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GRIDDING BASED FuMAM METHOD FOR DATA GATHERING IN WSN

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Abstract: In today 's period, because of its wide variety of applications, WSN is one of the most significant research areas. Wireless sensor networks (WSNs) are self-configured, adaptive and comprise of distributed sensors to track any physical or environmental situation. Sensor nodes distribute their data to a base station via the network collaboratively. The system is first broken into clusters by k-means clustering in current work, and then mobile agents are deployed from the base station to gather sensor data. The results recommend the Fuzzy-based approach to determine the itinerary, which takes as the input variables the energy consumption of the node, distance from the base station and quantity of neighbor and gives the next node to reach as the output parameter. A non-probabilistic grid-based Fumam method has been suggested in this article to extend the lifetime of WSNs. In this, the entire network is split into a predetermined grid region and a node is selected as the grid head (GH)-Fumam using two fuzzy variables, namely distance from the base station and residual sensor node energy. This technique uses the method to multi-hop communication. GH nodes are authorized to interact with the base station and other GH nodes. The simulation outcomes indicate that the suggested solution increases the lifespan of WSNs network relative to current ones.

Keywords: WSN, Energy Efficiency,Fumam,Grid based Fuzzy logic, Sensors.

I. INTRODUCTION

For several technologies, like military, environmental , and health applications, wireless sensor networks have currently been recognized as a promising innovation. A WSN involves the deployment of hundreds or thousands of tiny sensor nodes that interact wirelessly with each other in an area of interest to perceive particular actions[1].

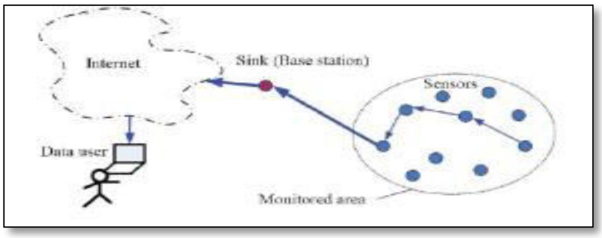

Fig 1. Wireless sensor netwoks[1]

Every sensor node processes information and transmits it to the sink, also named Base Station(BS). These sensor nodes are a power-limited trigger of constrained battery sources in Wireless Sensor Networks [2]. The productive use of the battery is therefore a critical issue. The amount of procedures plays an significant part in reducing the useful consumption of energy[2]. First of all, direct communication and multi-hop data transmission are used. But these methods do not function properly due to limited sensor node energy.

Clustering is a process in which nodes are organized into clusters that are used to efficiently achieve energy. All nodes contributing to precisely a certain cluster supply CH with their results. CH then integrates message and transmits aggregate data to BS where the information could be accessed by the end-user[3].

The paper is structured as follows: Section II describes the collection of cluster heads based on Fuzzy logic, Section III explain about grid clustering approach and section IV describes related work of grid ,fuzzy approaches for energy efficiency in WSN Section V and VI show proposed objectives and results .Section VII demonstrates Conclusion.

II. FUMAM APPROACH

Fuzzy Logic is used to model human experience and human decision making behavior. Further, it can handle uncertainties of real time applications more accurately than the probabilistic model. FL is adopted in this technique in order to handle the uncertainties for electing the SCH. The major benefit of using FL is to overcome the overheads of collecting and calculating energy and location information of each node. Most of the FL based clustering algorithms consider the sink node/BS as static. Now there is a trend to investigate sink or BS mobility that can relieve the network traffic, reduces delay and enhances energy efficiency [4].

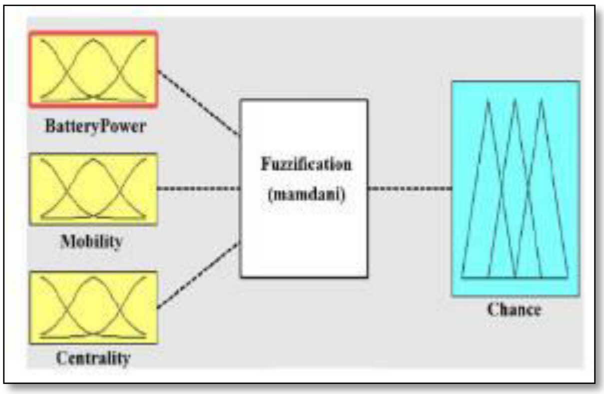

Fig 2. Fuzzy system[5]

III. GRID BASE CLUSTERING APPROACH

One of the common clustering techniques in which the entire network area is split into virtual grids is grid-based clustering [6-7]. The network is split into grids (also called cells) introduced by the BS in Grid-Based Data Dissemination (GBDD) [8]. As the crossing point (CP) for the grid, the first node involved in data transmission is set and its coefficients became a reference point for constructing the grid. In the Cycle-Based Data Aggregation System (CBDAS)[9], to create a cyclic chain, every cell head is connected to some other cell head. A cell head having high residual energy is chosen as the cycle head by the BS in each round. In both methods, the desired amount of grids needed in the network scenario is often hard to achieve. The global uniform leach protocol is one attempt was made in research that reduces variations in cluster sizes.

The constraint on the amount of grids and appropriate grid size is one of the primary constraints of grid-based clustering. The required set of grids for a specific scenario is often hard to achieve. Second, in the event of non-uniform deployment[7], network performance is enhanced. In addition, in some situations, grid-based strategies do not offer a fair range of CH with regard to all nodes in the network .

Grid-based clustering methods could be categorized into two forms [10]: fix-up grid partition approach and adaptive grid partition approach. A few clustering techniques including CLIQUE, STING , WaveCluster DENCLUE , GDILC shifting grid clustering, SCI and Dclust adopt fix-up grid partition approach , while some other clustering methods adopt adaptive grid partition approach including MAFIA , OptiGrid, MMNG, DESCRY , CBCM, GCHL , etc.

Table 1:Comparsion table of Grid Based Fumam approach and Fumam [11-13]

GB-Fumam approach	Fumam Approach
Flow of information is bidirectional.	Similar to human reasoning.
Power generation is distributed.	Based on Linguistic model.
Self Monitoring	Using simple mathematics for non linear ,integrated ,complex problems.
High efficiency	Does not simply capable to receiving feedback for applying of learning stage.
Active control	Lack of real time response
It's a environment friendly.	Method of nonlinear control and ability to be used efficiently for HVAC systems.
Remote testing	Restricted number of usage input variables.

IV. LITERATURE SURVEY

Omar et al.,[14] Use fuzzy logic to track the flow of the mobile sink when collecting the data from the sensors nodes in this article. The new location of the mobile sink is determined use of fuzzy logic during the communication network and for each R round. A fuzzy logic-based decision which relies on the residual energy of the sensor nodes and the existing distance of the mobile sink proportional to the sensor nodes is assumed to be the measurement of the new role. The suggested method is contrasted with a solution using a static sink and a solution using the mobile sink's random motion. The simulation result demonstrate that the suggested solution outclasses the other methods in terms of the residual energy and the set of nodes alive during the performance of the system.

Tripathi et al.,[15] This study describes an Energy Efficient Semi Grid-Based Clustering Scheme (EESGBC) for Heterogeneous Wireless Sensor Networks that, by controlled clustering, improves the network's energy consumption. In EESGBC, the choice of cluster heads and the formation of clusters is performed by the base station. It defines the total region into varying densities, and cluster heads are chosen from each block based on the amount of living nodes in that region. This approach protects much of the region of the network and decreases the early death of member nodes and improves the lifespan of the network performance. EESGBC efficiency is tested by simulation and it was noted that the routing framework worked faster than modern battery power and network lifetime protocol.

Zinon et al.,[16] In this paper , present a method for soft mobility management where fuzzy logic strategies help the mobility protocols. To help the operation of a mobile worker within an oil refinery field, our design was designed and deployed. The findings show that high consistency and influence over the handoff behaviour are offered by the present scheme.

Qadori et al.,[17] In this research, by analyzing three parameters: distance, remaining energy, and amount of neighbors, a fuzzy-based MA migration method (FuMAM) is suggested to define an effective itinerary for an MA. Studies with simulation show that the FuMAM method increases the rate of efficient round-trip MA and network life. In addition , in terms of energy distribution utilization between nodes, the suggested FuMAM represent excellent the comparative protocols.

Sasmita et al.,[18] In this method, relying on the sensory radius of the sensor node, the grids are of the same size , i.e. the triangular of every other grid equals to the sensing radius. As per Pythagorean Theorem, the length of every grid is ($l=r/\sqrt{2}$). So many alternatives are taken into account on the basis of grid separation to accomplish the exposure of the grid area with the aid of neighboring nodes located in the neighboring grids. Simulation experiments indicate that this method works superior to the current methods based on the grid.

Chen et al.,[19] A grid-based, accurate multi-hop routing framework is developed for wireless sensor networks in this paper. Our proposed scheme, a secure grid-based multi-hop routing protocol, optimize the cluster head election system to reduce and balance energy consumption by incorporating personal development consisting of node residual energy and node position and local cognition that could really balance cluster energy consumption through an advisory mechanism depend on the lifespan of the cluster head. Results show that, relative to other methods, the grid-based reliable multi-hop routing method has increased the reliability duration. Meanwhile, the efficient multi-hop scheduling algorithm depend on the grid has good energy efficiency performance, packet transmission delay and accurate data transmission.

V. PROPOSED WORK

- **EXISTING PROBLEM**

The idea of mobile agents in wireless sensor networks is used by the researchers in [87] to collect sensed node data. This strategy is used in order to reduce the network's energy usage. Utilizing k means clustering, the network is first grouped into regions and then mobile agents are deployed from the base station to gather information from various sensors. In order to determine the itinerary, the results recommend a Fuzzy-based framework that includes as the input variables the existing node capacity, distance from the base station and amount of neighbours and offers the next node to reach as the output variable. The first node from the base station that is accessed is the nearest node. Depend on the fuzzy law, the next module is determined. It is noted that the efficiency of the network decreases as the amount of source nodes grows.

In the suggested study, will concentrate on enhancing network efficiency with a greater amount of source nodes.

- **OBJECTIVES**

1. To assess the performance of the current FuMAM protocol in the network with higher amount of source nodes.

2. To suggest and applied GB- FuMAM (gridding based FuMAM) to enhance the network’s efficacy.

3. To contrast the performance of the GB- FuMAM and FuMAM depend on success rate, task duration and task time.

- **RESEARCH METHODOLOGY**

Rather than k-means clustering, the suggested technique called GB-FuMAM would use grid-based system splitting. The framework suggested operates in the prescribed sequence:

1. Rather than just 3 clustered in the current FuMAM, the system will be split into nine similar grids. If the amount of network sections is larger, the maximum area of the mobile agent's route is limited. This will really shorten the mobile agent's power usage.

2. The next phase is to schedule the assignment of the amount of mobile agents to the source nodes until the network is split into grids, and the amount of mobile node is initialized. For FuMAM, the output of the network began to decrease with the amount of source nodes being 70 and 80. So, 70, 80, and 90,100 will be the amount of sensor node that could take to evaluate the efficiency of the system.

3. Currently, every network or mobile agent's energy usage represents the distance it travels and the volume of information it holds. If one parameter (distance to travel or quantity of data) could be shortened, then energy usage could be minimized. The energy expended would be greater if the mobile agent holds more information and moves longer distances.

4 In the suggested GB-FuMAM, the mobile agent should first be deployed to the node in which the contact energy usage is the lowest. This would be the grid's furthermost node. Due to the mobile agent originally does not hold any information, but with the minimum data, the energy usage would be smaller as it moves the longest distance.

5. The next node would be determined as per the fuzzy system provided in the current system after reaching the first node.

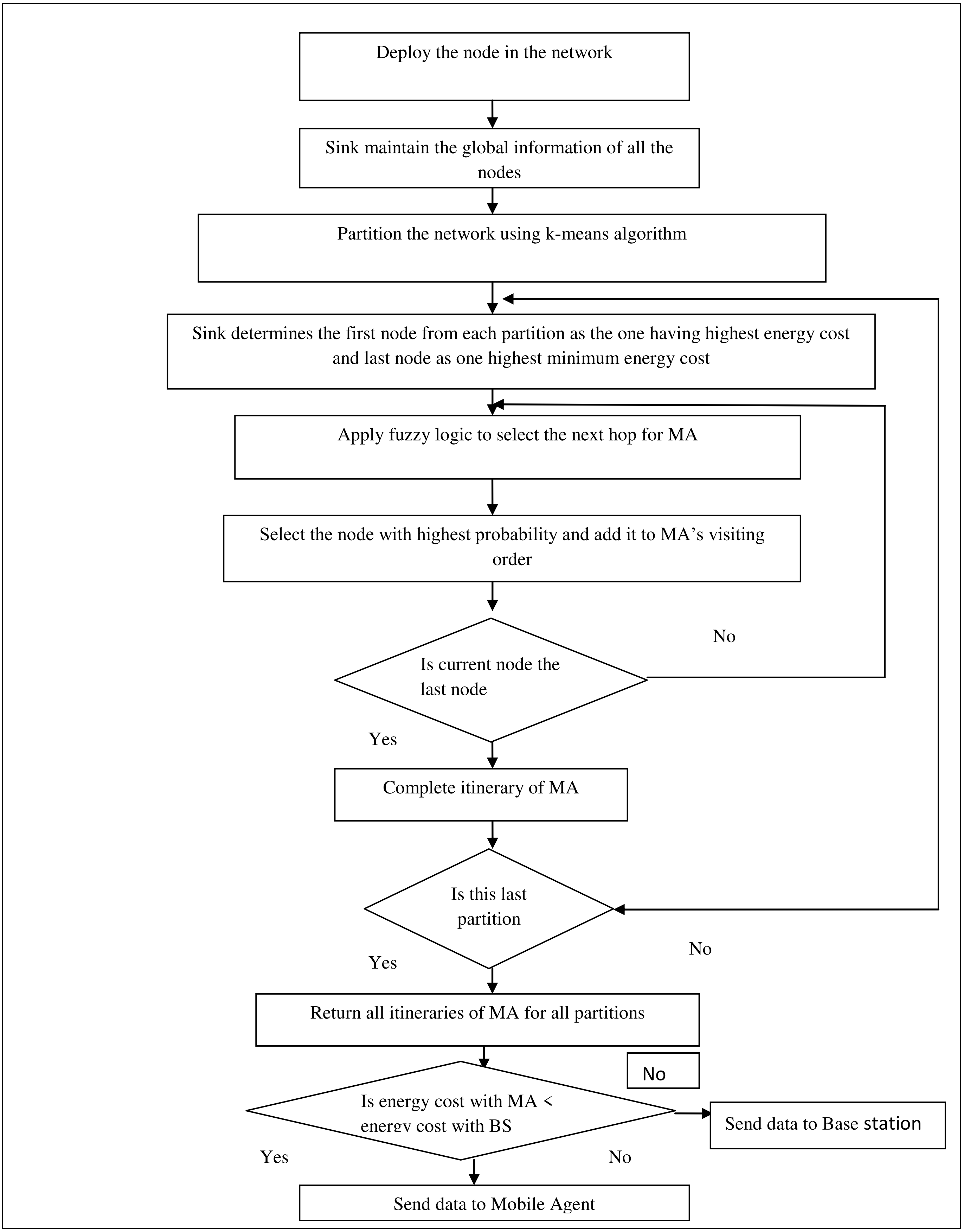

Fig 3: Flowchart of proposed work

VI. RESULTS AND DISCUSSIONS

In MATLAB, both the suggested solution and the current method have been introduced. In the simulation area of 1000 * 500 m2, a set of 800 nodes were placed randomly. The results of the two systems was considered on the basis of the Mobile Agent trip accuracy rate, mission length and energy usage of the mission.In the table 1 below, the numerous simulation parameters included in the simulation are provided:

Table 1: Simulation Parameters

Parameter	**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

The first phase is the randomized installation of the network's nodes. Using the rand() method enabled in MATLAB, nodes were implemented.

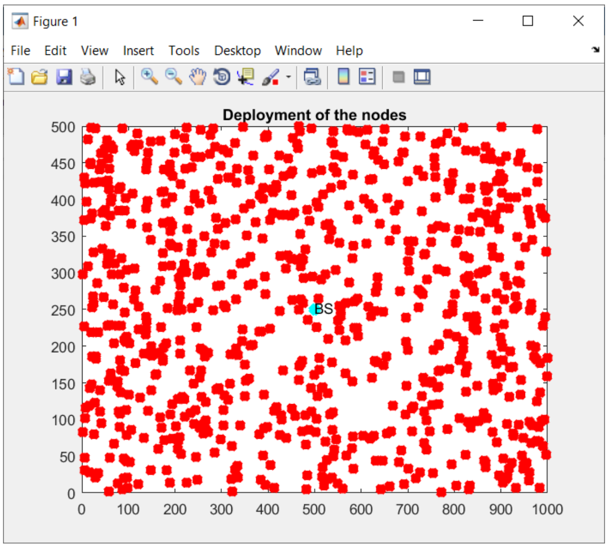

Fig 4: Deployment of the nodes

The 800 nodes installed in the entire network are shown in the figure above. The nodes are represented by red-colored forms. In the middle of the network, the base unit is situated. The very next phase is the network division into 3 phases. The classification is carried out as described in the current system by the k-means method.

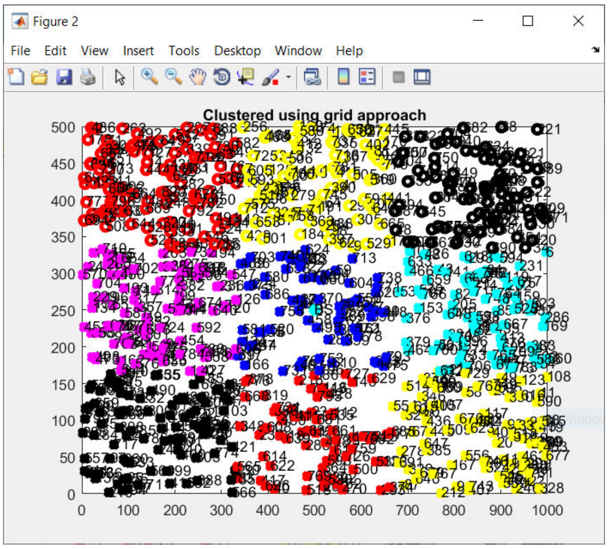

Fig 5: Clustering using gridding approach

Diagram 5 represents 9 grids across the core grid. There are equivalent measurements of these grids.

After this, the amount of source nodes within the network is initialized. In our analysis, here, also extracted the source node amount from 70 to 100. These are the network nodes which have few information forwarded to the mobile agent.

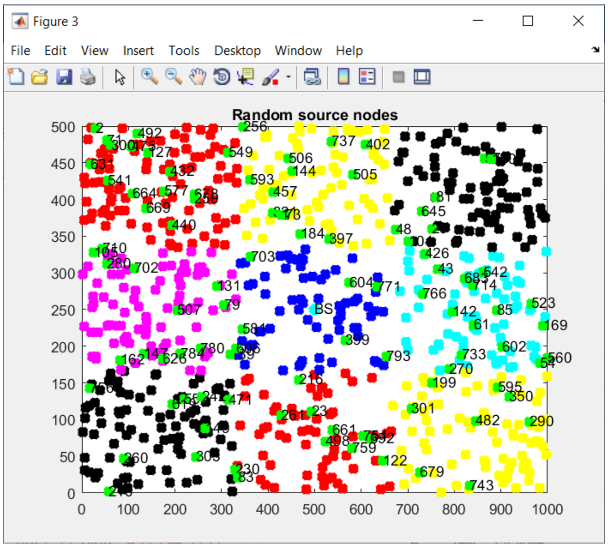

Fig 6 : Source nodes=100

The 100 random source nodes in the system are shown in the below figure. These nodes are seen in the green colour in the diagram 6.

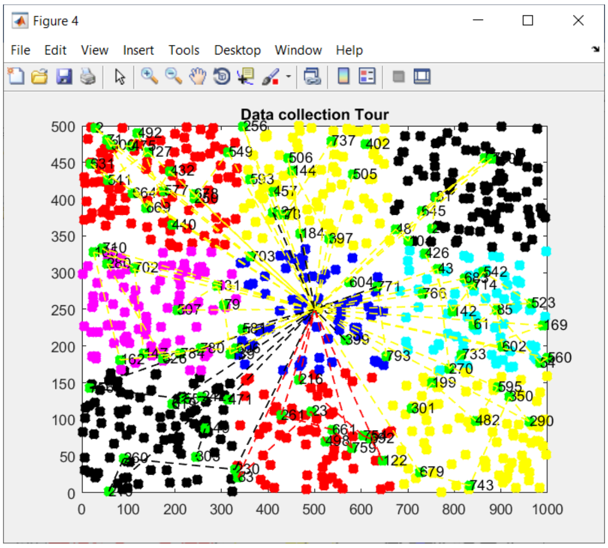

Fig 7: Data collection Tour

Depending on the rate of success of the mobile agent tour, process length and task energy consumption, the findings were analyzed.

Success rate: The round-trip response rate of MAs is the product of the amount of MAs effectively obtained at the sink after migration to the overall amount of MAs deployed by the sink. here, also measure this metric using the formula below:

$$S_{rate} = \frac{N_{receivedMAs}}{N_{dispatchedMAs}} * 100$$

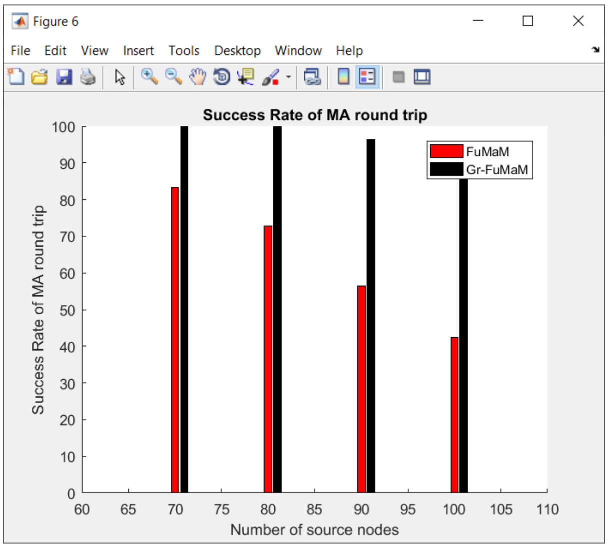

Fig 8 : Success Rate of MA trip

Diagram 8 result illustrates the mobile agent trip accuracy rate for the current and also suggested systems. Results were calculated from 70 to 100 for a different amount of sensor node. It has been seen that with the rise in the size of nodes, the rate of success came down for the proposed grid. For the proposed system, the rate of success was still stronger at higher amount of source nodes. This indicates that the system suggested surpassed the current system.

- **Task Length:** The length of the process in MA-based data collection is measured by the round-trip time with one specific data collection process.

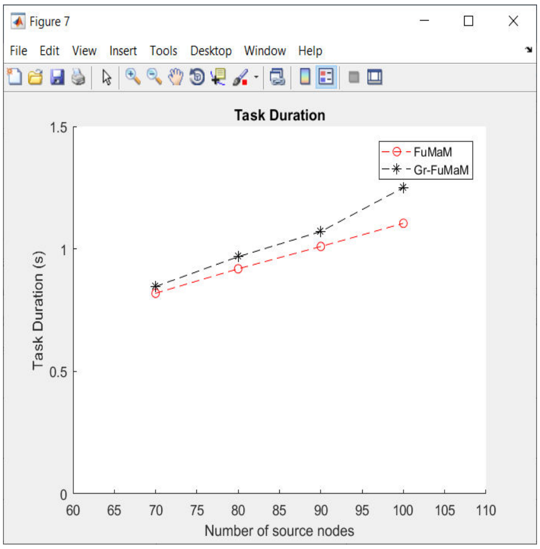

Fig 9 : Task Duration

- **Task Energy:** Task energy usage is the cumulative energy expended on sending , receiving and sharing control packets from all destination node to conclude the data collection method. Such usage for all the MAs' itineraries is the total electricity expense of migrants.

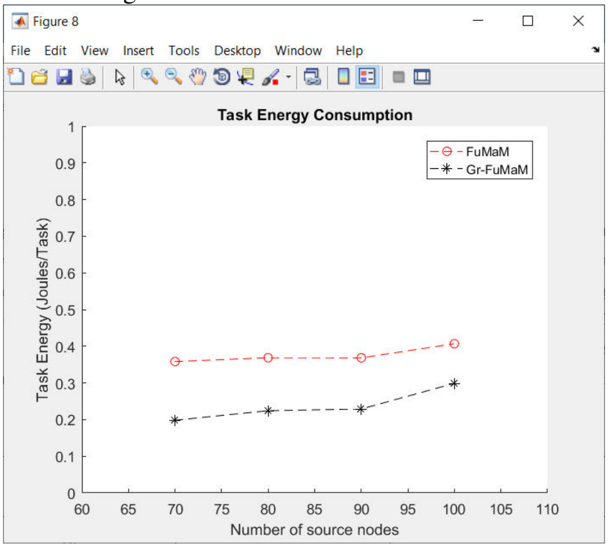

Fig 10: Task Energy Consumption

Number of nodes	Task Energy Consumption for Existing Scheme	Task Energy Consumption for Proposed Scheme
70	0.3582 Joules	0.1983 Joules
80	0.3687 Joules	0.2242 Joules
90	0.3683 Joules	0.2289 Joules
100	0.4069 Joules	0.2989 Joules

Table 2 : Task Energy Consumption Comparison

VII. CONCLUSION

Wireless sensor network (WSN) introduces a new paradigm of real-time embedded systems with minimal computing, connectivity, memory, and energy supplies that are being used for vast range of applications where the conventional infrastructure-based network is often impossible. The sensor nodes are usually implemented in a hostile environment to track, monitor, and analyze the natural phenomena and expend significant set of energy while distributing the information. Replacing the battery and sustaining a long operational life cycle is impractical and often difficult. A new approach for energy saver / balancer routing was presented in this paper, which enables users to have an efficient qos constraints. The critical QoS requirements are energy output and end-to - end latency. The Fuzzy Set systemic framework (GB-FUMAM) results in a higher energy efficiency representation of the WSN nodes The findings were achieved from the MATLAB simulator and demonstrate that the suggested algorithm (GB-Fumam) performs better than the current one (Fumam) protocol in spite of first node dies, half node alive, higher reliability, and better longer life).

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