

An Energy efficient Routing Protocols in Wireless Sensor Networks: A Survey

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Abstract— Wireless sensor network (WSN) consists of numerous sensor nodes which are deployed to inspect a certain subject. As a stream of packets from the source node is sent to the sink, the data has to reach without any delay or loss of packets. The key issue in WSN is that these networks suffer from the packet overhead, which is the root cause of more energy consumption in sensor networks. The previous works achieved are look-ahead bandwidth schedulers are deployed to meet high speed and to increase energy efficiency of WSN. Centralized and decentralized heuristic are developed and an energy harvesting method is used to maximize the network lifetime. To reduce redundant overhead and to conserve nodes' energy a cross layer energy balanced bidirectional minimum hop routing algorithm is used. The sensors nodes in WSN are battery operated and are hard to replaced and recharge the battery of these nodes. Sometimes the mode of the node changes from active to sleep the efficiency decreases as data has to wait at the initial point. In this paper we provide a survey on how to maintain the energy efficiency incase if there are any dead nodes and to find an optimal path in which data can be transmitted. To achieve this we proposed energy aware routing protocol named as PDORP.

Keywords— Assistive Storage, Bit Error Rate, Efficiency, Optimization, Throughput .

I. INTRODUCTION

The nodes in WSN are distributed spatially to manage the physical conditions such as temperature, sound, pressure etc. They are also called as Wireless Sensor and Actuator Networks (WSAN). WSN are used to transfer or pass the data to the main location without any loss of data. The WSN's developed these days are bi-directional, and also controls the sensor activity. Wireless sensor network consists of few or several nodes where in each node are connected to one or several nodes. Each sensor node contains different parts such as radio transceiver, microcontroller, internal and external antenna, a battery which works for years and energy harvesting using embedded system method.

The main source of lifetime in Wireless sensor network is battery. To transmit the information from source to destination or to the sink in order to establish the communication high amount

of energy is required in preparing the information and then transmitting it to the destination.

The battery of these nodes in Wireless sensor network is non-chargeable, they are not supplied any energy when they are draining out of battery. Many scientists have proposed many energy effectiveness routing protocols but each protocol depends on the assumptions of the individual.

To cover all the constraints such as reliability, shortest route, delay, energy efficiency, communication overhead and resource management a energy efficient routing protocol known as PDORP has been developed. The optimization in this proposed routing protocol PDORP is achieved using two algorithms namely GA and BFO. The reactive and proactive routing protocols are combined to form the proposed PDORP. The distance between the nodes can be reduced by using the directional transmission concept in WSN. This method also helps to reduce the energy consumption of the nodes.

. In addition, the cache memory is very helpful when a node becomes more aggressive at the time of transfer and earlier it was not in the cache memory, the other node receives a packet from it and in this way it can cause damage to the current routes. In order to solve this situation proposed routing protocol creates a trust for the first time in each round on the basis of the parameters allocated to the nodes.

II. LITERATURE SURVEY

You-Chiun Wang et al.[1]. proposed a new method "Energy-balanced dispatch of mobile sensors in a hybrid WSN". The objective is to schedule the mobile sensors travelling paths in energy-balanced way. This proposed method uses the technique of Centralized and distributed algorithm to dispatch mobile sensors in hybrid WSN. The main advantage of this proposed model is to maximize the overall lifetime of the network. The disadvantage or the limitation is that the mobile sensors collide with any obstacle to reach its destination.

S.Q. Zheng , et al.[2]. proposed a concept named "Finding obstacle-Avoiding shortest paths using implicit connection graphs". The main objective of this method is to solve shortest path related problems like one-to-one, one-to-many, minimum spanning tree problem in presence of obstacles. The basic techniques used in this method

are one-to-one shortest path algorithm, path finder algorithm and FDM. The advantage supported by this proposed method is it helps to reach the destination in limited time without any collision. The limitation endured in this method is the time and space complexities.

Xiao lin, et al.[3]. proposed a method namely "Time-Shifted multilayer graph : A routing frame work for bulk data transfer in optical circuit switched networks with assistive storage ". The objective of this proposed method is a specific protocol is used for bulk data routing. The techniques adopted fir achieving this bulk data routing is Routing Frame Work named TS-MLG. The advantage of using this protocol and frame work is that with single routing TS-MLG it can realize both spatial assignments and temporal arrangements. The equivalent drawback of using this method is it endures high delay while maintaining both utilization and blocking.

Xiangfei Zhu, et al.[4]. Proposed a new concept "An analytical model for a book-ahead bandwidth scheduler". The objective of this proposed system is that the schedulers are being deployed to meet high-speed and predictable service networking requirements of applications in the scientific research community. The techniques used here is model for non-homogeneous continuous time Markov chain which has an embedded discrete time Markov chain(CTMC). The advantage of the proposed non-homogeneous continuous-time chain with embedded discrete time is to solve scientific community mean scheduling delay. The proposed concept is limited with no exact analytical model for BA bandwidth schedulers.

Iftchar Ahmad et al.[5]. proposed a new method namely "Ahead reservation in QoS-Enabled networks. The main objective of this proposed system is it aims to reduce pre-emption probability at same time ensuring higher network utilization and lower wasted throughput. The techniques used in this proposed concept are resource reservation and preemption, dynamic look-ahead time model, book-ahead reservation. The main advantage achieved is lower preemption probability, higher throughput, lower wasted throughput and higher effective revenue. The limitations endured in proposed model are computationally small and will cause very small computational overhead on routers.

Swathi.V et al.[6]. proposed a new method "Improve the lifetime of WSN using data collection protocol". The main objective of this method is an EDAL-WAP protocol is used for increasing the energy efficiency of WSN. It will yield routers that associate all nodes with low cost routers, under restraints of packet latency requirements. The two important and basic algorithms used here is Centralized heuristic and distributed heuristic. Centralized to reduce the computational overhead and distributed protocol for large network operation.

The advantage of this proposed algorithm is that it increases energy efficiency of WSN and low cost routers can be achieved. The disadvantage is that it has limited number of computation, communication and storage resources and also it reduces network lifetime.

V.Prathibha , et al.[7]. proposed a concept namely " Enhancing the network life time of co-operative WSN using energy harvesting technique". The main objective of this proposed system is to improve network lifetime and communication is carried out by signal cooperation through relays in order to assist sources to exchange information for longer time. The technique used here is electromagnetic radiation energy harvesting. The advantage of this system is that water filling power allocation increases network lifetime, successful message exchange and the ratio of signal to noise is analyzed. The limitation that occurred in this system is that it is non-directional and is not bi-directional.

Zhi Ren, et al.[8]. proposed a system named "A cross-layer energy-balanced bidirectional mini hop routing algorithm for WSNs". The objective of this proposed system is to reduce the redundant overhead and to conserve nodes energy in WSN. The technique used in this system is Cross-layer energy-balanced bidirectional mini hop routing algorithm. The advantage of this method is it reduces consumption of node energy and also reduces network bandwidth. It also endures a problem where the energy is not balanced between the nodes.

Ahmed M.Shamsan et al.[9]. proposed a method called "An improved routing mechanism using Bio-Inspired for energy balancing in WSN". The technique used to achieve energy balancing is self optimization scheme using meta heuristic (AOC) Ant Colony Optimization. The advantage of this entire proposed system is that it minimizes the residual battery power, hop members and energy of both route and network and also distributes traffic load of sensor nodes throughout the WSN. The disadvantage of the system is it does not maintain throughput ,delay and packet loss.

Rashmi.A.Mahale et al.[10]. Proposed "Throughput aware ACO based routing protocol for wireless sensor network". The techniques used for this proposed system is WSN routing protocol based on ACO and NARP novel routing protocol based on ACO. The main advantage of this system is more node energy frequency of node and also improves network performance. The limitation that endures in this proposed method is more end-to-end delay.

Jae-Ho-Lee et al.[11]. proposed "WTE-MAC wakeup time estimation MAC for improving end-to-end performance in WSN". The main objective is to decrease energy consumption due to lower end-to-end delay than the X-MAC in multi-hop topologies. The technique used in this system is new MAC protocol named WTE-MAC with a new scheme called virtual tunnel (VT). The advantages

reached in this method are it is an on-demand approach with low power consumption by reducing unnecessary retransmissions. The limitation that endures is Virtual tunnel can be inefficient where collisions are incurred in burst by other interference.

Vikas , et al.[12]. proposed “Contention based energy efficient WSN”. The main objective of this proposed system is to avoid the collision in the network. To achieve this objective the techniques used in is medium access control protocol for both asynchronous and synchronous. The advantages achieved are MAC controls radio signal in channel of communication between the sensor nodes. The limitation that is endured is long listen interval and overhead created by beacons

Deepak Simaiya et al.[13]. proposed “Simulation and performance evaluation of energy efficient MAC protocol for WSN”. The techniques used are for synchronous approach sharing schedule information is used and for asynchronous approach [RI-MAC]. uses receiver initiated beacon. The advantage of this proposed system is it limits the idle listening, improves the performance of contending flow and data gathering. The disadvantage endured in this proposed system is RI-MAC supports less packet delivery ratio and throughput.

Dr.Trilok Chand et al.[14]. proposed “Comparative analysis of a contention based (RI-MAC) and TDMA based (ATMA) MAC protocols for WSN”. The main objective of this proposed system is to compare between RI-MAC and proposed ATMA. The techniques used in this proposed system are RI-MAC and ATMA. The advantage of this method is ATMA achieves higher energy efficiency when number of nodes is increased. The drawback of this proposed system is that it has small drifts that occurs which do not prevent the exchange of packets.

Surjya Ray et al.[15]. proposed “ATMA : Advertisement based TDMA protocol for busy traffic in WSN”. The main objective of this proposed method ATMA is added a new procedure where in it performs well which is called TDMA protocol. The basic techniques used in this process are TDMA protocol. The advantages of proposing this system are it minimizes the energy lost due to idle listening while nodes wait for contention and also works well in busy traffic. The limitation that is endured is Broadcasting scheme is limited.

Deng Yubo et al.[16]. proposed a new method namely “Modeling of broadcasting based on distance scheme for WSN”. The objective of this proposed method is modeling of WSN is very difficult because of its complexity therefore normal way is to evaluate various broadcasting protocols. The techniques used in this system are modeling method for data broadcasting in WSN is advanced by calculating the transmission probability based on distance. The main advantage of this method is broadcasting can be achieved easily. The limitation of using this method is there is no security, DoS

attacks occurs therefore there is no secure communication.

Jiawei Chen et al.[17]. proposed “Broadcast authentication protocol scheme based on DBP-MSP and safe routing in WSN against DDoS attacks”. The main objective is to help the WSN to achieve better performance against DDoS attacks in broadcast authentication. The techniques used here is strategy based on DBP-MSP is used and safe routing protocol is used. The Advantages of using this proposed system is it reduces energy and memory consumption of the sender, it also maintains nice property against DDoS attacks when broadcast workload is heavy and also increases the broadcast security. The limitation that endures in this method is inaccessible areas are present where the information will not be collected from.

S.Rani, et al.[18]. proposed “Energy efficient chain based co-operative routing protocol for WSN”. The main objective of this proposed method is to reduce in total transmission time and energy consumption and to collect information from inaccessible areas by using factorization of area into subareas (clusters). The technique used is Novel algorithm to handle in large extent and high density deployment. The advantage of this process is that it achieves co-ordination and co-operation among local nodes via relay nodes to serve each other and every other node. Transmission distance is also minimized. The limitation that endures is energy consumption becomes more.

III. PROPOSED MODEL

In this section we discuss the network creation, nodes deployment and the proposed routing method PDORP. With the help of algorithm 1, (Network creation) a network is created and the nodes N are randomly deployed in the network..And the area taken for this proposed system is 1000 square meters. Further in this algorithm 1, we have calculated the distance d of all the nodes from their neighbors and then we have compared the distance of all the nodes with the threshold th value, so that the nodes will be connected only when their distance is less than or equals to the threshold value. This algorithm is used to make sure that all the nodes are connected with a minimum distant value. In proposed network the network is deployed using the coverage set in this algorithm 1. The data transmission between the nodes takes place through the route using the algorithm 2 (Path Finding). The main aim of this algorithm 2 is to find the optimal path in the large coverage set of nodes so that no nodes are inactive in the optimal path. The transmission between the source node and destination node takes place if and only if both the source and destination are present in the coverage set. [20]. Optimized Routing Protocol (PDORP) mainly utilizes the characteristics of both the proactive and reactive routing model.

The Figure.1 shows the simulation model of proposed system. The proactive protocol and reactive protocol is both combined to develop this PDORP protocol in which GA and BFO algorithms are used. And all the parameters are checked and compared with the previous models. If a node becomes more aggressive at the time of transfer and previously it was not in the cache then the other node is bound to receive a packet from it and in such a way it can cause damage to existing routes.

The proposed system uses both GA and BFO concepts. The hybridization of GA and BFO helps in selecting the optimal path. The GA algorithm works in three steps: 1) Selection process where in the selection of nodes takes place. 2) Cross over where in the nodes will be divided in to chromosomes and then combined. 3) Mutation where in all the active nodes will be replaced by the dead nodes.

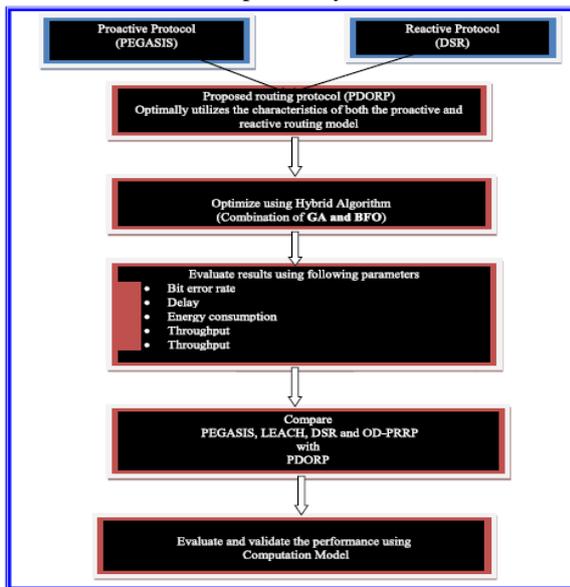


Figure.1: Simulation Model of Proposed System

In this way the proposed system works well and performs well when compared to the previous protocols.

III. EVALUATION

In this evaluation process it has been evaluated that the proposed routing protocol PDORP method outperforms than PRRP, OD-PRRP, LEACH, DSR and PEGASIS with respect to bit error rate, end to end transmission delay and energy consumption parameters. But the throughput parameter works well for LEACH than any other routing protocol. The disadvantage of this LEACH routing protocol is that it can not maintain the energy there fore energy consumption has become the main key constraint in LEACH. To overcome this problem the PDORP is proposed.

The Figure.2 shows the flow chart of proposed model PDORP. Initially the node will find the closest node and will find the distance between other nodes and if the node is active only then it will

transmit the data to the destination. All the nodes in the path should be active. Initially starting the N number of nodes will be deployed in the network after which the X location and Y location of each node will be calculated. Then the source node will find the closest node only in the direction of the destination node. If the requesting node appears in the cache then don't accept. Initialize the trust vector, and if node appears in the trust list at least once then transfer the data. The energy consumption of proposed algorithm is stable and maintained even if the number of rounds is increased. In terms of energy consumption parameter PDORP will act as optimal routing protocol.

A. End to end transmission delay

This parameter gives the time taken by a packet for transmitting the data also the propagation delay, transmission delay and queuing delay when passing the data from the source node to the destination node. The delay increases if the number of nodes increases. The time between the source sending the packets in order to the destination node receiving the packet is the time delay which is named as delay in transmission. The end to end delay for OD-PRRP[19] will be increased only if the number of rounds is increased. In addition, results show that proposed routing protocol PDORP outperforms than LEACH, DSR, and PEGASIS and even from OD-PRRP when considering packet delivery delay. The end to end transmission delay is less in PDORP when compared to other routing protocol as the nodes will be selected for the optimal path only if the node is active.

B. Bit error rate

This parameter evaluates the error that occurs in the network when there is the transmission of data from source node to destination node. The bit error rate is less in the PDORP when compared to other previous routing protocols.

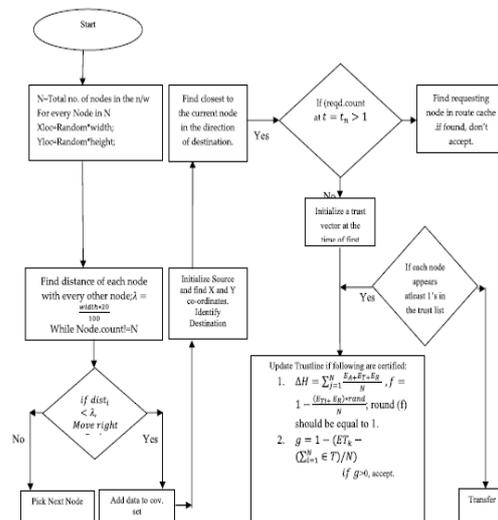


Figure.2: Flow chart of PDORP.

C. Throughput

This parameter gives the percentage of the successful messages that is transferred in the network from source node to the destination node in the given amount of time. As already indicated the LEACH performs well in terms of throughput when compared to other routing protocols. The other protocols such as PRRP, OD-PRRP, DSR all works in similar manner in terms of throughput. In PDORP throughput has to maintained better in the future works.

The Figure.3 shows the comparison of the proposed routing protocol PDORP with the other routing protocols like LEACH, PRRP, DSR, PEGASIS and OD-PRRP. It has been observed from Figure. 3. That proposed method outperforms than OD-PRRP, LEACH, DSR and PEGASIS when considering bit error rate, end to end transmission delay and energy consumption parameters and PDORP works well even if the number of rounds are. But LEACH performs well in terms of throughput when compared to other routing protocols but the main disadvantage of this LEACH is energy consumption is more which is a drawback for nodes battery. This drawback is over come by PDORP. This protocol PDORP is stable even when number of rounds is increased. In terms of energy consumption parameter PDORP will act as optimal routing protocol.

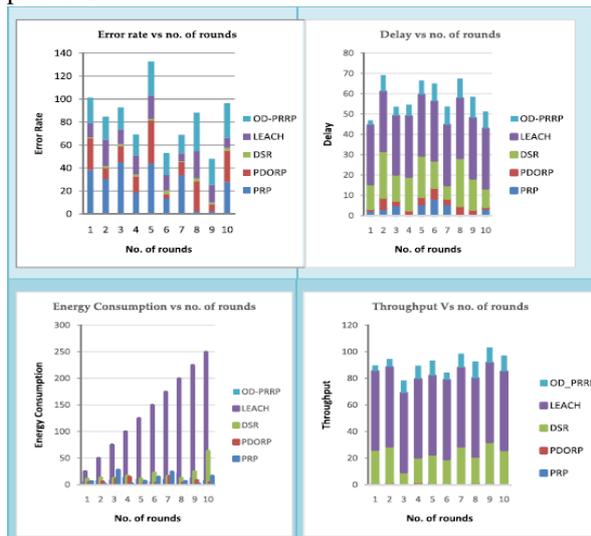


Figure.3 Comparison of various parameters with varying number of rounds.

IV. CONCLUSION

In this paper, we have provided a brief survey of maintaining and increasing the energy efficiency by selecting an optimal path where in all the nodes will be in the active mode and not in sleep mode. In the proposed model PDORP a hybrid optimization based PEGASIS-DSR optimized routing protocol (PDORP), use both the algorithms

GA and BFO which has used cache memory and directional transmission concept of the previous two protocols namely proactive and reactive routing protocols. The performance of PDORP has been evaluated and confirmed that it is the best routing protocol by comparing it with other existing available methods like PEGASIS, LEACH, DSR, PRP and OD-PRRP. The proposed system PDORP outperforms in most significant and important parameters like bit error rate, end to end delay, energy consumption and throughput.

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