Development of Wireless Sensor Network Protocol using Fuzzy logic and Optimization Routing Algorithm

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ABSTRACT

Smart people and normal people alike have been interested in wireless sense networks (WSN) for a few years recently. A lot of people believe it is wrong to keep an eye on the troops, the weather, or the temperature. Many nodes make up web-based sensing networks (WSNs). Each hub collects info and keeps an eye on everything. Wifi sensor networks make resources like power last longer so that the networks can last longer. They can't be changed or grown again because of this. This is a big part of making sure info is sent fast and with little power. This study's main goal is to find the best ways to make the route process work better. Fuzzy logic and gravity search optimization (GSA) are both parts of our model. GSA is used to find the best lines and pick the best ones. Fuzzy logic looks at things like position, delays, energy used, and energy left over to figure out the best way to send data. A lot has changed with network width, delay, and aspect touch, as shown.

Keywords: *Network model, Path selection process, Fuzzy logic, Knowledge gap, Results of Scenario.*

1. Introduction

There are many reasons why wired networks are better than wireless ones. Since they are small, cheap, and use little power, things that can do more than one thing make sense. There are lots of other things you can do with a motor that doesn't have lines. These really small screens can act like people, talk to each other, and feel things. Sensors are small devices that pick up on things around them and store information. Sensors can then be used to tell you important things. They can help you find nearby events. Mesh networking makes it possible for these things to talk to each other. Over radio waves, many things will be able to talk to each other quickly [1]. The wifi sensor network (WSN) is made up of these spots, which could be the same or different. The smart nodes are small, cheap, and easy to set up. You can learn them in a lot of different places. That's why they're very small. There is something strange about a wireless sensor network (WSN) that gets better as the number of nodes it has grows. Some networks lose their usefulness as they get bigger [22].

Also, adding more nodes to a network only requires a few changes to the settings. Mesh networking means that links can talk to each other and find a way to get to the goal. WLANs (WSNs) are useful in lots of ways so that you can use them for lots of different things. It can help with health care [2], transportation, safety, the military, the weather, and a lot more. It can also keep an eye on people in real-time. They are made up of four parts that all work together to do their job. The monitor, the CPU, the radio, and the power source are these. Everything gets power from the power box. The other three parts are doing the work. So, it can do its job; it checks the air's temperature, humidity, and pressure. The processing unit's job is to make sense of the sensor unit's info. The base station (B.S.) is this part. It sends info from the sensor unit to the user. They are spread out in the study area to get information, use it, and then send it back to the base point [23]. When people see how they can be used, they might think that wireless sensor networks (WSNs) work the same way as other networks, whether they are wired or wireless.

That's not really true, though, since most networks, whether they're wired or wireless, already have enough resources built in. It can remember things, has power that never goes out, sets network patterns, goes a long time without being touched, and can do maths. WLANs (WSNs) are weaker since they can only do math, store data, and use a certain amount of power. No matter what, we all want great things for wireless sensor networks (WSNs) [4]. But there are only so many tools that can help us get there. Once they are set up and being used, wifi sensor networks (WSNs) can be less useful because of certain things. When these things happen, it's hard to keep track of talks, jobs that don't need human help, network lifespan, and fault tolerance. Because of these problems, wireless sensor networks (WSN) are being studied to find better ways to work. But WSNs would work better if they made good use of what they had. People can save a lot of money if they only use the WSN parts that work. Touch changes the tools that WSNs have for sure [5].

In the WSN, nodes, B.S.s, and nodes can talk to each other in three different ways. The best way to do this swap is to pick [6]. There can be anywhere from a few hundred to a few thousand low-power sensor nodes in a wifi sensor network . Every node can do its own set of tasks. In these nodes, people can also talk, do math, and look for things. The central processing unit (CPU) of a node is one of its most important parts. The power unit and link unit are also very important. The types of matter can change, as well as the temperature and pressure [7]. As an answer, "sensor nodes" can play a recorded message [7]. These kinds of systems are called microelectromechanical systems (MEMS). Reader nodes either listen to or record what's going on in the area that will be watched. A conversion from analogue to digital takes an audio signal and changes it into a digital signal. After it is collected, it is sent to computers to be used in different ways. Remember that sensor nodes are small, fast, and only need a little power. You could also let them settle down on their own.

These days, a lot of small electronics only need a little power. They're known as wifi sensor nodes [8]. Every sensor node can always tell the truth about how much it picks up in its area. Some of the main things that make monitors use a lot of power are (1) signal conditioning, (2) signal sampling, and (3) signal sampling and signal conditioning. There are three main kinds of smart nodes:

1. Sensors that can work in any direction: Passive nodes get information about their surroundings without even touching them [9]. Right now, the only thing that needs power is to make their old words louder. It's not possible to have "direction" in environmental study.
2. The second kind of sensor is a narrow-beam sensor that is not moving. These panels look in the direction they are pointed.
3. They always keep an eye on what's going on around them when these cams are on [10].

2. Related Work

Wifi sensor networks (WSNs) need to use little power so they can send and receive info. Most of the time, no one is there to watch as the monitor nodes are set up. It takes work to follow the plan and figure out what's going on. In other words, none of the links would work anymore. In WSNs, routes need to be able to change over time [11]. This type of route method has been around for a while, but they still need to find a way to make moving data from one monitor point to another use less power. They do send the same thing every time, but it's true. Some well-known path measures were used in a new study on OR that just came out. How nodes can join and work together was the main topic. People had to come up with a new way to talk quickly [24]. This method is called GPS Random Forwarding. In this method, the route node is picked at random based on where it is in relation to the other nodes. Not on wifi networks that have more than one hop. Routers and media access processors (MACs) don't work together like this. This can only be done by strangers.

Each package is sent with the best device that works. The number ETX [12] is what this method is based on. Note down how many hops it took to finish. It will help you find the ETX. The file name was brief, so it was possible. It's possible to handle more data in this way. It only looks at new data, not old data. It could send out more bits or move more slowly if you change information that isn't needed. Because it always tries to get nodes to work together, ExOR is also hard to use in big networks. This wasn't possible with the last one. The best way to send info quickly is with the best forwarder. With MTS, you can pick from a list of routes based on your needs. This is different from the way to get around. MTS is used, not ETX. ExOR does the same thing. You can make changes faster with the MTS method than with the ETX-based ExOR method [13]. This route method works well with wifi networks that have short hops and more than one way to connect. The information is clear and easy to understand. With this method, the number of bits that were the same went down.

This method is easy to understand and works best when mixed with other methods that use various lines. They can now choose in a new way where to send calls. The name of the tech is Spectrum Aware Opportunistic Routing. It can help Best Link Transfer (OLT) figure out which nodes should be forwarders. When you use SAOR, you can skip lines, get better service, and go faster. It can figure out how much it costs to send data from one spot to another. The Easy Opportunistic Route (EEOR) is the name of this road. It is much faster for the EEOR to send and receive data packets than for the ExOR. Now that there is the Trusted Opportunistic Routing Algorithm for Vanet (TMCOR), more people are willing to accept the opportunistic routing algorithm. You can also use this picture to figure out how to balance cost and safety [14]. For cell phone social networks, a certain type of random path method was used. It checked how busy the social networks were and how well the social accounts and links worked together. This is likely how the file will be sent since it works.

Sensor-opportunistic routing is one way that WSNs choose which relay nodes to use. A node that doesn't need a lot of power can use it. They are both going at the same speed, so there is no change between them. The copy-free method is the only way for people to work together, which is good for the environment. Some people use coins. We promise that our way won't cause any more package swaps [15] if there aren't any already. It makes networks more stable and useful by saving them and the resources that go with them. With the help of a virtual network function, cloud fog computing gets service function groups back to work. The Internet of Things can be used in many ways, so don't forget that. It means that you can always lose information and files that are private. By putting service function groups on virtual networks, cloud-fog computing can save even more network resources. It can work in many places on the network. The cloud of things (CoT) has grown very quickly over the last few years [16]. The main reason for this is that it can give nearby tablets and different kinds of wifi networks a lot of hardware.

The CoT's job is to make quick decisions while things like load sharing are happening online. This keeps the network going strong. As part of this plan for the cloud of things, phones and cloud services can talk to each other better. This study's author(s) made it possible for people to share work on their phones. If this is done, cell phones might break down less often. The cost plan is better now, and some work is done. In the last few years, virtualization has made it easier for wifi sensor networks (WSN) to connect to the Internet of Things (IoT) and use less power [17]. This is the case because the service area is getting bigger quickly. People who work in healthcare are very interested in wifi body area networks (WBAN) because they are used in e-healthcare. Wifi Body Area Network (WBAN) body cams are used to keep an eye on patient data. No matter what, a plan is made for each patient based on how bad their symptoms are at the time the message is sent. EEOR uses transfer power to figure out how energy-efficient something is.

The dynamic energy usage model [19] was also used by this program to make sure that each node used less power. Your answer will depend on how big the file was and how far away the source and delivery nodes were from each other. How much electricity did this machine need? MDOR always chose the middle node because it worked best and used the least power. MDOR's study showed that it used less power and could be used for some WSN jobs, like keeping an eye on the environment and looking for forest fires. Less often texting was the best way to save power and get the most out of wifi networks. This is what Stretchy Route made me think of. This method could find many ways since it used radio lines. No matter what choice is made, the letter will still be sent. You could still send the letter even if a link didn't work. The forwarder list [20] would be used to find other friends who had the similar info.

3. Method

We are going to talk about the model that was suggested for the energy-aware route method for sensor networks in more detail today. We talk about what the network model and the energy usage model are in the first line. A model helps us pick the best trip. Some of these are price, safety, spot, wait time [20], energy use, and service quality.

3.1. The network model

This model suggests that the sense points are spread out randomly in the two-dimensional space given. We also need to find out where the receiving nodes are and think they are all the same. One that is already set up is shown in Figure 1. There's a chance that the tracking points can only hold so much power. What about the B.S. (base station)? You can keep, move, and look at a lot of info.

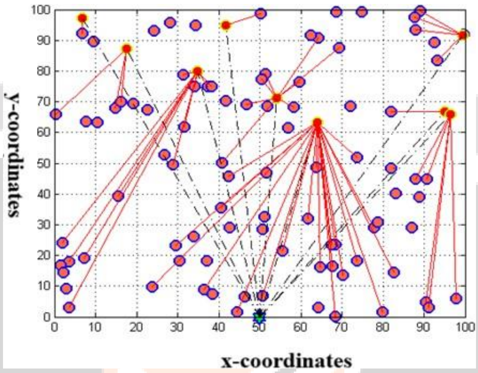

Figure 1. Modelling wireless sensor networks

As a graph, you can see how the network is set up. This is shown by the formula (V, D). In this graph, V is the set of points, and E is the set of lines that connect them. In this case, the function $(i, j) \in$ C is a wireless link between the nodes i and j. For the nodes to join, they need to be able to talk to each other. Please click on the link that looks like a cross (b, j) to get in touch. This link lets the node send a certain amount of info to the node. People in business are excited when they talk. Power boosts, radio gear, and radio systems all need more power. Figure 2 shows that sending the k-bit data file takes a lot of power. This is what we can say about how radio waves are used: Some info needs to be sent over three miles. How can I do that? To find out, do the math below:

$$E_{tx}(l.d) = \{ \begin{matrix} l.E_{elec} + l\varepsilon fsd^2 & ,d < d_{th} \\ l.E_{elec} + l\varepsilon mpd4 & ,d \geq d_{th} \end{matrix} \tag{1}$$

Different kinds of forms show you how to fade in different ways. It is clear that dth is the cutoff distance, fs is the free space model, and mM is multipath fading. Hero 2 and Hero 4 both lose 2 and 4 power. But work needs to be done to get the point across. This is how you talk about how much power is used in this phase:

$$E_{rx(}l) = \mathrm{l.E_{elec}} \tag{2}$$

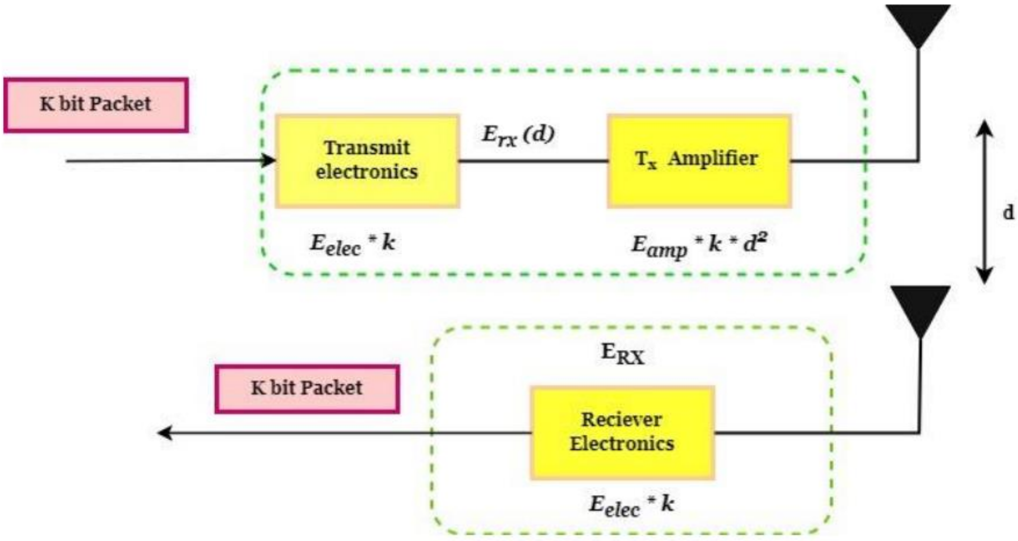

Figure 2. Free-space radio model

3.2. Parameters for a good goal function and path selection

This part talks about the important factors that were considered when choosing the most energy-efficient way to send data.

Power

It has been around for a long time since it doesn't need much power. The battery can't be charged because there isn't a wire close by. We've already talked about this. But the brain needs more power to get data from all the nodes. When two nodes in a network talk to each other, they lose some of their power. Each hop's power is shown by a dash (D). The number of hops is shown by a plus sign (░). This could be shown in this way:

$$\mathrm{En} = \frac{1}{D} \sum_{l=1}^{d} \mathrm{E}(\rho l) \tag{3}$$

You can find out how much energy was used by adding up the energy used for getting packs and the energy used for shipping.

Holdup

How much delay there is is a big part of how well a network works. As the network gets bigger, it takes longer for bits to move from one place to another. Cutting down on the number of nodes needed to send packets is a key way to do this. You can guess how long the wait will be by:

$$\mathrm{f}^{\text{delay}} = \frac{d}{\text{speed}} \tag{4}$$

Farther

There is a link between the data that sensor points send, how long they stay in the network, and how far apart they are. This gives you a rough idea of how far it is:

$$f^{\,distance} = \mathrm{v} \times t \tag{5}$$

Remaining power

A lot of people have already said that sensor networks have a hard time with power. Now you know why it's important to take care of computers and the energy grid. It takes a lot of extra power to use this part of the cluster head, send a lot of data, and choose the next hop. Adding up the energy that was there at the beginning and the energy that has been used will tell you how much energy is left. One way to say it is:

$$E_{res} = E_{initial} - E_{consumed} \tag{6}$$

You can find the $rmmed$ by adding up the power used over time. It was possible to make an objective function that takes all of these things into account with these numbers. After that, the method we learnt is used to choose the best route. One type of goal function that can be used to pick a path is shown below:

$$PathSelectioObjective = min\,(\frac{1}{energy} + f^{delay} + f^{delay}) + max(E_{res}) \tag{7}$$

3.3. Process for choosing a path

For a network, the most important thing is to find the fastest and greenest way to send info. Read these tips to make your wifi last longer. Things that don't need a lot of power can use this. Follow these steps to get through it all: Setting up the job is the first thing that needs to be done. This is the first thing that needs to be planned. The network model is based on what was picked. These are the first things you need to do to pick away. These steps help you figure out a lot of important things about the way. You still have time, space, energy, and energy. The third step is to talk. Figure out which nodes are the source and goal so that the link process can begin. The parent branch in Figure 3 is shown by the letter S. The extra sensor nodes are marked with the letter S.N., and the target nodes are marked with the letter D. As the network grows, it becomes even clearer.

To get to the fourth step, "identification of the routing route," we need to find the line that goes from Sto. D to the pack. With this setup, eleven lines have been found (Figure 3). For some of them, they can still send records. The most important thing is to choose the best way. There is a list of all the lines that have been found in Table 1. The sixth step is to figure out the best way to get there. We get a lot of flight lines, as was already said. But you need to think about the smartest way to save power. Here's a way to decide based on your doubts. We'll talk about fuzzy thought in the next section. In the sixth step, the gravity search method (GSA) is used. In the last step, you learnt a bunch of different ways to send information, which made this possible. It looks at how we handle data to help us send it in the best way.

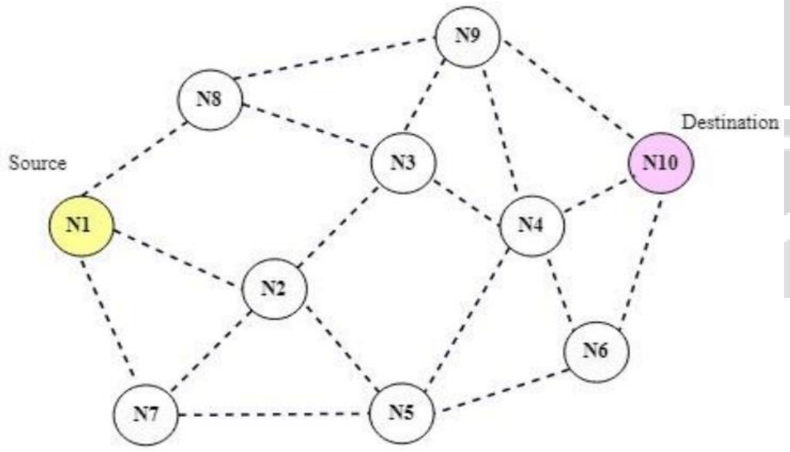

Figure 3. Example network with source, destination, and sensor nodes

Table 1. The path from source to destination

Number of the path	Found the way
P.1	$UN1 \rightarrow SN2 \rightarrow SN3 \rightarrow SN4 \rightarrow SN10$
P2:	$\theta N1 \rightarrow SN7 \rightarrow SN2 \rightarrow SN5 \rightarrow SN6 \rightarrow SN4 \rightarrow SN10$
P3:	$\theta N1 \rightarrow SN7 \rightarrow SN5 \rightarrow SN6 \rightarrow SN10$
P4:	$\theta N1 \rightarrow SN7 \rightarrow SN2 \rightarrow SN5 \rightarrow SN4 \rightarrow SN6 \rightarrow SN10$

P5:	$SN1 \rightarrow SN7 \rightarrow SN2 \rightarrow SN5 \rightarrow SN4 \rightarrow SN6 \rightarrow SN10$
P6:	$\theta N1 \rightarrow SN8 \rightarrow SN2 \rightarrow SN5 \rightarrow SN10$
P7:	$\theta N1 \rightarrow SN8 \rightarrow SN3 \rightarrow SN9 \rightarrow SN4 \rightarrow SN10$
P8:	$\theta N1 \rightarrow SN8 \rightarrow SN3 \rightarrow SN4 \rightarrow SN10$
P9:	$\theta N1 \rightarrow SN8 \rightarrow SN3 \rightarrow SN9 \rightarrow SN10$
P10:	$\theta N1 \rightarrow SN2 \rightarrow SN3 \rightarrow SN9 \rightarrow SN10$

3.4. Not so clear thinking

The most important parts of fuzzy logic are simple to learn. In real life, this math idea has been used a lot to deal with the fact that decision-making models only sometimes work right or quickly. You don't use plus and minus signs to figure things out. It means "level of truth" in English. Read this to find out more about fuzzy logic: Find the model's beginning and end points that are important. This is the right way to do things. These can be talked about with "Low," "Medium," and "High." Because you know how member functions join numbers, you already know what a fuzzy set is. Now, it needs to be clarified. This lets you check how well an input fits into a fuzzy set. Based on what comes in and goes out, you need to make rules here. For this step, make some loose rules. That's why "if-then" is often used to talk about these rules. By putting your ideas together with some fuzzy rules, you can make fuzzy output sets. You can think in more than one way besides Mamdani and Sugeno. In this step, it needs to be clarified when to use AND and OR on the fuzzy rule values.

A fuzzy output set is made up of more than one fuzzy output set. This method is called "aggregation." This is where the results of several rules are put together to make a single, full result. This process turns the fuzzy output set into a clear output number when it's done. You have to make a choice and pick the best end number once you have all the confusing information you need. In sensor networks, they can be used to find issues, figure out where things are, manage quality of service, link data, and figure out which jobs use the least amount of power. How strong the link is, how many devices are linked, and how much info is in a WSN are all things that you should know. Routers can be told to change. Systems that are flexible and can be used in different ways make this possible. Some things must be done in order to use fuzzy logic. Rules aren't always clear, and there's a tool that makes things even less clear. There's no need to change the fuzzy rules because they work well as they are. When you mix energy, time, space, and energy, you'll get new rules that need to be clarified. These are in Table 2.

Table 2. Fuzzy decision-making rules

Rule	**Powerful**	**Farther**	**Holdup**	**Remaining power**	**Way**
1	L	H	M	H	good
2	M	L	H	H	good
3	H	L	L	H	Very good
4	M	L	H	M	good
5	M	M	M	H	Very good
6	H	L	L	M	Very good
7	L	L	H	M	Worst
8	L	H	H	M	Worst
9	M	L	M	L	good
10	H	L	H	L	good

We'll use GSA to find the best answer once we have one. It has the following parts, in short order: It tries to make the forces of gravity work between pieces of matter. This is what the GSA method is for. It all starts with nature. People who are having trouble getting things in order can use a tool called GSA. It came from considering gravity and how things work in the real world. We built a model that used both fuzzy logic and GSA efficiency for this job. Outline 1 shows one possible answer to this job.

Algorithm 1. GSA and fuzzy logic optimize routing

Step 1: For each possible way to be looked at based on the given criteria, fuzzy rules need to be set up.

$$F(Path_i) = \mu_1(D_i) \cdot \mu_2(RE_i) \cdot \mu_3(Dist_i) \cdot \mu_4(EC_i) \tag{8}$$

Step 2: For each parameter, you need to set up the correct fuzzy sets and membership functions.

Step 3: Start the GSA first.

Step 4: The GSA should be set up like this: Along N lines, more than one mass can move. G stands for gravity, α is a factor that slows things down, and n is the most times this process can happen.

Step 5: The masses need to be set to zero for route X.

Step 6: Rate how well each of the great lines you've found fits using fuzzy logic:

$$Fitness(Path_i) = F(Path_i) \tag{9}$$

Step 7: Figure out the forces of gravity. To do this, find the gravity force that divides each possible pair of lines by using their fitness values.

$$F_{ij} G . \frac{m_1 . m_2}{r_{ij}^2} \tag{10}$$

Step 8: You can change how fast and strong you want to go. In order to do this, the pull of gravity must be used to change the speed and force of each path:

$$\alpha_i = \frac{F_{net,i}}{m_i} \tag{11}$$

$$v_i = \alpha . v_i + a_i \tag{12}$$

step 9: You can change where the different routes are placed based on the expected speeds if you want to move.

$$path + path_i + v_i \tag{13}$$

Step 10: To control the rate of convergence and stop divergence, you need to add a damper factor.
Step 11: Check out the body's health:

$$Fitness(path) = F(path)$$

Figure 4 shows the whole process of the best route method that was given. You can get it here. This method has a rule-based route method and lets you use fuzzy logic and GSA.

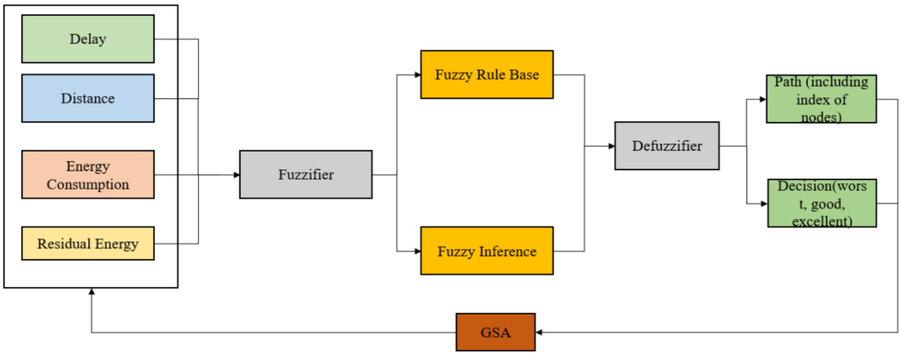

Figure 4. Fuzzy logic-GSA model design for efficient routing

In fuzzy logic, the two main steps are adding something fuzzy and taking it away. For this study, this is how we found the best way to get around. It checks for the duration, range, energy used, and, in this case, energy left over. This method is used on data that has already been worked on when new data comes in. The route is made up of different parts. Each node has a hop number and a choice flag.

4. Experiments and Discussion

The tree-based route method is put to the test with the fuzzy C-means and G.A. models. The amount of energy left over, the direction that made the most, and the number of live and dead nodes were all checked. For the tests, some rooms were 200 meters long and 100 meters wide and rooms that were 100 meters long and 100 meters wide. For either test, these sizes stayed the same [25] and are shown in Table 3. They can be changed to make a wireless sensor network (WSN). Among other things, you can see how well the WSN works and how much power it needs.

Table 3. The simulation settings

Describe	Value	Describe
E_{elec}	40 nJ/bit	How much power does it take to send and receive some data?
No. of nodes (N)	100	How many sensor nodes are in a network as a whole?
d_{th}	77 m	The minimum distance needed for communication.
P_n	0.20	The chance that the node is in the "on" state.
ε_{mp}	0.0013 p J/bit/m4	Loss of energy for multipath fading.
d_{DCH}	90 m	Too far away for direct contact.
ε_{fs}	10 p J/bit/m2	Loss of energy due to free space path loss.
E_{DA}	5 n J, bit, signal	The energy needed to collect info.
Rounds of simulation	1000	Count of times repeats.

4.1 What took place in Case-1

It looks at the mixed model that was given, which has 100 nodes in CASE 1. What does it look like? It looks for "FND," "HND," "final node dead," "live nodes," the number of days left, and other things are shown in the figure 5(a). This graph has two lines. Their names are x and y. x tells you how many nodes there are, and y tells you how far apart they are. The blue dots are farther from the middle than the red dots. HFCM-GA is used to show where the sensor nodes should go in Figure 5(b). There will be less to lose once all the sensor nodes have been changed into C.H.s. There are nodes close, which are shown by purple stars. The pink blocks show the Parent Cluster Heads (PCHs). Figure 6(a) shows a graph of the dead nodes for Scenario 1. As the number of rounds on the x-axis goes from 0 to 2000, more dead nodes are added. After 1600 rounds, most of the network ties are likely "dead." As the round number goes up, the graph shows that more nodes break. As time goes on, Figure 6(b) shows the live nodes in Scenario-1. As the rounds go from 0 to 1650, the number of active nodes that have 100 nodes that were living at the start goes down.

Every network point is gone at the end of the 1650th turn. Nodes can only do so much work over time. The first node died after 63 rounds, the second after 901 rounds, and the third after 1620 rounds. The FCM and G.A. styles helped us get there. Figure 7 is a graph in Scenario-1 that shows how much energy is left over after each round. It takes up 100 square meters of space. There are 2000 rounds, as shown by the number on it. This line tells you how much power the hub still has. The length of the y-axis can be anywhere from 0J to 50J. It has an extra 50 J of power, but as the games go on, it runs out slowly. The sense zone has many parts that can be set up in different ways. Even if the nodes are far apart, they can still talk and feel each other.

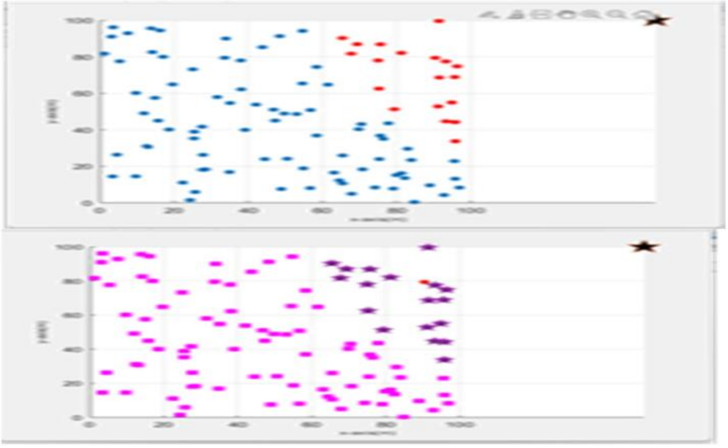

Figure. 5. Scenario-1 hybrid model nodes and final node deployment graph.

4.2 What took place in Case 2

This is how the shared mixed model with 200 nodes turned out in Scenario 2. To find out how long the network would last, we got FND, HND, end node dead, live nodes, extra energy, and coverage ratio.

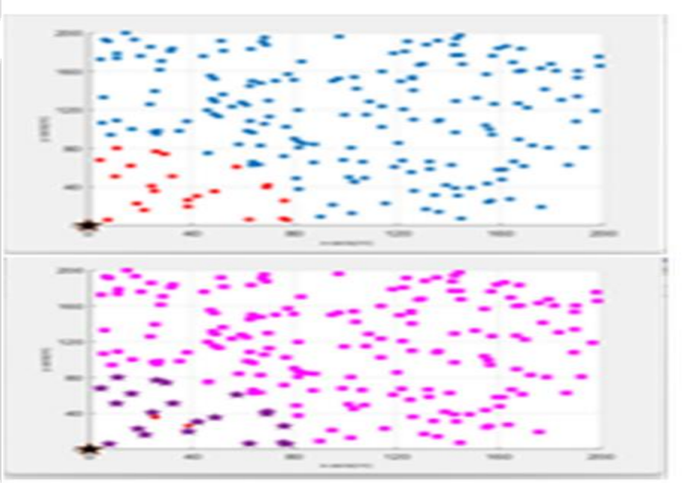

Figure. 6. Scenario-2 final node deployment graph with hybrid model nodes.

Figure 6(a) shows the design. This group of sensors is made up of 200 different parts. In this case, blue sensor nodes are farther away from the hub or sink than red sensor nodes. The BS and S.N. are set up in Figure 6(b). The pink leaves show that they are there. These purple nodes near the C.H. die after a certain number of times. Things need red PCHs to keep the flow of information going.

Table 4 shows the normal EEHCHR method results. Some people believe that the HFCM-GA would be better than the EEHCHR at this time.

Table 4. Compare Proposed Model Results for Both Scenarios

Checking the network's lives	First case: 100 nodes	Second case: 200 nodes
FND stands for "First Node Dead."	52	40
HND stands for "Half Nodes Dead."	800	835
LND stands for "Last Node Dead."	0510	0

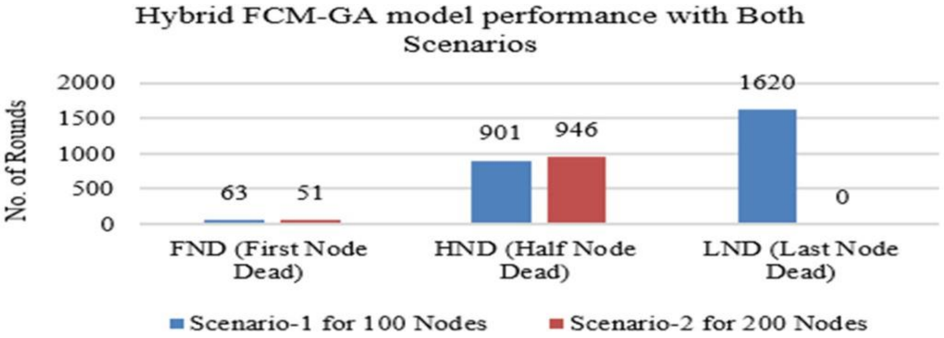

Figure. 7. Comparison bar graphs for both scenarios.

Table 5. Comparison of current and the proposed models

Checking the network's lives	The suggested HFCM-GA method		The current EEHCHR method	
	Situation 1	**Situation 2**	**Situation 1**	**Situation 2**
FND	52	40	34	20
HND	800	835	624	620
LAND	0510	0	0248	0013

4.3 Lack of knowledge

This study shows that there are issues with the ways that WSNs save power. This is filled by the mixed form of the method that was given. Now that this is added, it's better and stronger. To do this, the good parts of the G.A. and HFCM groups are mixed. Plus, a new study that looks at the suggested model in other ways shows how much more important it is. This study talks about rate scales like LND, HND, and FND because they are important. It also tells you everything you need to know about how well the model above does its job.

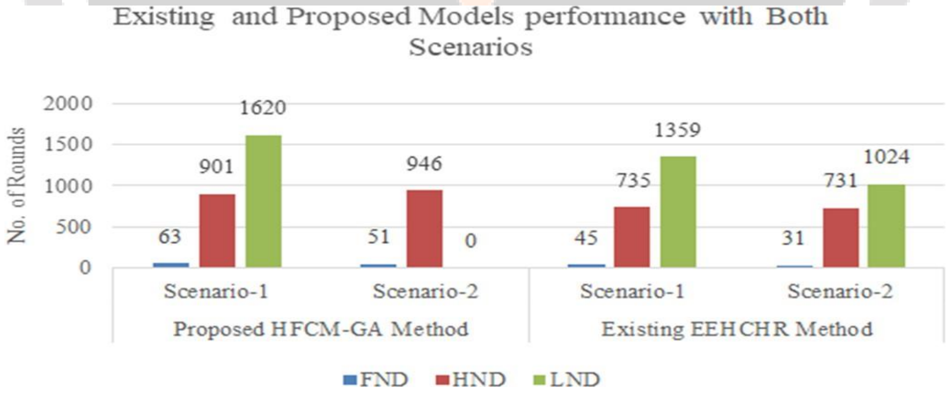

Figure. 8 Comparison of current and planned models

5. Conclusion

The study comes up with a new kind of linked route system that makes good use of the hardware that comes with power. HFCM-Gravity tree-based routing is used to find out more and make the network last longer. So that each machine could get the most power from its source, different kinds of groups were used. Exercise plans were used to help pick each C.H. If the apps need it, the hubs can give them more power. Another way of the same type doesn't last as long as the HFCM-Gravity method. The network spread is smaller, too. It was found that the suggested method helps the network reach more people with less extra power. Wifi sensor networks

(WSNs) and energy savings took a lot of work on my part. They'll be easier to use and better in the long run. The study needs to be stronger since it doesn't look into the FCH change in enough depth. Now, it takes a lot of work to keep an eye on the plan. To make sure the HFCM-Gravity works in a wide range of real-life networks and situations, we need to test it more and take a closer look at how the computer is set up. This wireless sensor network route method would work better if you used it more often and were more specific about the model. In the future, metaheuristics will be used to make the C.H. selection function that sorts multitier diverse sensor networks better. There is a push for WSN lines. It might be more useful and give you more options if you combine it with new technologies like machine learning and cloud computers.

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