Mobile Data Aggregation for Energy Efficient Node Placements in Wireless Sensor Network

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Abstract - Energy efficiency is also a priority in the development of wireless sensor networks. Mobile agent technology has given new space for efficient processing and data collection in the distributed wireless sensor networks for signal and information processing. The distributed mobile agent paradigm presents a variety of advantages over the current and widely-used client/ server wireless sensor network model. One of the most important issues in the mobile model is a traverse agent path. Multiple sinks mitigate this problem, reduce energy use in nodes and increase network life through multiple sinks. We present an MSP algorithm for optimizing network average life and reducing the average energy consumption of the network in this paper. Many sinks are used to communicate data. This maximizes the network 's overall life and reduces overall energy consumption. The simulation result shows that the proposed protocol exceeds the end-to - end delay, consumption and energy transmission.

Keywords: WSN, Distributed Computing paradigm, Mobile agent, multiple sinks, Average energy consumption, Average network lifetime, Data aggregation.

I. INTRODUCTION

Recent developments have paved the way for Wireless Sensor Network (WSN) in the fields of micro mechanical and wireless communication. Due to its ability to alter the relationship between human and physical environment, the WSN have become considered to be one of the most important research fields. In recent years, WSN has proven to be an enormous subject. WSN is a simple, small infrastructure network with a large number of small energy and computing nodes. Sensor nodes are used to track certain factors such as temperature, humidity, stress etc. in WSN under various conditions [1, 2].

The dense and dispersed systems that can perform more complex tasks and assumptions replace traditional central architecture. DSN consists of a large collection of homogenous or heterogeneously distributed, logically, spatially or geographically, sensor nodes, which are interconnected via a network over different interest and interconnected via a network [3]. Data are collected and processed continually through the network from their environments. The data obtained from different network areas are then combined in order to arrive at the final conclusions [4]. Since sensors are randomly distributed under unstable and uncertain conditions, there is no need for human interference. Sensors are self-configurable entities that collect and transmit data themselves. Many of WSN's main applications include military systems, remote control of the environment, safety surveillance, home automation and habitat surveillance, etc [1].

Battery powered system with limited computing abilities and limited range of sensor nodes were battery powered devices, also coordination was important, so nodes can compensate for the shortcomings of one another in controlling the redundant flow of data into a network, making it energy-efficient, and thus co-operate with other spatially located nodes. Distributed computing paradigms are needed to promote collaborative information processing at WSN [5, 6].

For WSN, mobile agent paradigm (MA) [7, 8] has been proposed to solve these problems. Under this model, MAs switch from node to node to perform the task assigned by using node resources. The MA model provides various benefits such as network load reduction, network latency overcoming, flexibility and fault tolerance.

In this paper, we propose a variety of sink positioning strategies in WSNs that iteratively identify possible sink areas. Throughout our work, sensor data are transferred through multiple sinks to the cloud computing system. In order to optimize average network reliability with average energy consumption of sensor network, we implement energy efficient multiple sink placement process. Algorithm proceeds iteratively and produces a result which maximizes average network life also minimizes average energy consumption after a limited number of iterations. Varied network scenarios compare the efficiency of various sink positioning strategies, contrasting them with the data aggregation technology of mobile agents and random placing algorithm (RPA) regulation.

II. RELATED WORK

The finding of optimal itineraries to MA traverse is an important investigation challenge for safe and effective data collection in the mobile sensor network from rising sensor nodes [9]. The node sequence in an itinerary has an important effect on the fusion consistency and will finally influence the main objective of WSN for applications such as target monitoring or environment surveillance. The Itineraries can be divided into two different types: firstly, whether static or dynamic; secondly, whether a single or multiple agent is used. Static or dynamic itineraries can be planned [9].

In [10], authors proposed two approaches: Local Closest First (LCF) with minimum distance of the node used for the following nodes; and Global Closest First (GCF) with lowest distance of PE at the next node. In [10] the authors addressed two approaches. In [11] Mobile Agent-based Directed Diffusion (MADD), a quiet solution similarly to LCF was suggested. The MADD only varies from LCF when the first source node selects; instead of choosing the nearest PE node, the first node would be the farthest. However, only the spatial locations of the nodes are taken into account and thus not the energy efficiency.

A genetic algorithm (GA) [12] method requires no definite node for the execution of an algorithm; it chooses the active node instead. GA is responsible for a lot of general communication as every node has to report its status for global PE information maintenance. The first source energy minimum algorithm (IEMF) and the minimum energy route algorithm (IEMA) are described in [13] two energy-efficient approaches. In addition to other itineraries, the IEMF chooses the first source node, whose next path would have a lowest estimate of energy costs, later utilizes the LCF strategy to schedule itinerary. In order to maximize more energy efficiency, IEMA iterates k times to IEMF.

In [14] the authors suggested a strategy to reduce cumulative delayed WSNs for Geographic Sink Placement (GSP). The center of gravity of a sector is sinks for GSP. To measure the center of gravity, GSP uses the field radius and number of sensors. Intelligent Sink Placement (ISP) [14] searches for candidates to get the best sink positions to prevent the worst delay. In order to achieve optimum location, ISP uses the number of sensors, position, range and the number of sinks.

In [15], author(s) presented many restricted methods of sink placement. This was proposed by the authors to be the best positioned on sinks and last centroid using the known K-means algorithm. Several sinks with and without information on location in WSNs were proposed in the authors [16] and [17]. Our research seeks to reduce connectivity and overhead computing. [18] To reduce the costs of deployment, the authors implemented two sink placement algorithms that ensure that each sensor was covered with sinks at least double.

Authors [19] suggest the MA method to aggregate data in the context of a flying path. The remainder of the node energy is also an important cost function parameter for balancing energy consumption between the nodes. This approach can also balance the power consumption between nodes, which increases the life of the sensor network as a whole.

III. PROPOSED SYSTEM

3.1 Network model

Throughout our model we have a network of wireless sensors, with a number of sensor nodes V, possible sink positions Sp and a number of links E. Sensor nodes are placed randomly in LxL square area. All sensors and sinks are believed to be unchanged after deployment. All sensors and sinks are located and are already known. A unique I'd is given for each node, starting from 1 up to and a list of transmissions (R). Both nodes have the same set of transmissions. The connection will connect two sensor nodes u and v if and only if they are within each other's range. If the distance from the node to the sink is the smallest, there is a relationship between the sink and the node. The sink powers are strongly unlimited. Both sensor nodes u, however, have limited power, known as residual energy levels (RE(u)). Enable fu to be the transmission rate of the sensor to the sink. The sink can only receive data while each node is able to send and receive data. Figure 1 displays the flow chart of the proposed system.

3.2 Controller

In general, control networks are small in contrast to data networks. The network will control small packets, minimal packet delay and transmission of high-quality packets. Packet delay and loss reduce network performance. It can thus absorb the routing information control and set the appropriate routing control support. It supports generating trace files, moving packets, finding and securing information. The accuracy of the device actions and the protocols is just such as the controller 's study. All operations are conducted throughout the network. The network parameters were determined for each node and packets were forwarded via the system.

3.3 System analysis

Here we suggest a multiple sink positioning strategy which will be energy-efficient to optimize average network lifetime and reduce average network power consumption. The four phases of proposed algorithms include deployment process, setup, possible detection of sink locations using LS and identification of final sink locations. Nodes and sinks are randomly distributed in the deployment phase in the field. The first sink location is selected in the setup phase and nodes are grouped. Third step investigate local sink locations to optimize or decrease the objective function. The final sink sites will be identified during the last process. In the second and third phases of each iteration, we look for the best solution.

A. Node Deployment:

The topological use of the nodes, dependent upon application and affecting the performance of the protocol for routing, is another consideration. The deployment is either deterministic or autonomous. The sensors are manually positioned and the data is directed in predetermined directions in deterministic circumstances. Nevertheless, in the self-organizing system, sensor nodes are uniformly distributed to allow a separate ad hoc network.

B. Setup phase:

The four steps include: (i) random selection of discharge locations; (ii) grouping of the nodes;(iii) generation of energy-aware tree; and (iv) network average prediction of energy consumption.

C. Random selection of sink locations:

We randomly choose K locations from S_G for every iteration. Sp is the number of candidate sink locations that are specified in $S_p<=S_G$. SG is the sink position set.

Grouping of nodes:

Next step is to group sensors for the locations. Grouping is an important part of WSNs for local node management and compatibility between nodes with different service quality (QoS) parameters. V nodes are divided into $K=|S_p|$ number of groups in this step using the mechanism of distance. A node should be aware of the location details of S_p in order to create a group. The distance of each node u from each sink $s_i€S_p$ is measured and then connected to the closest sink. Distance is determined in our work based on the time of arrival method (ToA) let, as well as a series of nodes closest to the sink and a relation (u,s_i) for each u €. A_{si} is set.

Generation of energy-aware communication tree:

We allocate a weight toward the link when a node was allocated to a group and the link represents energy costs for communications over the network.

Calculation of total lifespan with average energy consumption

We select node u for minimum lifetime in each Tsi T_{si} (si $\in S_p$), and this lifetime is called a sink's lifetime (si}. Similarly the total energy load of all nodes in Asi is determined and this value is energy of Tsi. We find $L(S_p)$ and $E(S_p)$ using Equation (1) and Equation (2) respectively after measuring the total energy per sink and its lifetime $\{si\}\in S_p$.

$$\mathrm{L(G)} \equiv L(S_P) = \frac{1}{|S_P|} \sum\nolimits_{si\in S_P} L(si) \qquad (1)$$

$$\mathrm{E(G)} \equiv \mathrm{E}(S_P) = \frac{1}{|S_P|} \sum\nolimits_{si\in S_P} \mathrm{E}(si) \qquad (2)$$

D. Potential sink location determination using LS:

We use local search (LS) in each iteration to find potential sink positions. Let Sp is the category of candidate sites in sub-phase 1. Next, we are analyzing the remaining sink sites to find a subset of RS sinks to replace some of the current sinks in Sp to improve both L(Sp).

This method represents the technique for the determination of possible sink position based on local search. Our device operates iteratively. During start of each iteration, randomly we choose S_G 's at Sp sink spot. So we calculate the average lifetime network $L(S_p)$ or total network energy consumption $E(S_p)$. At the beginning, the candidate's locations are the best value, and the position is checked on an iterative basis.

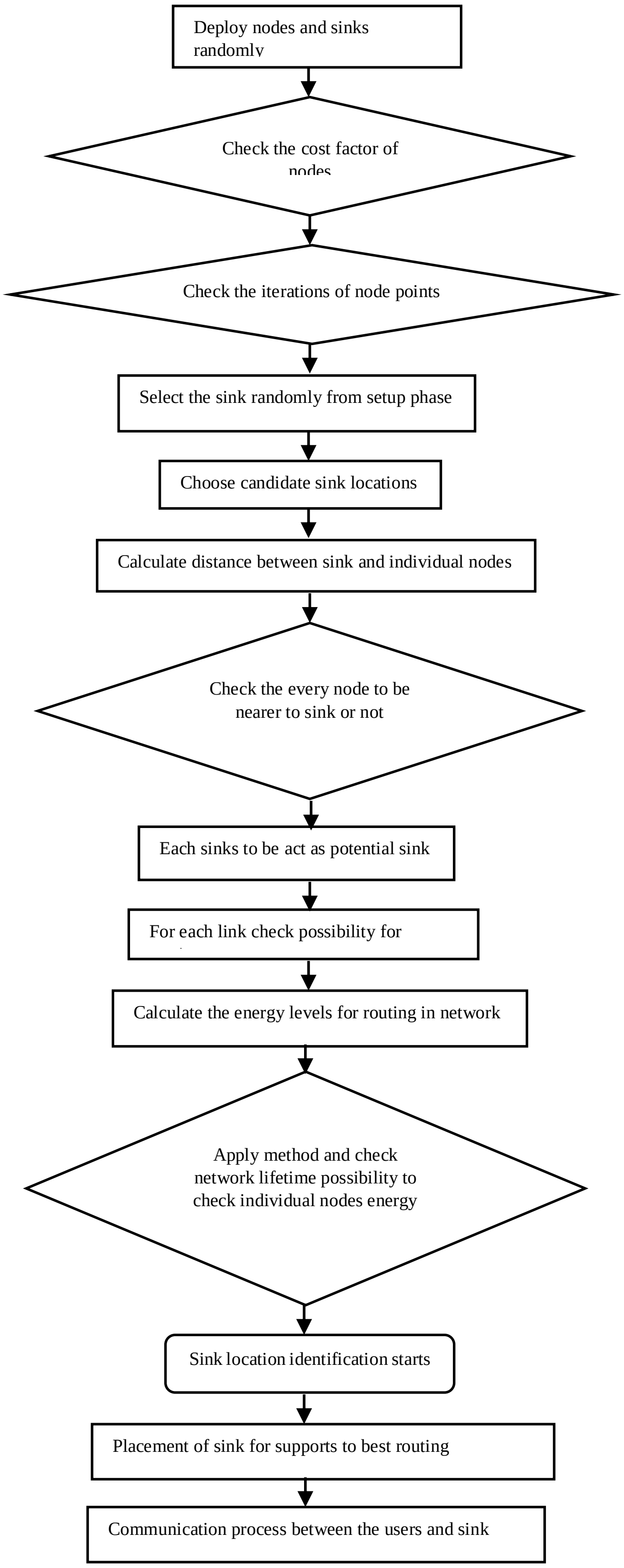

Fig1: Flowchart of Proposed system

IV. RESULT AND DISCUSSION

Our experiments are carried out using simulator NS-2.35. The experiments are performed in two. The initial step is to check the viability of our plan, and then the investigation is carried out in more detail to evaluate the delay, energy consumption and performance.

There are 43 mobile nodes in the network in the first step, and the communication starts from source to destination. Here hop-to-hop communication takes place, and we can measure the distance based on an individual node 's location. The individual user-to - user correspondence, the data flow numbers are calculated. Here we can use simulation time to know the transmission rate of each node. We can retain energy and delay for individual nodes in our work, and find the optimal direction for routing selection.

Within the 250 m radio link, we use device traffic as CBR with a link rate of 1000 bytes/0.1 ms. It sends data in the form of packets in the communication and has a size of 1000 bytes and Channel data rate is 2Mbps and its maximum speed is 25 m/s. There is 10 secs for all simulation time, 1000x1000 for network area and we use AODV as routing protocol. Some methods of routing are similar to RPA, DMADA, and EEMSP. Table1 represent the Simulation table.

Table1: Simulation Table

PARAMETER	VALUE
Application traffic	CBR
Transmission rate	1000bytes/0.1ms
Radio range	250m
Packet size	1000 bytes
Channel data rate	2Mbps
Maximum speed	25m/s
Simulation time	10secs
Number of nodes	43
Area	1000x1000
Routing protocol	AODV
Routing methods	LEACH, DMADA, MDAEENP

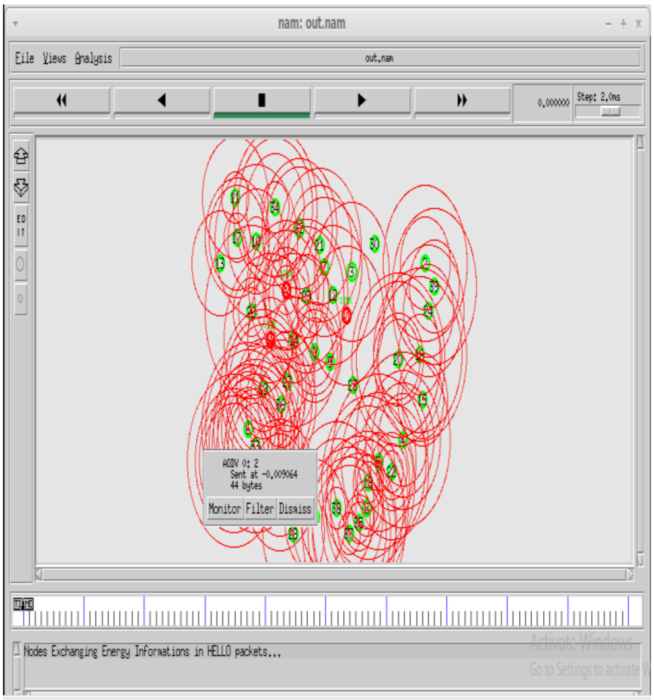

Figure 2: Broadcasting network deployment

Network node implementation is shown properly in figure 2 above. The display is shown which is based on the values of node topology and also follows all the properties of nam windows. Within this screenshot, we see the broadcast for contact purposes in the network. All nodes that are involved in the process.

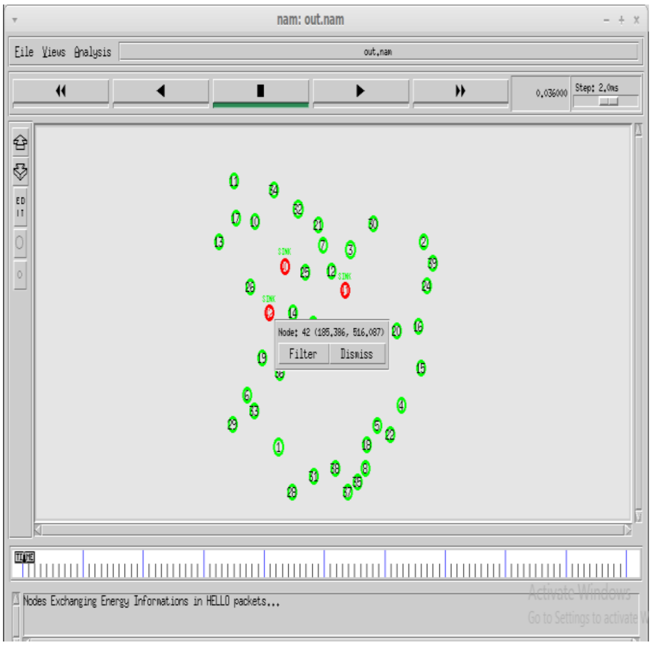

Figure 3: Hello packets Exchange in network

Many of the nodes use routing protocols to exchange the packets. Every node topology value shown in figure 3. Every node deployed with the help of a random way point model in the network.

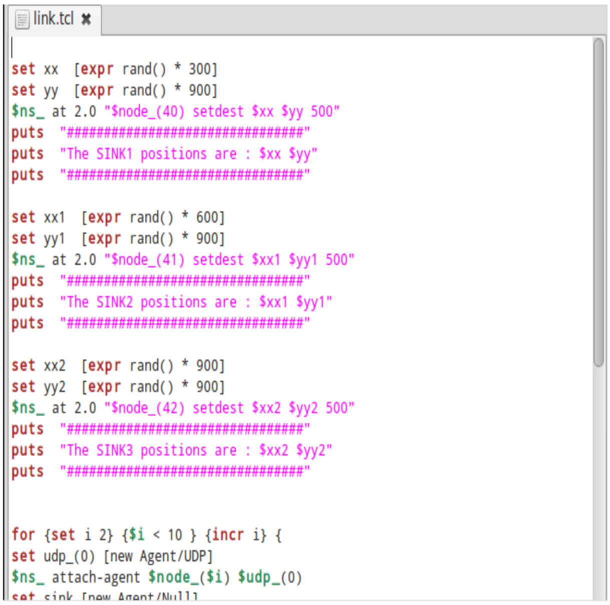

Figure 4: Sink positions displayed

The sink positions in network are shown and illustrated in figure 4 above. The position of sinks here depends on the random numbers and the destination address. More data transmission occurs based on the position of the sink node.

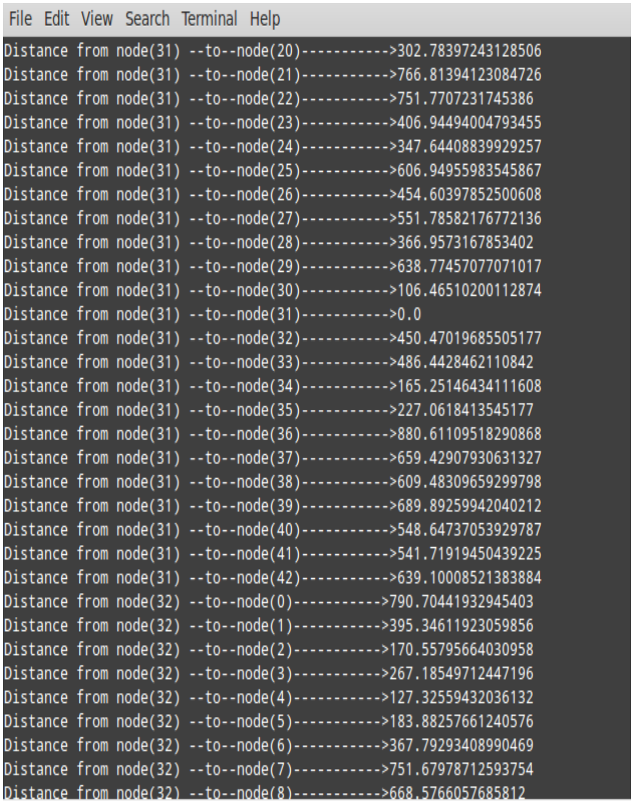

Figure 5: Distance between users

Figure 5 demonstrates the measurement of each node to node distance and displays in terminal. Here we use Euclidian formula for calculating the user distance.

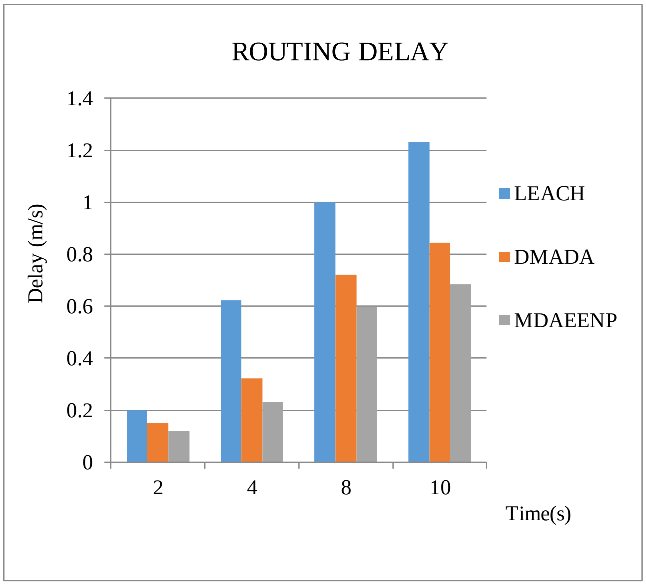

Figure 6: Routing Delay

Above graph figure 6 shows the delay and also the time of simulation versus delay. This shows execution multiple SINKs which decreases the delay in time that is by decreasing the delay in between node which are in communication of MDAEENP while comparing with previous methods like LEACH and DMADA.

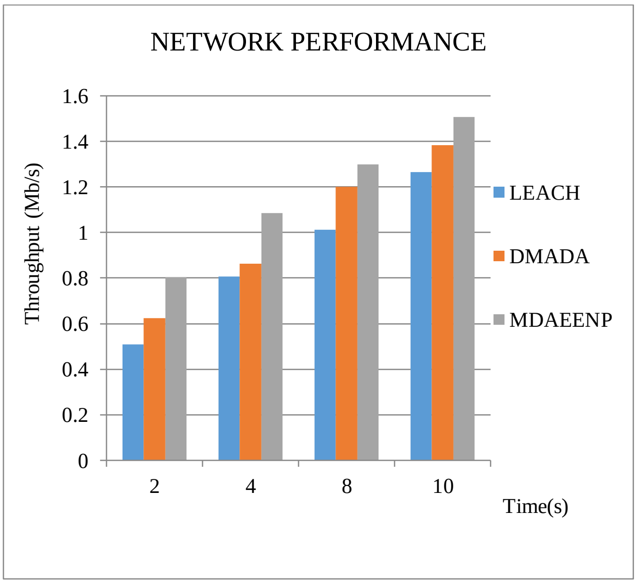

Figure 7: Network Performance

Figure 7 above shows the throughput, i.e., network output that shows the simulation time versus the throughput. This shows the improved performance that improves MDAEENP throughput as compared to previous methods such as LEACH and DMADA.

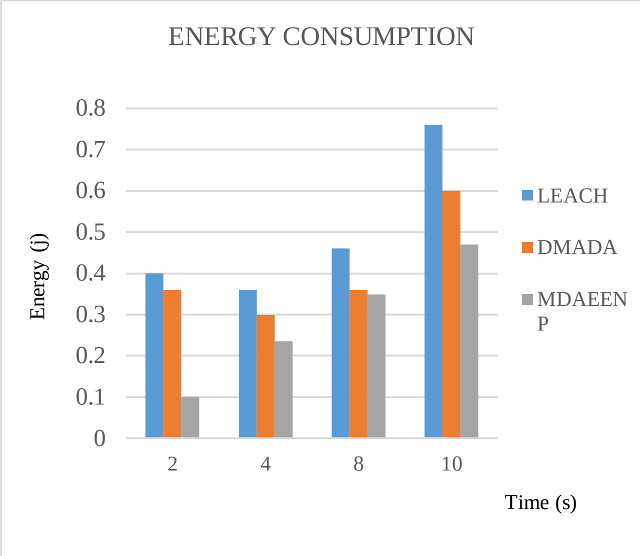

Figure 8: Energy Consumption

Figure 8 above displays the energy consumption and demonstrates the simulation time versus energy. It shows that the Multiple SINK execution scheme that decreases MDAEENP 's energy values compared to previous methods such as LEACH and DMADA.

V. CONCLUSION

In this paper we have proposed a number of WSN energy-efficient sink positioning strategies. Our proposal aims to increase the longevity of the network and to reduce the average energy consumption of the network. Our proposal solution to the enhancement of the energy efficiency of the network must require a certain number of iterations. The proposed algorithms are assessed and compared to the Dynamic Mobile Agent data aggregation and the Random Placement Algorithm for various output parameters. Experimental findings suggest that the new Algorithm is better than the current algorithms. To simulate the network process we use NS-2 simulation tool.

VI. REFERENCES

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