Data Aggregation Routing Protocol for Efficient Routing Maintenance in Wireless Sensor Network Communication

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Abstract- Wireless Sensor Network (WSN) is formed by group of sensor nodes without using any infrastructure or centralized control. The sensor nodes in a network are wirelessly connected in order to accumulate and report the environmental data. The sensor nodes in WSN are organized in a self-organizing manner. WSN consuming several constrained resources in terms of energy, computation, communication and storage to carry out three tasks such as physical quantity measurement, processing the sensed data and data information transmission to sinks node for consumer access. In WSNs, the routing i.e (broadcasting the data packets from source to sink node) is the significant task. The WSN routing is carried out by the interconnecting the sensor nodes through either single or multi-hop paths. In addition, data aggregation plays an essential role to conserve the energy by avoiding redundant data transmission in WSNs. Data aggregation is the collection of data packets from various nodes and combine them by implementing the data aggregation function to provide results in summary form for further analysis. But, while performing data aggregation and routing process to maintain the route for data transmission, the energy efficiency is the major concern in WSN. Therefore, our research work is focused on ensuring the route maintenance with improved network lifetime and minimized energy consumption.

Indexed Terms- Wireless Sensor Network, Routing, Data Aggregation, Route Maintenance, Energy Consumption, Network Lifetime.

I. INTRODUCTION

Wireless Sensor Network is a promising network to ensure crucial and popular ways of providing common computing environments for various applications because of some benefits such as low cost and power, small size and multi functions. WSN is one of the types of wireless network where multiple detection stations as sensor nodes organized in a number of separate groups without any specified infrastructure.

The sensor nodes are enclosed with a transducer, microcomputer, transceiver and power source to transmit the data packets among multiple paths.

The routing between sensor nodes is directly interconnected with energy conservation which leads to improve the network lifetime. Then, energy saving is the inherent issue in WSN to improve the data aggregation process. In order to improve the network performance with enhanced network lifetime and minimized energy consumption, the aggregation techniques are developed with routing protocol while transmitting the useful information from source node to sink node.

This paper is organized as follows: Section II discusses reviews on energy efficient routing protocol and data aggregation techniques in wireless sensor networks, Section III describes the existing routing and aggregation techniques for route maintenance, Section IV identifies the possible comparison between them, Section V explains the limitations and Section VI concludes the paper, key areas of research is given as to perform energy conserved routing for maintaining the route with improved network lifetime.

II. LITERATURE SURVEY

In [1], an efficient novel energy aware hierarchical cluster-based (NEAHC) routing protocol was implemented with the objective of minimizing the energy consumption and ensures the assurance to the energy consumption between nodes in a network. The relay node choosing problem was represented by nonlinear programming issue. Then, the optimal solution was discovered by implementing property of convex function. But, routing overhead remained unaddressed.

In [2], Low power and Lossy networks (RPL) routing protocol was developed with IPv6 Routing Protocol to reduce the energy consumption and energy load balance. This routing protocol was designed with relatively balanced RPL and improved protocol (IRPL). The loop domain communication route was carried out by implementing efficient clustering algorithm and an effective topology control model. Then, the optimal number of cluster heads was computed with the help of clustering algorithm. The cluster head node finishes the clustering process by utilizing clustering probability model and the node competition mechanism. But, lifetime of network was minimized by using energy-balanced clustering algorithm with RPL routing protocol.

The novel cluster-based routing protocol as distance-and-energy-aware routing with energy reservation (DEARER) was developed by [3] for ensuring the nodes with improved energy-arrival rate which act as CH nodes. The harvested energy was prevented by implementing the DEARER to assign non-CH nodes. Then, the enabler nodes were selected as CH nodes with improved energy. However, packet transmission was minimized in the non-CH mode and also the throughput gets decreased.

An embedding method as scalable and distributed routing algorithm was introduced with guaranteed delivery and low stretch for high genus 3-D WSNs (SLICE) in the [4]. The greedy routing was performed in high genus 3-D WSNs for embedding the surface network with planar topology. The variation of Ricci flow algorithm was developed by open surface planar convex polygon for ensuring the lower distance distortion. The developed method enclosed with greedy routing in high genus 3-D WSNs. SLICE was not able to perform for high genus 3-D surface WSNs. Hence, while performing the greedy routing variation, SLICE inserts it to planar convex polygon with circular holes to attain high genus 3-D surface network with holes. However, SLICE method was not suitable to provide complete solution for 3-D WSNs with arbitrary shapes.

An efficient route update and maintenance was performed by developing the global and local update processes is presented in [5]. Besides, global and local update processes was developed with hierarchical proactive routing framework. The potential routing path issues were addressed while updating the routing path in long period was done by global process and updating the routing path in shortest period. However, hierarchical proactive routing framework was failed to effectively maintain the routing process.

In [6], the load balancing issues were solved by implementing Opportunistic Routing based on Residual energy (ORR). Based on the forwarding cost estimation derived from duty cycle and network topology, optimal number of forwarders was identified. The high traffic was maintained through the nodes with high energy while consuming residual energy by forwarders. Then, the loops were removed by using the resultant routing protocol and the lifetime of network also improved with irrespective of duty cycle and network topology. But, the distributed algorithm was not able to detect the optimal number of forwarders at each node.

The complexity of data aggregation issues in static networks were solved by implementing the tight bounds in [7]. While graph degree is at most three, then the issue remains NP-complete in a static network. Besides, when the graph of degree is at most two, then the issue remains as NP-complete in a dynamic network. In the dynamic graph, the data aggregation time was minimized by utilizing the lower and upper. However, the tight bounds failed to enhance the data aggregation accuracy.

While collecting the predetermined number of data into one packet with Maximum Lifetime Data Aggregation Tree Scheduling (MLDATS), the lifetime of network was improved by solving the scheduling virtual data aggregation trees. The MLDATS issue remains as NP-complete. Therefore, the MLDATS issues are addressed by introducing a local-tree-reconstruction-based scheduling algorithm (LTRBSA) in [8]. However, tree-reconstruction-based scheduling algorithm failed to provide efficient data aggregation in the dynamic wireless sensor networks.
The energy consumption was reduced by introducing the network layer as Weighted Compressive Data

Aggregation (WCDA) in [9] based on the sparse random measurement matrix. For providing power control ability in sensor node WCDA algorithm was implemented with energy efficient routing trees in WSN. This in turns, the load-balancing issues were addressed. Then, the novel data aggregation method as Cluster-based Weighted Compressive Data Aggregation (CWCDA) was used to reduce the consumption of energy in WSN. However, CWCDA needs mobility prediction to reduce the communication overhead.

The energy efficient structure-free data aggregation and delivery (ESDAD) protocol was developed in [10] to aggregates the redundant data in intermediate nodes. While the data efficiently collected from the routing path, the waiting time of packets at every intermediate node was estimated. Then, data aggregation was performed by sending the sensed data packets to the aggregation point. Besides, ESDAD protocol carry outs the near source data aggregation and the cost function is estimated for structure-free, next-hop node selection. But, ESDAD protocol failed to perform in the real time dynamic environment.

In [11], Principal Component Analysis (PCA) was developed with data aggregation solution in power and computationally limited environment. The signal was reconstructed with minimized energy consumption with the help of Normalized mean squared error (NMSE) threshold. Through the subspace-based data aggregation method, NSME was developed on the new basis and explained Jacobi eigen value decomposition ideas. The developed solution helps to reduce the number of transmissions between sink and one or more data aggregation nodes (DANs) in network. However, subspace-based data aggregation method was not able to enhance the data aggregation accuracy.

In [12], decentralized method was introduced to solve the NP-hard problem and complexity issues with the objective of collecting data at sink with minimal latency and less transmission by addressing tree construction and the link scheduling sub problems. The interference neighborhood of every link leads to the link scheduling sub problem. Then, the interference was controlled by performing coordination transmission between links. However, decentralized method failed to minimize the energy consumption.

The client/server data aggregation routing protocol termed Cluster-Based client/server data Aggregation routing protocol (CBA) was developed in [13]. Based on the hamming distance while implementing the lightweight clustering approach, CBA separates the network into many data-centric clusters. The aggregated results were provided to the sink through the cluster-heads form Minimum Spanning Tree (MST) as network backbone. Then, the cost of tree infrastructure was minimized by using the parallel collision-guided technique. However, routing overhead remained unaddressed while forwarding the raw data packets from each source region to the sink.
In [14], for periodical data collection events, Adaptive Data Aggregation protocol with Probabilistic Routing was developed. The adaptive data aggregation protocol with probabilistic routing was performed with the aim of ensuring nodes to provide an optimal routing structure for data aggregation with probability. Based on the multi-objective steiner tree, optimal routing structure was formed where routing scheme was performed according to the ant colony optimization and genetic algorithm. The adaptability of topology transformations were provided by probabilistic routing decision. Then, adaptive timing policy minimizes the transmission delay and improves the aggregation probability by utilizing prediction model based on sliding window to arrive the data packets in future. However, adaptive data aggregation protocol with probabilistic routing failed to improve the probability of aggregation in the dynamic structure.

The zone-based mobile agent aggregation (ZMA) was implemented with bottom up mobile agent migration scheme by [15]. In the ZMA, the mobile agents were initiates the journeys from centre of event regions to sink. This mobile agent migration scheme improves the data aggregation routing accuracy with minimized MA itinerary cost and delay. But, ZMA was not efficiently performing the real applications while utilizing the NLOS signal propagation model and the network is deployed in urban areas.

III. WIRELESS SENSOR NETWORK

Wireless Sensor Networks have received great attention to perform different applications on computing environments. The routing between source and sink node plays an essential role. During data transmission, identification of optimal route path among multiple paths ensures the effective routing on WSN. The data aggregation is the process of accumulating the data samples from different sources and combines them which data are used for future purposes. From that, gathering of sensed data is done by data aggregation process in an energy efficient manner thereby network lifetime is increased. By developing the energy and space optimization techniques, the efficient communication is performed with minimum energy and delay to reach the sink node. This in turns, the lifetime of network is improved on WSN. The performance of WSN is compared against with three methods including novel energy aware hierarchical cluster-based (NEAHC) routing protocol, Energy Efficient Structure-Free Data Aggregation and Delivery (ESDAD) protocol and Zone-Based Mobile Agent Aggregation (ZMA) protocol.

3.1 Improving network lifetime by using novel energy aware hierarchical cluster-based (NEAHC) routing protocol

In WSN, an energy aware routing protocol called as novel energy aware hierarchical cluster-based (NEAHC) routing protocol is developed by combining the clustering approach with optimal relay selection algorithm to improve the lifetime of network with minimized energy consumption. The NEAHC routing protocol is implemented with the main objective of performing the routing in WSN with minimized energy consumption and balancing the energy conservation between nodes. Besides, NEAHC routing protocol reduces the delay time of the nodes to reach the sink which improves the reliable data delivery on WSN.

The NEAHC routing protocol is performed in two phase such as cluster setup phase and steady state phase. The clusters are classified in the cluster setup phase. From the each cluster, nodes with low remaining energy are selected. Based on the residual energy of nodes, the cluster heads (CHs) are rotated in each round. The cluster head node selecting algorithm is designed to deals with the energy consumption for data communication between the CH and BS. According to the residual energy of node, CHs are selected by using NEAHC routing protocol. The low energy cluster members (CM) are controlled between sleep and active modes to balance energy among nodes.

The data packet transmission is carried out in the steady state phase. In the stead state phase, the sensed data is collected by every non cluster head node and transmit to the cluster head node. From that, the cluster head receives the all data information from all the member nodes. This in turns, the data aggregation is performed with reduced redundant data thereby neighbor cluster head node as next hop node is selected to effectively transmit the data packets. According to the residual power and fairness of each node, the relay node is selected within the one cluster. Then, the optimal solution is ensured by choosing the next hop node selection problem as a convex optimization problem. The optimal routing path between source and destination is selected to transmit the data packets by ensuring the highest remaining battery power, minimum energy consumption in multi-hop path and optimum fairness among sensor nodes.

3.2 Data aggregation delivery based on the Energy Efficient Structure-Free Data Aggregation and Delivery (ESDAD) protocol

The Energy efficient Structure-free Data Aggregation and Delivery (ESDAD) protocol is developed with the objective of performing efficient data aggregation of redundant data and delivery without structure maintenance. The ESDAD protocol carry outs the near source data aggregation. By using ESDAD protocol, waiting time for packets at each intermediate node is computed thereby the data aggregation is performed effectively in the routing path. The data aggregation is carried out by broadcasting the sensed data packets to aggregation point. According to the required reliability for aggregation, ESDAD protocol transmits the data packets. For the structure-free, next-hop node selection, ESDAD protocol estimates the cost function. The various kinds of flows to achieve the effective data delivery are controlled by partitioning the buffer of each node. Besides, while the congestion in WSN, ESDAD protocol adjusts the transmission rates of sources and intermediate nodes.

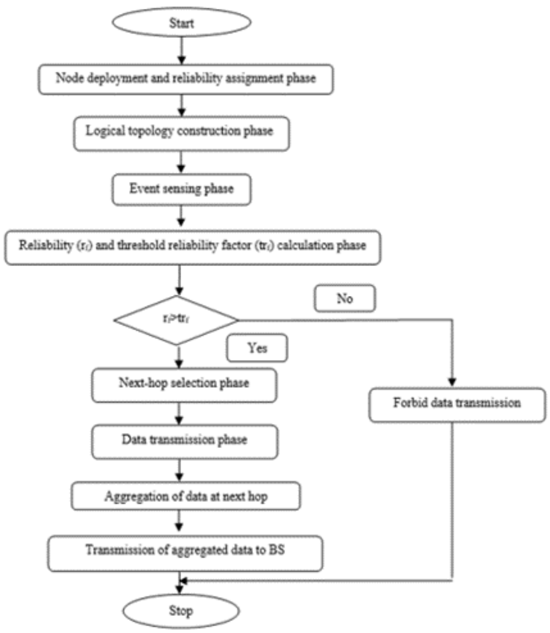

Figure 1 Basic steps of ESDAD protocol

The figure 1 illustrates the steps involved in the ESDAD protocol. At first, the sensors are deployed over a network. Based on the required reliability of the occurred event, logical topology construction phase selects the suitable neighbouring sensors to broadcast the sensed data. To efficiently broadcast the data between nodes, the sensor node needs to recognize its own position, position of neighboring nodes and base station. The logical topology construction phase reduces the utilization of maximum power to communicate, interference, maximum number of possible route. In addition, logical topology construction conserves connectivity by using the use minimal power. The logical topology construction phase is established through the Base Station (BS) by transmitting the data packets. After a random waiting period for removing collision among peer nodes, each node receives and transmits the data packets to identify the neighbor node. The transmitted data packets contain node ID, location information, energy level, buffer status and its hop-count. The sensor node selects the neighbor node with minimum hop-count value to reach BS.

The sensing zone is separated into sub regions such as higher reliability required sub region and lower reliability required sub region according the required level of reliability requirements to collect the data from sensor nodes. By selectively forwarding the sensed data packets to data aggregation points, the energy consumption is minimized during the data broadcasting over network. While considering the residual energy and available buffer space of next-hop node and strength of link between current node and next-hop, the cost function is computed to identify the next-hop node. Each node in WSN preserves neighbor information table to calculate the cost function and select the next-hop node. Based on the routing structure, number of packets is aggregated in the routing path. Then, efficient congestion control mechanism minimizes the packet loss and the local recovery of the lost packets.

3.3 Improving data aggregation routing by using Zone-based Mobile Agent Aggregation (ZMA)

The mobile agent routing protocol as Zone –based Mobile Agent Aggregation (ZMA) protocol is a mobile agent itinerary planning protocols which is implemented with bottom-up mobile agent migration scheme. With the objective of providing better improvement on data aggregation routing accuracy with minimized Mobile Agent (MA) itinerary cist and delay, through the bottom-up mobile agent migration scheme mobile agents initiates their process from the centre of the event regions to the sink. Besides, by performing event source distribution model or data heterogeneity through the data aggregation routing, the impact of network architecture is minimized.

The data aggregation is carried out to collect and aggregate the data across the WSN. The data aggregation routing is the process of improving the number of collected data samples at the same time which leads to reduce the network resource consumption and data collection delay. The data aggregation is performed by identifying the best possible paths to move the multiple MAs among the wireless sensor network. The ZMA network is model is enclosed with three aspects such as sink node, sensor node, event node. The performance of network is monitored by data consumer access-point (sink nodes). Then, the sensor nodes are responsible to compute the quantities and forwarding the MAs. The event sources are static or mobile to create the environmental data in the network field.

- Formation of zone

As the Data Centric (DC) way, the event regions are decomposed into many zones through the ZMA protocol. The zone forming phase is initiated if the sink node transmit the data. Thereby sensor nodes are allowed to accumulate the required routing information (in multi-cast or unicast) by forwarding the MAs at each data region. This in turns, the communication overhearing is minimized by limiting the routing communications to bound region.

- Establishment of Zone Mobile Agent Coordinators (ZMACs)

The MA journey is started by selecting the group of nodes in every zone called as Zone Mobile Agent Coordinators (ZMACs). The zone mobile agent coordinators possess maximum connectivity degree. While performing the data aggregation routing, ZMACs is the responsible to start the MA migration at every zone. After forming the zone in ZMA, the vicinity discovery phase is carried out to identify the local vicinity. By identifying the available connections to any neighbor that has same type data in the same zone. Besides, the weight function is used to discover the nodes which are more eligible to form ZMAC at each zone. ZMACs are selected by ranking the collection of weight values during vicinity phase. This ranked list of nodes is used to identify the most eligible node to become the new ZMAC.

- ZMA routing

ZMA protocol uses bottom-up MA migration to migrate the MA across zoned network for collecting the data. In ZMA, the structure of MAs comprises four components such as identification, data space, code part and itinerary. The information of the MA and dispatcher is ensured by identification and the aggregated data stored by data space. Then, the code represents the aggregation function and the MA routing information is ensured by itinerary. Based on the consumer requirements, the migration of MA to data regions are controlled by ZMA thereby the number of captured data samples are increased which leads to improve the data aggregation accuracy. Besides, the random or blind migration of MA is avoided through the ZMA thereby it identifies the path which guide the MAs to the desirable source nodes. While analyzing the requirement of source node, the MAs are moved across network. This in turns, the delay and energy consumption for transmission is reduced on WSN.

IV. PERFORMANCE ANALYSIS OF ROUTE MAINTENANCE IN WSN

In order to compare the routing and data aggregation process using different techniques, number of packets is taken to perform the experiment. Various parameters are used for analyzing routing and aggregation performance.

4.1 Performance analysis of network lifetime

The network lifetime in WSN is measured as ratio of number of sensor nodes addressed for data transmission to the total number of sensor nodes in a network. The network lifetime is evaluated as given below.

$$NL = \frac{sensor\ nodes\ addressed}{total\ number\ of\ sensor\ nodes} * 100 \qquad (4.1)$$

From equation (4.1), the lifetime of network is represented by 'NL'. The network lifetime is measured in terms of percentage (%). While the lifetime of network is high, then the method is said to be more efficient.

Table 4.1 Tabulation of network lifetime

Number of sensor nodes	Network lifetime (%)		
	NEAHC routing protocol	ESDAD protocol	ZMA protocol
50	45.32	43.45	38.32
100	49.35	45.23	42.35
150	54.76	49.54	44.76
200	57.89	52.34	46.89
250	61.45	55.34	48.45
300	63.45	57.87	51.45
350	65.32	59.67	54.32
400	67.34	61.23	57.34
450	69.75	63.56	59.75
500	71.12	65.77	61.12

The above table 4.1 shows the results of lifetime of network based on the number of sensor nodes in WSN. The number of sensor node taken from 50 to 500 which are considered as an input. The three methods such as NEAHC routing protocol, ESDAD protocol and ZMA protocol are compared for the simulation purposes. As shown in table 4.1, while increasing of number of sensor nodes, the lifetime of network also increases in all three methods accordingly. However, NEAHC routing protocol ensures better performance in the improving on network lifetime in WSN than the other methods.

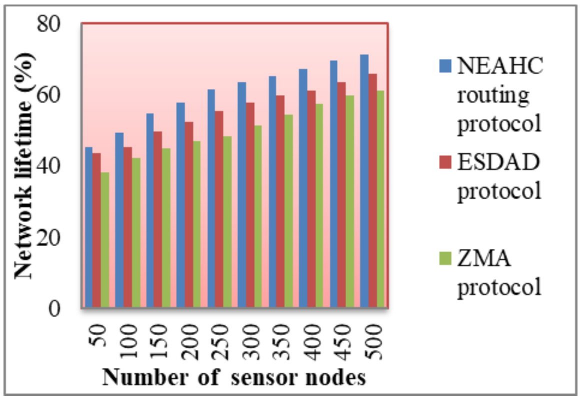

Figure 4.1 Measurement of network lifetime

Figure 4.1 illustrates the measurement of network lifetime in WSN using three methods namely NEAHC routing protocol, ESDAD protocol and ZMA protocol. From the figure, it is evident that, the NEAHC routing protocol effectively improves network lifetime when compared to other methods. With the help of clustering approach AND optimal relay selection algorithm, NEAHC routing protocol reduces the energy consumption between nodes during the data transmission thereby the lifetime of network gets increased on WSN. Therefore, network lifetime of NEAHC routing protocol is improved by 9% when compared to ESDAD protocol and improves 20% when compared to ZMA protocol respectively.

4.2 Performance analysis of data aggregation accuracy
The data aggregation accuracy in WSN is defined as the degree at which the data collected exactly from the sensor nodes. The data aggregation accuracy is measured in terms of percentage (%). Higher data aggregation accuracy ensures the better performance of a method.

Table 4.2 Tabulation of data aggregation accuracy

Number of data packets	Data aggregation accuracy (%)		
	ESDAD protocol	NEAHC routing protocol	ZMA protocol
10	60.34	55.23	50.45
20	62.45	56.45	52.23
30	63.34	58.34	54.67
40	65.32	61.76	55.23
50	68.23	63.57	59.45
60	70.23	65.45	62.34
70	71.34	67.67	65.76
80	72.45	69.23	67.12
90	74.34	72.91	68.45
100	75.12	73.54	70.34

The above table 4.2 shows the results of data aggregation accuracy based on the number of packets sent in WSN. The number of packets is taken as an input which is varied from 10 to 100. The three methods such as NEAHC routing protocol, ESDAD protocol and ZMA protocol are compared for the simulation purposes. As shown in table 4.2, if the number of packets is increased then the data aggregation accuracy also increased for the all three methods. But, ESDAD protocol provides better improvement in the data aggregation accuracy in WSN than the other methods.

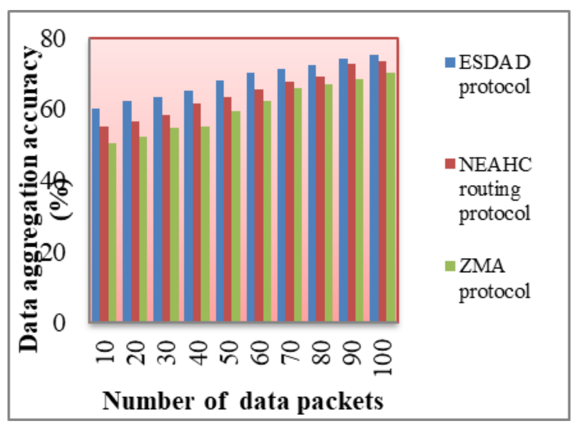

Figure 4.2 Measurement of data aggregation accuracy

Figure 4.2 illustrates the measurement of data aggregation accuracy in WSN using three methods namely NEAHC routing protocol, ESDAD protocol and zone-based mobile agent data aggregation. From the figure, it is evident that, the ESDAD protocol effectively improves data aggregation accuracy when compared to other methods. By using ESDAD protocol, waiting time of packets at every intermediate node is computed which leads to collect the data from other nodes efficiently. As a result, ESDAD protocol improves the data aggregation accuracy by 6% when compared to NEAHC routing protocol and improves 13% when compared to ZMA protocol.

4.3 Performance analysis of Energy consumption

The energy consumption for routing the data packet in WSN is computed through consuming energy by single sensor node to reach the sink node based on the total number of nodes in WMN. The energy consumption is expressed as given below.

$EC = Energy_{WSN} * Total_{WSN}$....Eqn (4.2)

The above equations (4.2) acquire the energy consumption 'EC'. 'Energy $_{WSN}$' specifies the consumption of energy by single data packet and 'Total $_{WSN}$' represents the total data packets by all the number of nodes in the WMNs. Energy consumption is measured in terms of Joules. When the energy consumption for routing is less, then the method is said to be efficient.

Table 4.3 Tabulation of Energy consumption

Number of sensor nodes	Energy consumption (J)		
	Zone-based mobile agent aggregation	NEAHC routing protocol	ZMA protocol
50	45.47	47.47	52.14
100	47.15	54.8	56.69
150	49.16	56.12	58.41
200	54.68	58.64	60.24
250	58.61	62.23	65.32
300	60.76	64.8	68.17
350	64.13	68.71	75.24
400	69.1	72.24	77.91
450	73.73	75.53	78.42
500	75.12	78.14	80.25

The above table 4.3 shows the results of energy consumption with respect to the number of sensor nodes in WSN. The number of sensor nodes is taken as input which is varied from 50 to 500. The three methods such as NEAHC routing protocol, ESDAD protocol and ZMA protocol are compared for the simulation purposes. As the number of sensor nodes increases, the Energy Consumption gets increased accordingly for all three methods. But, ZMA protocol provides better performance of reducing the energy consumption in WSN than the other methods.

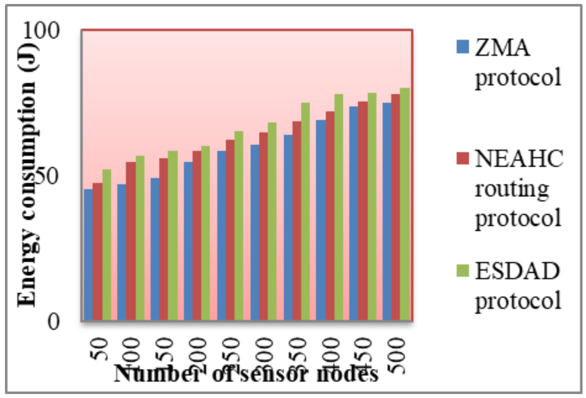

Figure 4.3 Measurement of Energy Consumption

Figure 4.3 demonstrates the measurement of energy consumption in WSN using three methods namely NEAHC routing protocol, ESDAD protocol and ZMA protocol. From the figure, it is evident that, the ZMA protocol effectively reduces the energy consumption when compared to other methods. ZMA protocol controls the migration of MA to data regions according to the consumer requirements which leads to reduce the energy consumption by nodes. Hence, the performance of energy consumption is reduced by using ZMA protocol to 7% when compared to NEAHC routing protocol and reduces 11% when compared to ESDAD protocol.

V. DISCUSSION ON LIMITATION FOR PERFORMING ROUTING AND DATA AGGREGATION TECHNIQUES

The Novel Energy aware hierarchical cluster-based (NEAHC) routing protocol is employed to enhance the lifetime of network and minimize the energy consumption by utilizing the clustering approach and optimal relay selection algorithm. Though NEAHC routing protocol improves the network lifetime but it failed to reduce the routing overhead. Besides, the consumption of energy is not minimized below threshold level by NEAHC routing protocol.

Then, the Energy efficient structure-free data aggregation and delivery (ESDAD) protocol is implemented to effectively perform the data aggregation and delivery on WSN. The sensed data are aggregated selectively to ensure better improvement on reducing energy consumption and end-to-end delay. But, the ESDAD protocol is not suitable for real-time WSN applications and it needs diverse reliability in the sensing field.

The Zone-based Mobile agent Aggregation (ZMA) is developed for selecting the optimal path by migrating the MAs to data regions over a network. Thus, the number of captured data samples are improved thereby data aggregation accuracy is enhanced on WSN.

Though ZMA protocol improves the data aggregation accuracy but it does not fit for the real applications while the network is deployed in urban area. In addition, the structure of ZMA needs to be modified to solve the changes in network.

5.1 FUTURE DIRECTION

The future direction of proposed scheme enhances the performance of route maintenance in WSN. In future, the energy optimization and data aggregation mechanisms are developed to improve the network lifetime by effectively collecting sensed data from neighbor node to reach the destination through selecting the best path. Another future direction is performed to ensure the efficient routing and data aggregation techniques on WSN.

CONCLUSION

In this paper, the survival study is carried out to maintain the routing over a network. The comparison of different techniques is carried out for ensuring the routing with improved data aggregation accuracy on WSN. The performance of routing and aggregation techniques is simulated with the metrics such as network lifetime, data aggregation accuracy and energy consumption. The experiments are conducted on methods such as Novel Energy aware hierarchical cluster-based (NEAHC) routing protocol, Energy efficient structure-free data aggregation and delivery (ESDAD) protocol and Zone-based Mobile agent Aggregation (ZMA) to provide comparative results for data aggregation routing in WSN. From the simulation results, it is clear that NEAHC routing protocol and ESDAD protocol enhances the lifetime of network and data aggregation accuracy respectively. In addition, the ZMA protocol reduces the consumption of energy by nodes in WSN as compared to state-of-the-art-works. Finally, the research work focused on improving the route maintenance with minimized space complexity and improved network lifetime during the data transmission on WSN.

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