Industrial Engineering Journal
ISSN: 0970-2555
Volume : 51, Issue 11, No. 1, November : 2022

WSN DESIGN LIMITATIONS AND ROUTING PROTOCOL ANALYSIS FOR MULTIMEDIA APPLICATIONS USING ROUTING ALGORITHMS

J. Bala Venkata Subrahmanyam, Dept of Computer Science and Engineering, Sree Venkateswara College Of Engineering, Nellore (Dt), Andhra Pradesh, India.
I. Shalini, Dept of Computer Science and Engineering, Sree Venkateswara College Of Engineering, Nellore (Dt), Andhra Pradesh, India.
K. Srikanth Reddy, Dept of Computer Science and Engineering, Sree Venkateswara College Of Engineering, Nellore (Dt), Andhra Pradesh, India.
P.Bhargavi, Dept of Electronics and Communication Engineering, Sree Venkateswara College Of Engineering, Nellore (Dt), Andhra Pradesh, India.

ABSTRACT
The use of multimedia applications is increasing and they have already become a necessary component of our daily life. Researchers' interest in multimedia sensors is quickly growing because to wireless sensor networks, which is shifting focus away from classic scalar sensors and towards sensors with multimedia components. The capacity of multimedia sensors to capture video, picture, audio, and scalar sensor data allows for the distribution of multimedia material over a network of sensors. Protocols for multimedia wireless sensor networks should take into account both the demand for multimedia transmission and the resource-constrained nature of WSNs, since adding multimedia would bring new difficulties. This paper addresses the design flaws in the WMSN routing protocols that have been suggested. The WMSN recommended procedures are surveyed and thoroughly discussed, followed by a discussion of their drawbacks and advantages.

Keywords: WSN, WMSN, Routing

1. INTRODUCTION
A WSN is made up of wireless sensors that are used to monitor changes in the immediate physical and environmental environment. The central location receives the collected data and sends it back for examination and analysis. Environmental elements include things like temperature, pressure, sound, and heat. There is not much infrastructure in this network. A wireless sensor network is made up of thousands of sensor nodes. These nodes communicate through radio transmissions.[1]

Applications of Wireless Sensor Network:
Area monitoring: In this method, sensor nodes are set up in an area where an event is to be monitored.
Military applications: Threat detection, battlefield monitoring, and targeting systems are all highly useful in the military.
Application in healthcare: Sensor networks are employed in healthcare to monitor patients. Wearable technology makes it possible to monitor a person's fitness and health.
Monitoring of air pollution: In this process, sensors are placed across cities to measure and manage air pollution.
Environmental sensing: It is also utilized to find different environmental factors.

Wireless Sensor Network Architecture
The wireless sensor network is composed of five levels and three cross layers. The transport layer, application layer, physical layer, network layer, and data link layer are the five tiers. The three cross-

layers are made up of the planes for managing job, mobility, and power. In order to create a network and enable effective sensor communication, these layers are used.

Application layer: Application layer handles traffic management and aids in converting data into intelligible forms using software applications.

The transport layer is utilised when a system intends to connect to another network. Many different protocols are available for the transport layer's function, which is to provide unstoppable and trustworthy delivery.

The primary purpose of the network layer is routing. The key difficulties for the network layer are limited memory, power savings, and buffering.

Data connection layer: The data link layer handles data stream multiplexing, error handling, and data frame detection. Error detection and repair is the primary task of the data connection layer.

Physical layer: The physical layer offers the interface for transferring the bit stream over the physical medium. layers that cross: Controlling the power of sensor nodes is the responsibility of the power management plane.

The mobility management plane is in charge of preserving network connectivity.

It is used to manage how tasks are distributed across sensors on the task management plane. [2]

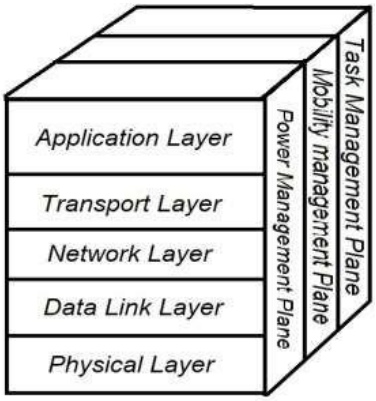

Fig1:WSN Architecture

Pros and Cons of Wireless Sensor Network Pros

- It is very flexible network.
- It is cost effective as wired are not required.
- New devices can be connected easily.
- It can be deployed in harsh conditions or environment.
- It can be easily accessed with centralized monitor.

Cons

- It is not a secured network. It can be easily hacked by hackers.
- Sensors need to be charged, it is battery operated.
- Communication speed I spoor of WSN.
- It gets distracted by other devices like Bluetooth.

2. Related Study

Elhabyan, R., et al. A taxonomy for categorising coverage processes in WSNs has been proposed by [1]. The coverage procedures should then be divided into three groups based on the network stage at

which the coverage is optimised (exactly, coverage aware deployment techniques, sleep scheduling protocols for flat networks, and cluster-based sleep scheduling protocols). Using the selected coverage approaches, the pertinent procedures for each category are carefully evaluated and categorised.

L.L. Hung et al. [2] The Energy-Efficient Cooperative Routing Scheme for Heterogeneous Wireless Sensor Networks (EERH, for short), a proposed energy-saving routing mechanism, states that deploying multiple WSNs in the same area and having sensors relay packets for both their own WSN and other WSNs will create a heterogeneous sensor network. Using data like the directions of event packet transmission, routing pathways are generated dynamically, the remaining power of the underlying sensors, the neighbours of the underlying sensors, etc. In order to conserve delivery energy, the identical sensors' packets that are transported in the same direction are also aggregated.

Additionally, the EERH's network parameters, such as event packet propagation delay and sensor transmission distance, are adjustable to meet the demands of the real-world environment..

Li, G. et al. [3] The aforementioned issue was addressed with a DCDA-based data gathering method. A Denoising AutoEncoder (DAE) is taught to produce the data measurement matrix and the data reconstruction matrix using the previously identified data during the data training phase. The sensed data from the entire network are then gathered using a data collection tree during the data collection phase. Each sensor node's detected data is compressed using data measurement matrices, and the original data from the sink is recovered using data reconstruction matrices. Finally, using real-world sensed data, the data communication and data reconstruction performances of the proposed scheme are assessed and compared to those of existing schemes.

A fresh approach to cross-layer service differentiation for Fi- WSNs by M. Akerele et al. The suggested approach employs an adaptive scheduling mechanism and makes it possible for WSNs to connect with the optical network unit (ONU) in order to decrease the latency for high priority traffic. For time-sensitive smart grid monitoring applications, we analyse how the proposed strategy would impact the quality of service (QoS) dependability and end-to-end latency. We simulate the end-to-end latency in the Fi-WSN system and the long-reach passive optical networks (LR-PONs) and show that the proposed QoS mechanism may reduce the end-to-end latency.

Lyu, B. et al. [5] his present a relaying approach that is effective in the special case, where a relay is only ever allowed to take energy from the HAP while it is delivering the user's data to the HAP. Then, in both cases where the relays operate in the amplify-and-forward (AF) and decode-and-forward (DF) modes, the system is examined using maximisation problems.

A technique for allocating resources across virtualized wireless sensor networks was given by Li, Z. et al. in paper [6]. The manufacturer of wireless sensor networks, in particular, pools physical resources. Then, using network slicing technology, virtual sensor networks are constructed to offer one-to-one services based on the application requirements and the state of the actual sensor nodes at the time. A system-friendly resource allocation method is also advised in order to optimise the combined configurations of sensing frequency, time slot, and transmission power and reduce the overall network energy consumption.

A novel zero-power wireless sensor architecture is proposed by Khalid, N., et al. [7]. The suggested passive wireless sensor is a wireless sensor that may be used in place of a wired sensor. Without considerably reducing the readrange and complexity of conventional RFID tags, it combines UHF RFID with a capacitive sensor to enable wireless reading of physical and chemical data. The sensor uses a non-coherent IQ demonstration at the receiver to alter the phase of the backscattered RFID signal. Any type of sensor, including temperature, humidity, and water level sensors, may be achieved

thanks to the adaptability of this design.

T. Qiu et al. [8] To increase the resilience of the scale-free topology and build initial scale-free topologies consistent with the characteristics of WSNs in the real-world environment, the resilience Optimisation method with Multi-Population Co-evolution for Scale-Free Wireless Sensor Networks (ROCKS) has been developed. Use ROCKS to employ cutting-edge crossover and mutation operators to increase the resilience of the scale-free topologies designed for WSNs. To guarantee that the scale-free WSNs topology is kept in the optimised topology, our suggested approach keeps track of each node's initial degree.

Tan, X. et al. [9] introduced a hierarchical software-defined network architecture that allows for better adaptability and complicated network administration for wireless sensor networks. A QoS-based routing protocol that combines a clustering method, a routing algorithm, and local network management is also something we suggest. It is named QSDN-WISE. The energy hole effect is avoided, and the stress on a single cluster head is decreased using the double-cluster head-based uneven clustering technique known as DCHUC. The two heterogeneous forwarding pathways created by the central QSDN-WISE routing algorithm for nodes satisfy the needs of various data levels..

Gao, D. et al. [10] presented RowBee, a novel routing technology built on a CTC method. RowBee uses the Wi-Fi node's coordination benefits to help ZigBee nodes create routing patterns and gives nodes the freedom to pick their duty cycles with a finer duty-cycle granularity. The ZigBee nodes are coordinated to awaken at the same time in accordance with the Wi-Fi nodes' beacons using a straightforward yet effective technique.

Mohit Saini et al. (2013) [11] Since sensor nodes typically run on batteries, one of the most important challenges is figuring out how to lower their energy consumption while maintaining reasonable network lifetimes. The author of this study first breaks down the energy usage of a typical sensor node's components before outlining the key strategies for energy saving in WSNs. Then, we give a systematic and thorough taxonomy of the energy conservation programmes, which are then thoroughly discussed. Promising solutions that have not yet received widespread attention in the literature, including methods for energy-efficient data gathering, have received special attention.

Satvir Singh and Meenaxi (2013) [12] WSNs, or wireless sensor networks, have become a viable option for a variety of applications. The majority of conventional WSN systems are made up of static nodes that are widely dispersed within a sensing region. There have been a number of WSN topologies based on mobile elements (MEs) recently. To solve the issue of data gathering in WSNs, the majority of them use mobility. First, based on the function of the MEs, this paper defined WSNs with MEs and provided a thorough taxonomy of their architectural designs. Then, we give a brief overview of the data collection procedure in this scenario and point out any problems or difficulties.

K. Arun prabha and K. Hemapriya (2013) [13] proposed the concept of "smart phone sensor networks," a subclass of mobile wireless sensor networks where several smart phone devices work together to conduct sensing tasks. Even though these new networks have great promise, nothing has been done in the way of design-time validation and verification to make sure that a system would function as intended. The Empower simulation environment for smart phone sensor networks is described in this study. Empower simulates smart phone-specific sensor network characteristics, such as data collecting policies, and produces high-level system metrics, such as coverage of the monitored environment.

Eugene Shih et al. (2012) [14] Since sensor nodes typically run on batteries, one of the most important challenges is figuring out how to lower their energy consumption while maintaining reasonable

network lifetimes. The author of this study first breaks down the energy usage of a typical sensor node's components before outlining the key strategies for energy saving in WSNs. The energy conservation schemes are then fully addressed after we provide a systematic and complete taxonomy of them. A specific focus has been placed on promising solutions that haven't yet gotten much attention in the literature, such as strategies for acquiring data in an energy-efficient manner.

Routing Protocols in WSN

The network layer is essential to the QoS support for multimedia applications since it is in charge of delivering an energy-efficient path that complies with QoS standards and serves as a middleman for the exchange of performance characteristics between the application and MAC layer [6]. This section covers the various routing protocols that have been suggested for WMSN and looks at their advantages and disadvantages. Then, a detailed comparison is made between them. The following categories truly encompass these techniques. There are two statuses for the links: accessible and unavailable. To eliminate gaps, the routing pathways should go through active nodes and links that are accessible, and they should then be optimised to have the fewest hops possible. Geographic forwarding and path optimisation are suggested for these two phases. Geographic forwarding consists of two algorithms and is responsible for identifying routing pathways with bypassing gaps.

The neighbour node with the shortest distance to the sink is selected as the next hop node via greedy forwarding;

(1) Take a step back and mark: if a node has just its previous node as its next node, it will mark itself as a block node and the previous node will search for another node that is available.

Path optimisation seeks to eliminate path circles and discover routing pathways with the fewest number of nodes. Thanks to label-based optimisation, the forwarding phase can now include more features. A label with a route number and a digressive node number will be attached to each forwarding node. An acknowledgement is given back after the routing path has reached the desired location. The acknowledgement will go to the node with the highest node number and matching path number. The results show that TPGF typically finds more and shorter channels than useful protocols like GG and RNG. The disadvantage of TPGF is that it must create an exhaustive map of the network topology, which restricts its capacity to scale.

Conclusion

Numerous fresh, important applications for our daily lives have become possible with the introduction of WMSN. In this study, WMSN technologies are described. There are issues and resource restrictions indicated. Current routing protocols are categorized based on the direction of the research at hand. The suggested routing techniques for multimedia transmission are also looked at, and the performance drawbacks of each proposed routing technique are highlighted. Our study shows that a number of techniques are used by the suggested protocols for wireless multimedia sensor networks to meet the criteria for multimedia transmission. TPGF and GPSR are examples of geographic routing techniques that fall under the second group. These protocols are great for WMSN because they guarantee constant energy use and meet the limitations for packet loss and delay. Additionally, they work well when skipping entire networks. The last class of suggested protocols covers various QoS metrics needed for multimedia transmission with the resource-constrained nature of WMSN and follows several algorithm types. Since routing protocols are essential to the development of WSN, we predict that research in this area will become more intense and attract more attention.

References

1. Elhabyan, R.; Shi, W.; St-Hilaire, M.; "Coverage Protocols for Wireless Sensor Networks: Review and Fu-ture Directions",JournalofCommunications and Networks,Vol:21, No:1, 2019,pp:45-60
2. Hung, L.L.; Leu, F.Y.; Tsai, K.L.; Yo, C.K.; "Energy-Efficient Cooperative Routing Scheme for Heteroge-neousWireless SensorNetworks",IEEE Access, Vol: 8, 2020,pp:56321-56332
3. Li, G.; Peng, S.; Wang, C., Niu, J.; Yuan, Y.; "An Energy-Efficient Data Collection Scheme Using Denois-ing Autoencoder in Wireless Sensor Networks", Tsinghua Science and Technology, Vol: 24, No: 1, 2019,pp: 86-96
4. Akerele, M.; Al-Anbag, I.; Erol-Kantarc, M.; "A Fiber-Wireless Sensor Networks QoS Mechanism forSmartGridApplications",IEEE Access,Vol: 7, 2019,pp:37601-37610
5. Lyu, B.; Qi, T.; Guo, H.; Yang, Z.; "Throughput Maximization in Full-Duplex Dual-Hop Wireless PoweredCommunicationNetworks",IEEEAccess,Vol:7,2019,pp:158584-158593
6. Li, Z.; Zhong, A.; "Resource Allocation in Wireless Powered Virtualized Sensor Networks", IEEE Access,Vol:8,2020,pp: 40327-40336
7. Khalid, N.; Mirzavand, R.; Saghlatoon, H.; Honari, M.M.; Mousavi, P.; "A Three-Port Zero-Power RFIDSensorArchitecturefor IoTApplications", IEEE Access, Vol:8, 2020,pp: 66888-66897
8. Qiu, T.; Liu, J.; Si, W.; Wu, D.O.; "Robustness Optimization Scheme With Multi-Population Co-Evolutionfor Scale-FreeWirelessSensorNetworks",IEEE, Vol:27,No: 3, 2019,pp:1028-1032
9. Tan, X.; Zhao, H.; Han, G.; Zhang, W.; Zhu, T.; "QSDN-WISE: A New QoS-Based Routing Protocol forSoftware-DefinedWirelessSensor Networks",IEEEAccess, Vol:7, 2019,pp:61070-61082
10. Gao,D.;Zhang,S.;Zhang,F.;He,T.;Zhang,J.;"RowBee:ARoutingProtocolBasedonCross-Technology Communication for Energy-Harvesting Wireless Sensor Networks", IEEE Access, Vol: 7,2019,pp:40663-40673
11. Mohit Saini, Rakesh Kumar Saini, "Solution of Energy-Efficiency of sensor nodes in Wireless sensor Net-works", International Journalof Advanced Research in Computer Science and Software Engineering,ISSN:2277-128X,Vol: 3,Issue 5,May2013,pp: 353-357
12. Satvir Singh, Meenaxi, "A Survey on Energy Efficient Routing in Wireless Sensor Networks", Internation-al Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 7, pp.184-189,July2013.
13. K. Arun prabha, K. Hemapriya, "Energy Saving In Wireless Sensor Network Using Optimal SelectiveForwarding Protocol", International Journal of Advancements in Research & Technology, Volume 2, Is-sue1,January-2013.
14. Eugene Shih, SeonghwanCho, Nathan Ickes, Rex Min, Amit Sinha, Alice Wang, AnanthaChandrakasan,"Physical LayerDrivenProtocolandAlgorithmDesignforenergyefficientWirelessSensorNetworks"
15. Shashidhar Rao Gandham, Milind Dawande, Ravi Prakash, S. Venkatesan, "Energy Efficient Schemes forWirelessSensorNetworkswithMultipleMobileBaseStations."
16. Wei Ye, John Heidemann, Deborah Estrin, "An Energy-Efficient MAC Protocol for Wireless Sensor Net-works"
17. Stefanos A. Nikolidakis, DionisisKandris, Dimitrios D. Vergados, Christos Douligeris, "Energy EfficientRoutinginWirelessSensor Networks ThroughBalancedClustering"
18. Xun Li, Geoff V Merrett, Neil M White, "Energy-efficient data acquisition for accurate signal estimation inwirelesssensor networks",Journal onwirelessCommunications and Networking 2013.

19. Meera Gandhi. G, P. Rama, "GPS based Multi-hop Communication with Localization in SubterraneanWirelessSensorNetworks",Vol: 57,2015,pp:1189-1198
20. Prabha R, Krishnaveni M, S H Manjula, K R Venugopal, L M Patnaik, "QoS Aware Trust Metric basedFramework for Wireless Sensor Networks", International Conference on Intelligent Computing, Communi-cation&Convergence,Vol: 48,2015,pp: 373-380