# Improving Lifetime of WSN Using Mobile Agents

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***Abstract-*** *The wireless sensor networks consists of hundreds of small nodes that sense data from the environment. Their small lifetime is major issue faced by the researchers. WSNs make use of clustering schemes to increase their network lifetime. Mobile agent based data collection is one of the techniques seen in the recent past that improves the network lifetime. This paper proposes a modification to existing technique that uses the mobile agent to collect data from the sensor nodes. The itinerary of the mobile agent has been modified and the performance of the network has been compared based on the success rate of the mobile agent, the task energy and task time. The evaluation has been done in MATALB and these parameters have shown improvement over the exiting scheme.*

***Keywords***- WSN, Clustering, Mobile agent, Success rate, Task time, Task Energy

## I. INTRODUCTION

Wireless sensor network is a set of undersized power-constrained nodes that logic data as well as correspond it to the base station. These nodes cover a huge district of interest (ROI) for some purposes according to the application requirements[1]. The sensor node, sink node, the user node comprise the three fundamentals of sensor networks. Sensor node is the basis of the whole network, they are responsible for the perception of data, processing data, store data and transmit data. The sensor node can sense much environmental information, including temperature and humidity, pressure, light condition, vehicle movement, mechanical pressure strength, the speed of the airflow direction aswell as other characteristics. It is these characteristics, sensor network in many aspects, like medical health, environment and agriculture, intelligent home furnishing and building, military, space as well as marine exploration have been extensively functional as well as demonstratean expensive submission prospect.

The main features of wireless sensor networks are self-organization, multi-hop route, dynamic network topology, node resources limited, data-centric and security problem. The main technologies of wireless sensor networks WSN are power management plus security administration, network protocol, time-synchronization, localization, data aggregation [2]. These nodes have smaller batteries and consequently their lifetime is very less. To solve this issue, clustering is used for these networks which arranges the network into clusters. Apart from clustering, the issue of energy efficient data transmission is also solved by the use of mobile agents.

A mobile agent is a software program that can schedule from one node to another node on behalf of the user with the description of autonomy, social ability, learning, adaptively, reactivity, mobility etc. [3] Each agent is classically collection of the agent code, the agent execution thread along with an execution stack, as well as the agent data part, which corresponds to the values of the agent's global variables. Mobile agent has features that can reduce network overload, overcome network latency, synchronous plus autonomous execution, robustness as well as fault-tolerance, system scalability in addition to operating in varied environments.

This paper provides an insight into the previous works related to mobile agent based data collection techniques in Section II. Section III provides the details of the proposed technique and results have been shown and discussed in the section IV. Finally the paper has been concluded in the last section of this paper.

## II. RELATED WORK

In this work [4], a plain plusefficient scheme was presented, which is named as cluster independent data collection tree (CIDT). After the cluster head election as well as cluster formation, CIDT constructs a data collection tree (DCT) based on the cluster head location. In DCT, data collection node (DCN) does not take part in sensing, which is simply gatheringthe data packet from the cluster head and delivering it into sink. CIDT decreases the energy exploitation, end-to-end delay and traffic of cluster head because of relocating of data with DCT. CIDT provides less complexity involved in creating a tree structure, which maintains the energy consumption of cluster head that helps to decrease the frequent cluster formation and maintain a cluster for considerable amount of time. The simulation results show that CIDT offers improved QoS in terms of throughput, end-

to-end delay energy consumption, and network duration for mobility-based wireless sensor network .

In [5], to attainlesser energy consumption,authors presenteda data gathering method with the help of mobile agents in opaque MWSNs. The proposed method ensuresthe sensing coverage of the entire area using mobile agents that autonomously perform sensing operations, transmit sensor data, as well as progress between sensor nodes. By crowding only sensor datamade by sensor nodes where mobile agents are running, the proposed method can attain efficient gathering of sensor data.

In [6],symmetric in addition to asymmetric keys has been adopted in this work to offer authentication in addition to confidentiality. In this paper, Chord (A scalable peer to peer lookup service) is utilized for storing along with looking up public keys in a clustered mobile agent WSN to look after sensor nodes from malicious agents. Cluster heads act as a distributed key storage furthermore lookup facility forming a ring overlay network. Performance evaluation results through network simulation show that the proposed scheme offer effectivenessin addition to scalability in terms of key storage spacein addition to lookup.

In [7], a mobile agent diffusion routing algorithm (MADR) is proposed. Itmotives at low energy consumption than protocols that torrent the whole network with enquirylike directed diffusion (DD). The MADR is to get a trade-off between delay timesin addition to energy efficiency with mobile agent diffusion. It includes policies used for agent diffusion, sensor node as well as sink node. Simulation experiments prove that MADR has the following advantages: (1) quick response without flooding; (2) energy efficiency with mobile agents.

In [8], author emphasis on the improvement of energy based resource planning structure as well as proposed a calculation that consider the collaboration between different server farm foundations as well as execution. Likewise safety of wireless sensor network (WSN) is measured through quality of service (QoS). Then a new cloud booking calculation enhancement for energy consumption of data-centres in view of client QoS priori in sequence under the basis of WSN as well as mobile communication has been consummated.

In [9],authors presented a data aggregation method with the help of multiple mobile agents which takes into account aggregation ratio, network lifespan, as well as energy efficiency. The network is unconnected into four quadrants, along with a mobile agent is shippedfor single quadrant to assembledata from the quadrant assigned to it. Simulation results show that the planned method consumes best amount of energy; hence, the network duration is unlimited.

In [10], a system data sharing protocol of mobile WSN known as synchronous dynamic multihop data sharing protocol (S-DMDS) is presented for automated guided vehicle (AGV) system. It is a cross-layer protocol planned from route layer to MAC layer. By adopting a perception of system data sharing, it is possible to make each node swap the data timely with all the other nodes. It is also a topology-agnostic protocol which has no information of neighbours, routes, or next hops. From the results of the 16-nodes simulation, S-DMDS protocol is proved to be efficient exchange data timely between the devices of AGV system in mobile multihop situation. Moreover, it also revealsthat S-DMDS significantly outperforms NST-AODV withspending about 41.6% system contribution delay as well as 80% RAM consumption. At last, 5-node experiment indicates that S-DMDS can work well in real situation.

In [11], authors outlined a dynamic mobile agent based data aggregation methodthat takes into deliberation energy efficiency, network lifetime, end to end delayplus aggregation ration while producing the choice for migration of agent in multihop sensor network. As this method focuses on discovering the most enlightening way by traversing moderately less number of nodes consequently mobile agent takes less time to return to dispensation element, thus, exhibiting lower delay.

(CCMAR) Cluster-chain mobile agent routing is projected in this work [12]. It makes complete utilize of the compensation of both low energy adaptive clustering hierarchy (LEACH) in addition to power-efficient gathering in sensor information systems (PEGASIS). CCMAR divides the WSN into a few clusters plus runs in two phases. The proposed system is simulated in addition to evaluate for the performance metrics like energy consumption, transmission delay in addition to lifespan of network. The results reveal that the proposed CCMAR outperforms LEACH, PEGASIS and other parallel routing algorithm, energy efficient cluster-chain based protocol.

In this paper [13], a fuzzy-based MA migration approach (FuMAM) is proposed to determine appropriate itinerary for an MA by considering three parameters: distance, remaining energy, and a number of neighbours. The proposed FuMAM approach increases the rate of successful MA's round-trip. Furthermore, the FuMAM algorithm improves network lifetime by selecting the node with a high residual energy as the next hop for MA migration. Simulation experiments show that the FuMAM approach improves the

rate of the successful MA round-trip and network lifetime. Moreover, the proposed FuMAM approach outperforms the compared algorithms in terms of energy distribution usage among nodes.

## III. PROPOSED WORK

Initially, random number of source nodes will be activated that have some of the data to forward to the base station. The base station will divide entire network into 3 clusters using k means clustering algorithm as defined in the existing scheme. At the start of the tour, the base station will compute the energy communication cost of every node with itself.

Since packet size increases as the mobile agent visits more number of nodes and collect data from them. Thus, the last node will have to spend highest energy because of highest packet size. Therefore in the proposed scheme, we will aim at reducing the distance by choosing the last node as the node which is nearest to base station. Thus, the node having highest data will be the one that is closest to the base station. So mobile agent will go to the nearest node at last of the tour unlike the existing scheme in which the mobile agent goes to the nearest node at first.

Base station will choose the last node as the one that has minimum energy cost and first node as the one that has highest energy cost.Also every node will compute the energy cost of direct communication with the base station against the energy cost of sending the data via mobile agent. If the energy consumed by the mobile agent is more, then the node will send data to the base station using direct communication.

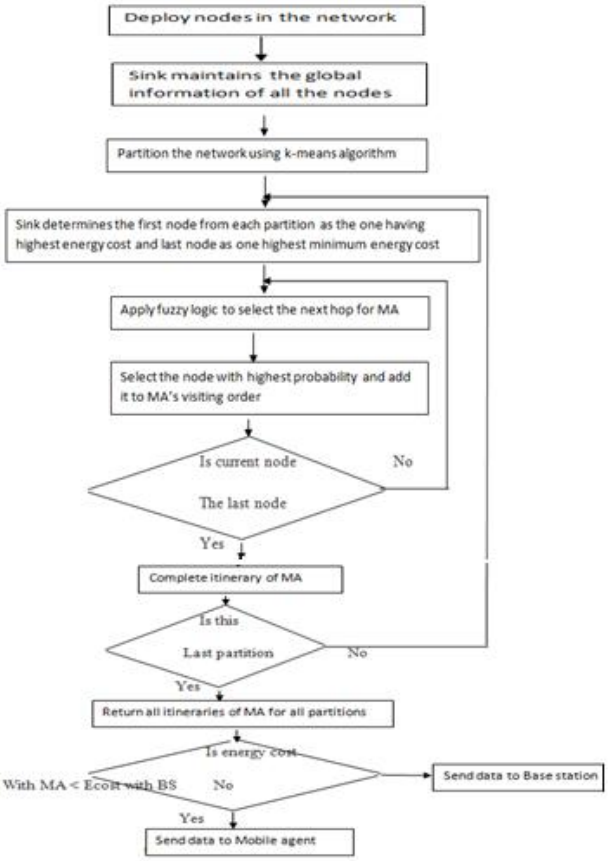
## IV. RESULTS AND DISCUSSION

The proposed scheme was implemented in MATLAB 2016b. The performance of both the schemes was compared based on task duration, energy consumption and success rate of MA trip. The set of various parameters used for simulation are given in the table below:

Table 4.1: Simulation Parameters

| Parameters | Value |
|---|---|
| Number of nodes | 800 |
| Network area | 1000 * 500 $m^2$ |
| Sink location | 500,250 |
| Initial energy | 2.0 Joules |
| $E_{elec}$ | 50 nJ/bit |
| $E_{fusion}$ | 50 nJ/bit |
| $E_{amp}$ | 10 pJ/bit/$m^2$ |
| Number of source nodes | 10-80 |
| Raw data size | 2048 bits |
| MA processing code | 1024 bits |
| Raw data reduction ratio | 0.8 |
| Aggregation Ratio | 0.9 |
| Mobile agent memory | 10 Kb |
| Transmission Range | 60 m |

**PROPOSED FLOWCHART**




The figure below shows the values of success rate obtained for both the schemes against number of source nodes. The values of success rate however, started falling when number of source nodes were more than 60 for the existing scheme. But, the values of success rate obtained for the proposed scheme are more than the values for the existing scheme. This means that mobile agent had more success in gathering the data from the source nodes under the proposed scheme.

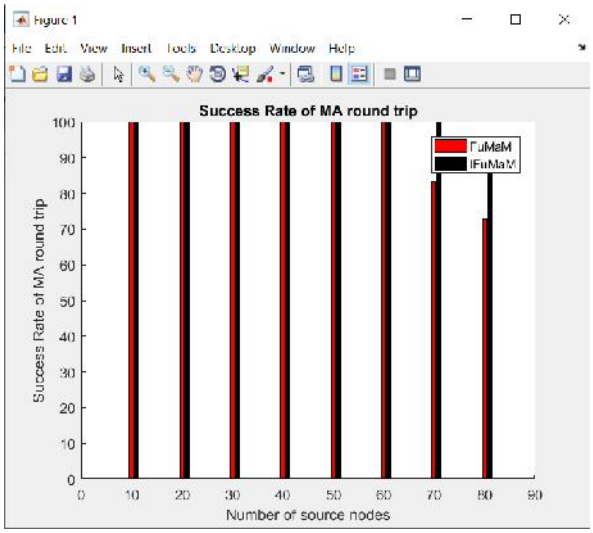



Figure 4.1: Success Rate Comparison

The graph 4.2 below compares the values obtained for task duration for both the schemes. The task duration obtained for the proposed scheme was approximately equal to or less than the proposed scheme. This indicates that the mobile agent took less time to collect data from the source nodes.

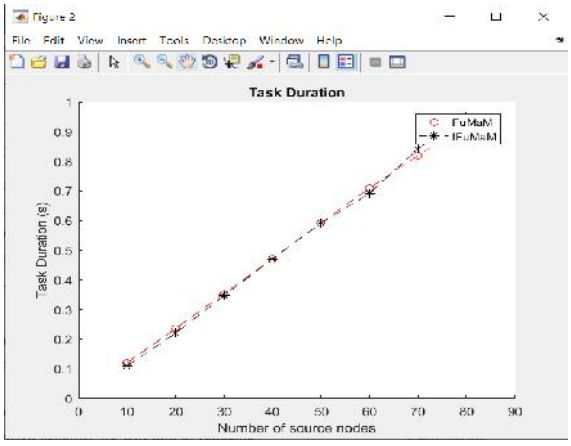



Figure 4.2: Task Duration Comparison

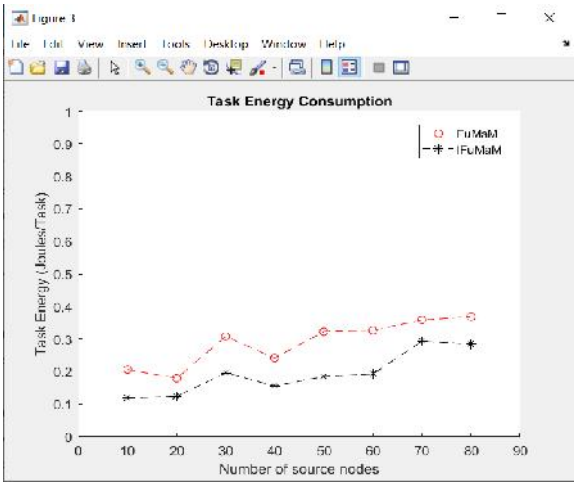



Figure 4.3: Task Energy Comparison

The above graph shows the value of task energy for both the schemes. The mobile agent consumed lesser energy with the proposed scheme for the source nodes. This also led to higher success rate for the proposed scheme. This indicates better network performance.

## V. CONCLUSION

The paper proposed improvement over the existing FuMaM technique in terms of modified mobile agent itinerary. The performance of the network was measured in terms of task duration, energy consumption and success rate of MA trip. It was seen that these parameters showed an improvement over the existing scheme. The reason is attributed to the fact that the mobile agent with less data visits the farthest node and continues its journey with increasing data and lesser distance towards the base station. This allows for lesser energy consumption of the mobile agent and increases the performance of the network.

In future, work can be done where this method of data collection can be applied with various clustering protocols to increase the network's performance.

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