stefanos A., Dionisis Kandris, Dimitrios D. Vergados, and Christos Douligeris. "Energy efficient routing in wireless sensor networks through balanced clustering." *Algorithms* 6, no. 1 (2013): 29-42.

[5] Energy Efficient Routing In Wireless Sensor Networks, Curt Schurgers , Mani B. Srivastava. Networked & Embedded Systems Lab (NESL), Electrical Engineering Department, University of California at Los Angeles (UCLA), CA

[6] An Energy Efficient Protocol for Wireless Sensor Networks Andrea Depedri, Alberto Zanella and Roberto Verdone IEIIT-BO/CNR, DEIS-University of Bologna, Italy.

[7] Energy-Efficient Routing in Linear Wireless. Sensor Networks, Marco Zimmerling, Waltenegus Dargie, Chair for Computer Networks. Faculty of

Computer Science,Technical University of Dresden Dresden, Germany.

[8] A Centralized Energy-Efficient Routing, Protocol for Wireless Sensor Networks by Siva d. Muruganathan, daniel c. F. Ma, rolly i. Bhasin, and Abraham o. Fapojuwo, university of Calgary.

Amit Kumar Bindal is an Associate Professor in Department of Computer Engineering M. M. Engg. College, M. M. University Mullana, Ambala, Haryana, India. Mr. Bindal received his B.Tech & M.Tech in Computer Science & Engineering from Kurukshetra University Kurukshetra. He is Pursuing Ph.D . from M. M. University Mullana in field of Wireless Sensor Network. His research interest is on Wireless Sensor Networks, Underwater Wireless Sensor Network, Mobile agent applications. He is presently working on WSN & UW-WSN.

Waleed Hadi Madhloom Alkurdy received his Graduation degree from Islamic University college, Alnajaf, Iraq in 2012, and the M.Tech degree in Computer Science and Engineering from Maharishi Markandeshwar University, Mullana, India, in 2014. My research interests include power optimization in Wireless Network Communication, Various Deployment Technique in WSN, Network Security. At present, I am engaged in domain of Expert Lectures in various Domains.