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Review of Energy Aware Routing Protocols for Wireless Sensor Networks

[1]Namit Gupta, [2] Dr. Kunwar Singh Vaisla, [3] Dr. Rajeev Kumar,
[4] Dr. M. M. S. Rauthan,
[1] *Research Scholar, Department of Computer Science, Uttrakhand Technical University, Dehradun, Uttarakhand, India*
[2] *Associate Professor, Department of Computer Science and Engineering, BTKIT, Dwarhat, Uttarakhand, India*
[3] *Assistant Professor, Department of Computer Science, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India*
[4] *Department of Computer Science, HNB Garhwal University, Srinagar, Uttarakhand, India*

ABSTRACT
A wireless sensor network is a self organizing, infrastructure less, bidirectional communication network of resources limited sensors which not simply sense the environment but collaboratively attain information gathering and distribution tasks. The necessitate to preserve energy to enlarge the network's lifetime is the most vital issue in the design of routing protocols for wireless sensor networks. In this paper, we present brief description and evaluation of different energy aware routing protocols for wireless sensor networks. This can be accomplished by using a range of methods like apply residual energy, placing inactive node in to the sleeping mode, adaptive energy or transmission range which not alone improves the network survivability but also improves wireless sensor network performance.
Keywords: Energy Aware Routing, Network Lifetime, power consumption.

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I. INTRODUCTION

Energy efficiency is one of the significant factors for wireless sensor networks. Although energy harvesting from environment is also potential in some applications. But the focus is on sensor nodes with non rechargeable batteries. Due to restricted energy resources and constraint of long operation time, modern communication techniques need to be developed that consider to reduce energy inefficiencies in all networking layers. In wireless communication, communication needs supplementary power than data processing. additional the nodes transmitting more will be battery consumption. So to lessen data redundancy data aggregation techniques are used. There are two categories of data aggregation techniques [21].

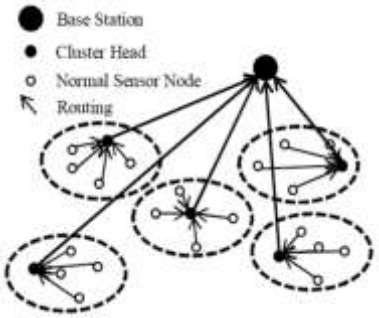

Fig 1: WSN Node Clustering

The first category aggregates the data gathered from different sources and then sends the final data. The second category merges the data from different sources beneath single header and sends it to the sink node. This header packet consolidates and passes it to the base station devoid of any variation to the original data from the sensors. Therefore accuracy is improved [21].

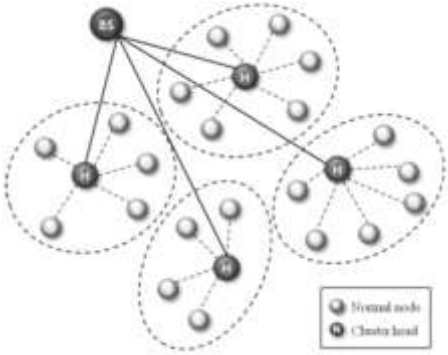

Fig 2: Power Efficient Gathering in Sensor Information Systems

Clustering techniques are needed to improve the scalability of the network. Apart from achieving scalability of the network it has further advantages like conserving communication bandwidth inside the clusters, localizing energy efficient route setup inside the clusters etc. Routing protocols based on this approach are LEACH, HEED and DECA etc. LEACH (Low Energy Adaptive Clustering Hierarchy) is a cluster based protocol which randomly selects a few nodes as cluster heads. These cluster heads eliminate data redundancy and send the aggregated packet to base station in order to reduce the information that must be transmitted to BS. In HEED (Hybrid Energy Efficient Distributed Clustering Approach, cluster head is selected on the basis of residual energy of the node. This method ensures that every node also will get a chance to become a cluster head or will connect one of the neighboring clusters. It not merely extend networks' lifetime except also bear scalable data aggregation.

Tree based approach, tree resembling structure is used to cumulative the data in hierarchical manner where leaves are the sensor nodes and the root is the sink node. As data activities through intermediate nodes, it gets aggregated itself. several protocols based on this approach are PEGASIS, PEDAP etc. PEGASIS (Power Efficient Gathering in Sensor Information Systems) is a tree based protocol in which sensor nodes communicate only with their neighbors to decrease the power consumption. Since there are no cluster heads, it minimizes the overhead effectively. In this technique, the data aggregated by the sensor nodes will be sent to the sink node by one of the node in the sequence. Hence each node will get a possibility to transmit the gathered data.

II. REVIEW OF LITERATURE

This paper proposed [20] the design and implementation of the Intentional Naming System (INS), a resource discovery and service location system for dynamic and mobile networks of devices and computers. Such environments require a naming system that is (i) expressive, to describe and make requests based on specific properties of services, (ii) responsive, to track changes due to mobility and performance, (iii) robust, to handle failures, and (iv) easily configurable. INS uses a simple language based on attributes and values for its names. Applications use the language to describe what they are looking for (i.e., their intent), not where to find things (i.e., not hostnames).

INS equipment a late binding mechanism that integrates name resolution and message routing, enabling clients to prolong communicating with end-nodes even if the name-to-address mappings adjust while a session is in progress. INS resolvers self-configure to form an application-level overlay network, which they use to discover novel services, perform late binding, and maintain authorak consistency of names using soft-state name exchanges and updates. author investigate the performance of the INS algorithms and protocols, present measurements of a Java-based implementation, and describe three applications author have implemented that demonstrate the feasibility and utility of INS.

In this paper [19], author appear at communication protocols, which can have significant impact on the overall energy dissipation of these networks. Based on our findings that the conventional protocols of direct transmission, minimum-transmission-energy, multi-hop routing, and static clustering may not be most advantageous for sensor networks, author proposed LEACH (Low-Energy Adaptive Clustering Hierarchy), a clustering-based protocol that utilizes randomized rotation of local cluster base stations (cluster-heads) to evenly distribute the energy load amongst the sensors in the network. LEACH uses localized coordination to enable scalability and robustness for dynamic networks, and incorporates data fusion into the routing protocol to reduce the amount of information that must be transmitted to the base station. Simulations show that LEACH can achieve as much as a factor of 8 reduction in energy dissipation compared with conventional routing protocols. In addition, LEACH is able to distribute energy dissipation evenly throughout the sensors, doubling the constructive system lifetime for the networks author simulated.

In this paper [18], Author proposed an adaptive rate control mechanism aiming to support these two goals and find that such a scheme is most effective in achieving our fairness goal while being energy efficient for both low and high duty cycle of network traffic.

During this paper [17], author outline network period of time because the time spanning from the moment once the network starts functioning properly, till a similar level of coverage

can\'t be secured to any extent further attributable to lack of energy in sensors. To maximize system period of time, author proposed to use sensing element abstraction redundancy by process subsets of sensors active in several time periods, to permit sensors to save lots of energy once inactive. During this paper, author consider regarding video police investigation and aforementioned about the way to save the ability of a sensing element by golf shot them in sleep mode after they area unit inactive so author are able to improve the period of time of the network however it absolutely was unacceptable in continuous transmission of the information.

During this paper [16], author conferred AN energy-efficient distributed cluster approach for ad-hoc sensing element networks. The approach is hybrid: cluster heads area unit at random elite supported their residual energy, and nodes are part of clusters specified communication significance is decreased. During this paper, author proposed a replacement energy economical approach for cluster nodes in unintentional sensing element networks. Author anticipated a protocol, HEED (Hybrid Energy-Efficient Distributed clustering), that sporadically selects cluster heads per a hybrid of their residual energy and a minor parameter, like node proximity to its neighbors or node degree to enhance network period of time however during this approach it doesn't take into account any assumptions about the distribution or density of nodes, or regarding node capabilities.

Backhyun Kim et. Al [15], In this paper, authors proposed an energy-aware routing protocol to reduce the energy consumption of wireless sensor networks. This was accomplished by the combination of tree-based minimum transmission energy routing and cluster-based hierarchical routing. In this technique, a cluster-head is chosen with highest energy node such that the size of every cluster is less than and/or equal to hops. Every node can have different energy level which transmits its data to its cluster-head with short distance tree algorithm. Cluster head sends data to the other cluster-head or the sink with tree based minimum transmission energy algorithm due to the limit of nodes' transmission range. Since the node address represents its energy level, it is easy to reconstruct routing tree when wireless nodes or cluster-heads die. This technique is helpful to create a new route specially when a node, about to die, falling in the path of sink node.

R. Vidhyapriya et. Al [14], In this paper a reactive routing protocol called energy aware routing is introduced that is intended to provide a reliable transmission with low energy consumption. This protocol uses two metrics link quality and the available energy to identify an energy efficient routing path, which in turn minimizes packet collisions and increases the network lifetime. The author concludes that this algorithm uses less energy than traditional algorithms. However, further proposals are needed to confirm the delivery of packets under non-uniform transmission range. Also protocol must be improved to decrease the delay.

During this paper [13], author proposed a unique mathematical model for shrewd the higher bounds on the period of time of a sensing element network. Sensors area unit organized into clusters and a applied math model is introduced for shrewd a cluster head rotation schedule. In contrast to most alternative cluster algorithms, this rule maximizes the network period of time instead of minimizing the energy dissipation of sensors, during this paper, author proposed a unique mathematical model for shrewd the higher bounds on the period of time of a sensing element network so it maximizes the network period of time instead of minimizing the energy dissipation of sensors however it doesn't work once the network is incredibly massive.

During this paper [12], author gift a period of time communication protocol for sensing element networks, known as SPEED. The protocol provides 3 varieties of period of time communication services, namely, period of time unicast, period of time area-multicast and period of time area-any cast. SPEED is specifically tailored to be a unsettled, localized rule with borderline management overhead. In this paper, author proposed a period of time communication protocol for sensing element networks, known as SPEED that provides period of time communication services and it maintains a desired delivery speed across the network through a unique combination of feedback management and non-deterministic qos-aware geographic forwarding however it considers solely regarding the info delivery of the network.

During this paper [11], Author developed theme by coming up with the network with multiple-sized fastened grids whereas taking under consideration the arbitrary-shaped space perceived by the sensing element nodes. In this paper, author considers the various initial energy states of sensors, and placed that sensing element per that energy state. Therefore energy loss was avoided. However shrewd completely different initial energy state and inserting the node per that energy state is tough in real time.

Hanh-Phuc Le et. Al [10], Considers one of the energy constraints i.e. Network survivability and tradeoffs which affects energy-aware routing strategies. The proposed adaptive energy-slope control (AESC) method try to keep each and every node alive for a certain required maintenance period. This method suppresses a mote from being a favorite intermediary node with high traffic for long period of time. In the proposed strategy, the

network is expected to cope with worst cases of environment-dependent connectivity while still sustain energy-efficient connections in normal situations. The author concludes that the proposed strategy optimizes the use of various energy sources like scavengers for each sub network so as to extend the network survivability.

Zhi Chen et. Al [9], proposed a new algorithm Adaptive Energy-Aware routing Protocol (AEAP), which is based on Link Estimation and Parent Selection (LEPS) protocol. This algorithm uses a broadcast delay method to suppress frequent updates to mitigate unnecessary rebroadcasts. It is a load balancing strategy which consider both energy state and link quality to choose next hop among neighboring nodes and cope with changes in topology with an adaptive node self-organization mechanism.

During this paper [8], author proposed the way to place sensors by use of a borderline variety to maximize the coverage space once the communication radius of the metal is not but the sensing radius, which ends within the application of standard topology to wireless sensor networks preparation. This paper author mentioned the small print of sensing element preparation. Attributable to best coverage sensing element preparation, it reduces the number of sensors usage and conjointly will increase the period of time of sensors.

George-Emil Vieriu et. Al [7], proposed a power aware adaptive routing protocol and topology control at network layer which is based on the residual operating time of sensor nodes. The proposed protocol can adapt to the changes of the energy reserves of the network. In addition to power monitoring power down management and sleep management is also implemented locally for each node.

Akoijam Premita et. Al [6], proposed a power efficient routing protocol which saves the energy by selecting the energy efficient path in the routing method. To increase the energy efficiency additional transmission power of the nodes is also adjusted based on the location of their neighbors. The proposed protocol extend the life time of the overall sensor network by avoiding the unbalanced exhaustion of node battery powers as traffic congestion occurs on specific nodes participating in data transfer. However, there is need to handle overhead of mobility and topology changes in such energy restricted environment.

Savita Lonare et. Al [5], provided survey of routing protocols for wireless sensor network which give enhanced performance with limited resources. This paper concludes that energy factor is one of the most vital factors to be considered while designing routing protocols. This paper summaries energy efficient routing protocols for wireless sensor network.

In this paper [4], proposed an on-demand routing protocol based on adaptive threshold transmission range and adaptive threshold energy which considerably enlarge network lifetime by improving energy utilization in routing. In this paper, the transmission power of node is varied according to the minimum amount of neighboring nodes connected in the network.

In this investigation [3], author develop a cluster routing algorithm over large-scale networks and anticipated a low-duty-cycle medium access control algorithm to reduce collision, idle-listening, and overhearing. In addition, this work focuses on the combined optimization of routing and a medium access control policy for achieving a superior trade-off among low delay, energy efficiency, and tracking accuracy. To organized this protocol in a real tracking application, author also proposed a clustering synchronization procedure that does not necessitate distributing the global timing information over the absolute network to achieve network-wide time synchronization.

Target tracking applications in wireless sensor networks need to attain energy efficiency, tracking accuracy, and certain real-time constraints in response to the fast-moving targets. From a layer view, an energy-efficient cross-layer communication protocol that consists of a medium access control layer and network routing layer is necessary for dual optimization. Due to the interference and contention above the wireless medium, the limited resources of battery-operated sensor devices and the active topology of large-scale networks, this cross-layer design becomes a challenging assignment.

This paper [2], proposed a Trust and Energy aware Secure Routing Protocol (TESRP) for wireless sensor network that developed a distributed trust model for discover along with separation of mischievous nodes. Trust and Energy aware Secure Routing Protocol employs a multi-facet routing strategy that takes into consideration the trust level, residual energy, and hop-counts of wireless sensor neighboring nodes while making routing decisions. This strategy not simply ensures data dissemination using trusted nodes but also balances out energy consumption amongst trusted nodes while traversing through shorter paths.

In this paper [1], author proposed a Trust and Energy aware Routing Protocol (TERP) that makes use of a distributed trust model for the discover along with separation of mischievous nodes. TERP incorporates a composite routing function that residual-energy, encompasses trust, and hop count of neighbor sensor nodes in making the routing decisions. This multi-facet routing approach helps to stabilize out energy consumption among trusted nodes even as routing the data using shorter paths.

III. CONCLUSION

This paper concludes that energy consumption is one of the most vital factors for wireless sensor networks. There is a require to preserve energy of nodes by efficient utilization. For this point various algorithms and protocols have been proposed by different authors. Some proposed techniques were based on adaptive transmission range and topology whereas some authors suggested clustering and tree based approach.

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