

Review on Efficiency of Routing Schemes In Wireless Sensor Networks

Mohit Singh Bisht¹, Arvind Kumar²

¹Research Scholar, School of Computer Science and Engineering, Lovely Professional University, Phagwara, Punjab, India

Email: bisht.mohit604@gmail.com

²Assistant Professor, School of Computer Science and Engineering, Lovely Professional University, Phagwara, Punjab, India

Email: arvind28april@gmail.com

Abstract: WSNs includes collecting multiple small sensor nodes deployed over a defined area of interest, autonomously detecting, processing and transmitting. the data directly forward to the base station or firstly data will go to through sink node than base station. Sensor hubs are negligible exertion, energy prerequisite devices with low memory and band-width whose benefit usage is application subordinate. The nodes are when in doubt passed on in remote zones and thusly, inconvenient if not hard to resuscitate their ability sources. In WSN various kinds of routing protocol has been exhibited. In this paper we are introducing the structure issues of sensor systems and furthermore examination between different kind of protocol dependent on certain parameters like versatility, information accumulation, control use and system lifetime and so on.

Keywords: WSN, routing protocols, energy-efficiency, clustering, LEACH, PEGASIS, SPEED.

1. INTRODUCTION:

Wireless sensor network is one of the areas of modern research, In which many researcher have been done continuously for the past 15 years, yet some of its problems are still intact, for which researchers are still engaged in research. Today WSN is utilized in various fields. Although these networks are still unimaginable to the world of people as it is used in our lives, other networks in which we are often exposed such as banking network, mobile phone network, internet etc. Yet it has its own special significance which we should know about. WSNs include hundreds or thousands of sensor nodes outfitted with detecting, processing and correspondence capacities. Every node can detect the earth for an object and can perform straightforward calculations. A sensor node either conveys between its friends to gather the detected information or sends (gets) the information to (from) a base station [1]. A base station interfaces the sensor networks to another system.

Wireless sensor networks (WSNs) are categorized by various resource constraints such as power, processing capabilities, storage and transmission distance. Out of these elements, vitality of sent sensor node has been the significant asset limitation of the WSNs .In view of this paradigm, and inferable from the constrained power supply of the sensor nodes, the most significant issue is energy efficient, and so as to expand the lifespan of a WSN, energy of nodes should be utilized proficiently [2]. This is the fundamental goal of the existing clustering techniques.

For delayed network there ought to have great measure of energy in it. The network energy can be expanded by most extreme number of sensor nodes. Extending the amount of sensor nodes builds the network energy, however that will cost to high on the grounds that sending an additional sensor acquires the expense of the sensor, which is more than multiple times of expense of the batteries. In this way, it is progressively suitable and conservative to build the network lifespan by sending a maximum amount of battery with a few types of sensor.

Energy used by the nodes in WSNs can be reduced by using hierarchical systems. Clustering

is especially valuable for applications that required hundreds or thousands of nodes. Scalability suggests the requirement for load adjusting, effective asset use, and data aggregation. Clustering can also be used to reduced energy consumption in routing[3]. Clustering can be incredibly viable in one-to-many, one-to-any, many-to-one, or one-to-all data packets transmission.

Clustering in WSN, is sorting out sensor nodes into gathering and choosing an master node among them which is known as a cluster head and other sensor nodes as its individuals. Cluster head as a rule plays out the fusion and aggregation. Clustering effectively reduces the energy consumption of SNs by proper selection of cluster heads (CHs). The energy spent in the network using clustering algorithms is likely to be lower than direct transmission. For cluster-based routing, however, inadequate cluster formation can cause overloading of some cluster heads (CHs). CH collection and load balancing are therefore major concerns for SN clustering.

1.1. Components of WSNs:

- **Low power embedded processor:** Computational issues on a WSN device incorporate both privately detected data processing as data transmitted by different sensors. Actually, due primarily to financial limitations, the embedded (inbuilt) processor is often all-round requirements of such system, gadgets normally run different segment-based installed operating framework, such as tiny OS.
- **Memory / storage:** Storage as sporadic access and read-only memory involves both program memory (from which the processor executes guidelines) and data memory (from which primary and ready sensor estimation and other neighbourhood data can be stored).
- **Radio Transceiver:** WSN gadgets include a handheld radio (10-100 kbps, < 100 m) with a low rate and short range. On a regular basis, radio communication is the most power centred process in a WSN gadget and therefore the device needs to combine energy-efficient modes of rest and wake-up.
- **Sensors:** Because of the transfer of speed and power constraints, WSN gadgets basically only enable the identification of low information levels. Temperature sensors, light sensors, humidity sensors, weight sensors and synthetic sensors may be integrated [4].
- **Geo positioning system:** In numerous WSN application, it is essential for sensor estimation to be area stepped. The least complex approach to acquire situating is to preconfigure sensor areas at arrangement. Such data are effectively acquired through satellite-based GPS at the point when the system is transmitted in a loathe habit.
- **Power source:** The WSN gadget is hardly to be powered by a battery for adaptable arrangement. While in some implementations, a portion of the nodes could be wired to a constant power source.

1.2. Objectives of Network Design:

The principle structure objective for sensor systems incorporate the accompanying a few viewpoints:

- **Small Size:** Decreasing node estimate is one of the essential structure targets of sensor systems. Sensor nodes are normally sent in an unforgiving or unfriendly condition in vast numbers. Reducing the node size can improve the structure of networks, and

furthermore decrease the expense and power utilization of sensor nodes.

- **Less Power Consumption:** The most important goal of a sensor arrangement project is to minimize the use of force. Because sensor nodes are controlled by batteries and are usually disturbing or even difficult to change or energize their batteries, reducing the power utilization of sensor hubs is crucial in order to minimize the lifetime of the sensor hubs just as the entire system is drawn out.
- **Low Cost:** Reducing the cost of nodes is another important sensor system architecture goal. Since sensor nodes are typically sent in large numbers in a cruel or unfriendly condition and cannot be change, it is vital to minimize the expense of sensor nodes in order to reduce the expense of the entire system.
- **Scalability:** The quantity of sensor nodes could be at the demand of dozens, hundreds, or thousands in sensor arrangements. Organize conferences for sensor networks along these lines should be adaptable to various network sizes.
- **Self – Configurability:** In sensor networks, sensor nodes are typically sent without careful arrangement and design in a district of enthusiasm. Once sent, sensor nodes should be cabable of self-regulate in a correspondence arrangement and rearrange their availability in the event of topology modification and node deceptions.
- **Reliableness:** For some, sensor arrange applications, it is necessitated that information be dependably conveyed over noisy, mistake - inclined, and time - fluctuating remote channels. To meet this necessity, organize conventions intended for sensor systems must give error control and adjustment components to guarantee dependable information conveyance.
- **Adaptability:** A node can fail, join, or transfer in sensor organizations, resulting in modifies in node thickness and topology of the network. The design of conventions for sensor systems should therefore be flexible with such shifts in thickness and topology.
- **Fault Tolerance:** Due to cruel arrangement conditions and unattended activities, sensor nodes are inclined to disappointment. Sensor nodes should then be tolerant of blame and have self-recovery capabilities-testing, self-aligning, self-fixing, and self-recovery [5].
- **Security:** Sensor nodes are transmitted in a threatening situation in various military applications and are thus defenceless against enemies. In these cases, a sensor network must incorporate effective security tools to intercept unauthorized access or malicious attacks to information on the network or sensor node.
- **Channel Usage:** Sensor systems have restricted capacity assets for data transfer. In this way, conventions of correspondence intended for sensor networks should use data transmission effectively to improve the use of channels.

1.3. Issues of wireless sensor networks

Wireless sensor networks are so useful, on the other hand there are some issues in using it, researchers are creating new protocols to overcome. Some of the major issues that we can call the challenge are:

- **Limited Battery Energy** - Energy to the sensor node, mainly to keep it active, to get data from one node to another node, the information spent on sensing is spent on reaching the other node. That node gets this energy from a battery [6]. Replacing or recharging this battery is very difficult, so researchers are making protocols and programs, so that the data transmission can have at least the energy expenditure and the node's Lifetime can be increased.
- **Data Security** - It is critical to have an answer for the security information, when the nodes exchange data between sensors. Keeping this in view, the researchers have created some security protocols, which can be used to send the data safely. Researchers are now researching protocols with more security.
- **Data redundancy** - Sometimes there is a lot of similarity between the data sensed by two or more sensor nodes around the atmosphere, which reduces the data redundancy at the base station. Data aggregation protocols have been created by researchers to overcome this problem and still, these are being researched. With the help of data aggregation, data redundancy can be increased to its quality so that the information about the work reaches the user.

2. RELATED WORK:

Al-Shaikh et al. [7] analysed current wireless sensor network routing protocols and categorized WSN network architecture approaches into three types. Depending on network structure, the three main categories were: location-based, flat, and hierarchical routing protocols. They analysed the correlation among resources and the overhead savings for interaction in each routing protocol. And they also compared all the routing protocols based on parameters like data aggregation, scalability, QoS etc.

Bhattacharyya et al. [8] discussed wireless sensor networking technology. In addition, they classified the routing protocols based on various key elements and described their operating mode. Finally, a comparative analysis on these different protocols was conducted.

Xu et al. [9] discussed in depth the advantages, drawbacks, implementations and various traditional hierarchical routing protocols evaluated or compared on the basis of performance parameters. Ultimately, together with the current research status, the problems of routing protocols and possible future research directions were summarized.

Rana et al. [10] discussed about different types of hierarchical based protocols, and also compared with other protocols based on various parameters such as scalability, data aggregation, network lifetime etc. The protocol results were evaluated based on the findings and expectations produced.

Bansal et al. [11] presented hierarchical protocols for LEACH and PEGASIS. This technique was evaluated by these protocols based on the total lifetime energy consumed, overheads, and sensors and provided simulation outcomes for comparison with PEGASIS and LEACH.

Tanwar et al. [12] presented H-HEED protocol which was used to convey information from a source node by steady infusion of packets into the system at moderately low speed which permits nodes that experience information misfortune to recuperate missing information from their neighbors. They also compared between various hierarchical routing protocols based on some

parameters like power usage and mobility etc.

Mittal et al. [13] focused on routing protocol categories based on applications needed. This survey's key idea was to show the significance of sensor routing protocols in different inside and outside scenarios. And also compared between protocols based on key parameters like scalability, data aggregation and power usage etc.

Yang et al. [14] proposed and dissected a vitality proficient directing calculation that recreated a solicitation without flooding to the fitting topographical area. The proposed Geographic and Energy Aware Routing calculation utilized vitality cognizant neighbor determination to highway a parcel to the objective locale and Recursive Geographic Forwarding calculation to scatter the bundle inside the objective territory. They utilized reenactment to assess the GEAR convention. What's more, found that GEAR displayed essentially longer system lifetime than non-vitality cognizant geographic steering calculations, especially for non-uniform traffic dispersion.

Kordafshari et al. [15] suggested a routing technique in the SPEED protocol to consider residual energy in routing choices. Due to a sensor hub's limited energy, energy-efficient routing is a major problem in sensor systems. This technique discovered energy efficient ways for postpone compelled information progressively traffic. The SPEED protocol doesn't consider any energy metric in its routing. In their technique, routing depended on a weight work, which was a blend of the three variables: Speed, Energy and Delay.

Table 2. Classification of routing protocol based on parameters

Authors name	Routing protocol	Types	Power usage	Scalability	QOS	Energy efficiency	Data aggregation	Network lifetime
Al-Shaikh et al. [7]	LEACH	Hierarchical	High	Good	No	Very low	Yes	Very good
Bhattacharyya et al. [8]	TEEN	Hierarchical	High	Poor	No	Very high	Yes	Very good
Xu et al. [9]	AP-TEEN	Hierarchical	High	Good	No	Moderate	Yes	Very good
Rana et al. [10] & Bansal et al. [11]	PA-GASIS	Hierarchical	Max	Good	No	Moderate	No	Very good
Tanwar et al. [12]	HEED	Hierarchical	Max	Moderate	No	Moderate	Yes	Good
Mittal et al. [13]	SPIN	Flat / Data centric	Limited	Limited	No	Moderate	Yes	Good

Yang et al. [14]	GEAR	Location	Limited	Limited	No	Low	No	Good
Kordafshari et al. [15]	SPEED	Data centric / Location	Low	Good	Yes	Low	No	Good

3. CONCLUSION:

Over the past few years, WSN has taken on a significant role in the environmental situation. This system arrangement is in a level and circulated foundation. We are used to monitor government, modern territories, environmental problems, and therefore to focus on military. Most calculations are used to eliminate problems with remote sensor systems, such as control use, restricted data Capacity for transfer, limited recurrence. In this paper, we recognized a portion of WSN's plan issues and also thought about the different kinds of convention guidance depending on some parameters. Although a number of guiding protocols has been developed for sensor systems, a few issues remain to be addressed.

4. REFERENCES:

- [1] J. Yick, B. Mukherjee, and D. Ghosal, "Wireless sensor network survey," *Comput. Networks*, vol. 52, no. 12, pp. 2292–2330, 2008.
- [2] M. Khalil, A. Khalid, F. U. Khan, and A. Shabbir, "A review of routing protocol selection for wireless sensor networks in smart cities," *2018 24th Asia-Pacific Conf. Commun. APCC 2018*, pp. 610–615, 2019.
- [3] S. Bandyopadhyay and E. J. Coyle, "An energy efficient hierarchical clustering algorithm for wireless sensor networks," *Proc. - IEEE INFOCOM*, vol. 3, no. C, pp. 1713–1723, 2003.
- [4] W. Guo and W. M. Healy, "Power Supply Issues in Battery Reliant Wireless Sensor Networks: A Review," *Int. J. Intell. Control Syst.*, vol. 19, no. 1, pp. 15–23, 2014.
- [5] I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, "Wireless sensor networks: A survey," *Comput. Networks*, vol. 38, no. 4, pp. 393–422, 2002.
- [6] T. Bala, V. Bhatia, S. Kumawat, and V. Jaglan, "A survey: Issues and challenges in wireless sensor network," *Int. J. Eng. Technol.*, vol. 7, no. 2, pp. 53–55, 2018.
- [7] A. Al-Shaikh, H. Khattab, and S. Al-Sharaeh, "Performance comparison of LEACH and LEACH-C protocols in wireless sensor networks," *J. ICT Res. Appl.*, vol. 12, no. 3, pp. 219–236, 2018.
- [8] D. Bhattacharyya, T. hoon Kim, and S. Pal, "A comparative study of wireless sensor networks and their routing protocols," *Sensors*, vol. 10, no. 12, pp. 10506–10523, 2010.
- [9] D. W. Xu and J. Gao, "Comparison study to hierarchical routing protocols in wireless sensor networks," *Procedia Environ. Sci.*, vol. 10, no. PART A, pp. 595–600, 2011.
- [10] H. Rana, S. Vhatkar, and M. Atique, "Comparative Study of PEGASIS Protocols in Wireless Sensor Network," *IOSR J. Comput. Eng.*, vol. 16, no. 5, pp. 25–30, 2014.

- [11] P. Bansal, P. Kundu, and P. Kaur, "Comparison of LEACH and PEGASIS Hierarchical Routing Protocols in Wireless Sensor Networks," *Int. J. Recent Trends Eng. Technol.*, vol. 11, no. June, pp. 139–144, 2014.
- [12] S. Tanwar, N. Kumar, and J. J. P. C. Rodrigues, "A systematic review on heterogeneous routing protocols for wireless sensor network," *J. Netw. Comput. Appl.*, vol. 53, no. March, pp. 39–56, 2015.
- [13] M. Mittal and C. Iwendi, "A survey on energy-aware wireless sensor routing protocols," *EAI Endorsed Trans. Energy Web*, vol. 6, no. 24, 2019.
- [14] D. Yang, X. Li, R. Sawhney, and X. Wang, "Geographic and energy-aware routing in Wireless Sensor Networks," *Int. J. Ad Hoc Ubiquitous Comput.*, vol. 4, no. 2, pp. 61–70, 2009.
- [15] M. S. Kordafshari, A. Pourkabirian, K. Faez, and A. M. Rahimabadi, "Energy-efficient speed routing protocol for wireless sensor networks," *Proc. 2009 5th Adv. Int. Conf. Telecommun. AICT 2009*, no. June, pp. 267–271, 2009.