

Energy Aware Data Harvesting Strategy Based on Optimal Node Selection for Extended Network Lifecycle in Smart Dust

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Research Article

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Abstract

Smart Dust environment face additional challenges as a result of the use of movable Smart Dust basestation(BS), despite its benefits. The main point of contention is the BS positioning updates to the smart dust nodes. Each smart object ought to be aware of the BS location so that it can send its data to the BS. According to the prevailing Flooding approach, the moveable BS must continuously distribute its location throughout the network in order to inform smart dust nodes about the BS location. In every case, visit positioning upgrades from the BS can result in maximal power usage as well as enhanced network breakdowns. Different sorts of routing architectures can be used to reduce BS position updating. A routing strategy based on the movable BS is successful if it preserves the network network's power consumption and latencies to a minimum. The study's main goal is to develop an energy-efficient routing mechanism focused on adaptive movable BS modification. In the Smart Dust Head (SDH) establishing the inferred surroundings, the most latest movable BS location will be preserved. As a result, rather than soliciting SDH in the environment, the location of the BS is propagated to the smart dust nodes located at the sectors in integrated networking. By transmitting request information to the nearest sector, the remaining SDH can find the most current BS location. The message's recipient is determined based on the information gathered. The best fuzzy related clustering algorithm will be used to accomplish this. The Enhanced Oppositional grey wolf optimization (EOGWO) methodology can be used to perform the improvement. Optimum network throughput, low latency, and other metrics are used to assess performance. To enhance productivity, the findings will be analyzed and compared to previous routing methodologies.

1. Introduction

As a result of recent technical advancements, many benefits to modernity have been realized, and the quantities of computer devices have skyrocketed. Because of the large range of platforms, the development and functioning of these frameworks must be monitored on a regular basis in order to provide various types of technology networks. A wireless sensor network (WSN) is a science-based adhoc networking [1] which handles with related works [2]. As a result, WSN attracts substantial interest from a wide range of applications throughout the worldwide due to its ability to obtain critical data depending on numerous aspects such as pressure, motion, and biochemical group computation [3]. In today's world, WSN participation in Big Data and the Internet of Things is unavoidable [4]. Environmental data may be easily viewed and tracked using this method [5]. It collects data, detects threats, tracks them down, and controls them, among other things. In these conditions, nevertheless, physical control is vital and challenging [6].

Whereas the sensors share and gather data, this technique operates as a multi-hop in the overall environment [7]. Furthermore, the data collected by WSN sensor nodes is spatio-temporal correlated [8]. Channel capacity is among the most successful elements of WSN, wherein sensor nodes communicate data to the specified location by sharing data prior distribution, resulting in a more efficient communicating amongst them [9]. It is also used in a variety of uses, covering monitoring systems,

medical services, industry, e.t.c [10]. Energy expenditure is a major hurdle in WSNs, and can be affected by a range of factors, including data collecting [11]. Identification of messaging services and consolidation locations, on either side, is a complex network need in WSN [12]. Depending on the scenery of flexibility implementation, quick access, and relatively inexpensive, the traditional WSN used the operation is dependent on a decentralized system [13]. MANET has two subtypes: WSN and VANET. WSN and VANET are two of the most popular and innovative technologies that have recently received more investigation. Also with Vanet [14], a variety of approaches were merged into the current WSN invention. WSN techniques are outfitted with a slew of independent sensors in a variety of domains in order to track the environmental by detecting moisture, heat, noise, and vision, among other things, and to send the data to the respective destinations in real time. In the event that perhaps the charge fails and needs to be changed, the battery provides a power supply to the devices [15]. Unfortunately, replacing the expended cells is either prohibitively expensive or impracticable. Energy restrictions are a critical problem in modern innovation, particularly in the WSN context, since they can reduce the lifespan of the system of the complete WSN system, particularly in data collection [16]. As a consequence, an appropriate approach for prolonging duration of the WSN environment is required. As a result, numerous cryptographic functions protection approaches have emerged, allowing the protection system to function properly. Nevertheless, there is a restriction in WSN, particularly in energy utilization, since its proportion is difficult to forecast and differs from each other [17]. The WSN might collapse based on a variety of factors. WSNs may misbehave for a variety of reasons, including existing in third-party contexts, sensor ageing, energy depletion, connectivity hurdles, and etc. In this case, the likelihood of sensor devices performing incorrect observations is considerable, or its values might vary considerably somewhat from nodes in the local environment. Numerous studies have concentrated their efforts in the field of research on designing an integrated WSN related route procedure for processing and analysis.

2. Literature Survey

Given the limited energy storage of nodes in WSN, effectiveness in energy utilization is seen as a critical difficulty. Due to the generally anomalous characteristics of the transmission of data as well as the amount of sensors under a specific node, one intrinsic feature of WSNs is whether the environment is required to collaborate without human involvement for a sufficiently longer duration, as replacing the power packs in the sensor hubs consumes a lot of effort. The multiple levels transportable BS guiding protocols [18] are most significant and widely welcomed of the numerous alternatives available to cope only with issues of BS placement in WSNs. Many guiding computations have used the moveable BS decline to improve the system lifetime in distant sensor systems. It suggests that the placement of the BS is constantly broadcast through the use of the system region in order to keep all sensor hubs up to date while providing data to the decrease. Unfortunately, repeated BS placement updates can result in both elevated use and increased breakdowns in the system described in [19]. In [20] suggested a novel WSN-based approach. Wirelessly smart objects, a newly developed methodology in latest innovations, have been used to control windmills owing to its advantages. This was necessary since existing wiring equipment was inadequate for monitoring rotor components.

As a result, the group has shifted its focus to developing a unique methodology for monitoring those complicated structures. WSNs may be used to create a network to transcend the restricted variety of communication accessibility and offer connectivity between faraway locations. Routing protocols have been the main caregivers of these ad hoc WSNs, which necessitated the implementation of a trustworthy and energy-efficient strategy to improve network reliability and availability.

WSNs have risen in popularity from the variety of sources. In the modern world, it was unavoidable. It was used to resolve a network's energy conservation difficulties that had surfaced as a challenge that needed to be addressed in order to achieve efficient capabilities. As a result, numerous algorithms have been presented to handle with high efficiency concerns in traditional WSNs in order to reduce power consumption. The researchers established numerous WSN technologies for this project. In [21] developed an innovative methodology in which an SDN was incorporated into WSNs as well as an enhanced SDWSNs architecture was built.

In [22] introduced a revolutionary methodology in the realm of mobile wireless networks throughout this paper. They talked about a mobile wireless sensor network (M-WSN) that composed of sensors coupled to a railroad area to increase mobility after the initial establishment. MWSNs were useful in circumstances where sensor deployment was essential and/or fatal. The final challenge in sensor nodes dissemination was ensuring that disseminated sensors offered the appropriate level for the region of investigation while also ensuring the scattered network's compatibility. Industrial Internet of things emerged as a result of contemporary technology advancements. For manufacturing and intelligent buildings, this produced a new technique to measure, regulate, and manage. It was developed using intelligent and questioned sensors, which were made possible by a younger breed of telecommunication concepts, particularly WSN. Adoption of this technique was hampered by the need for an organization wants to improve to overcome distribution challenges. A unique approach is proposed by [23]. The sectors the advancements of established industrial wireless sensor networks equipment and created a methodology for rapid adoption of WSNs in this paper. In [24] examined Commercial WSN and offered a novel approach. It has the tendency to enhance the setup of a wide range of unique contemporary enterprises. The neighbor reveal technique was one of the main reasons for this decline. They created and categorized two innovative neighbor finding techniques that improved the reliability of smart applications' ability to stay connected to IWSN.

The Route Identification in data analysis and mobile BS in WSN have been explored by in [25]. The researchers presented two strategies for path sector over that minimize Hop counts and minimum hop duration, and information was acquired using the MS scheduler methodology. Because to their location in a harsh atmosphere, sensor nodes in WSNs have experienced numerous safety issues and threats. As a result, these nodes would not have any defenses against dissipation of energy or adversary equipment attacks. If the opponents continue to invade the infrastructure, they should do it in two ways: using permission nodes, which lead to efficient consumption and the absence of legitimate observations. To achieve optimized power utilization, in [26] presented a methodology Fuzzy-based dynamic identification of the central management nodes in PVFS. Cloud computing high processing capacity and capabilities

infused fresh vitality into WSNs and inspired the establishment of innovative technologies. Nevertheless, data collecting in a cloud domain is difficult to the WSN's bad communication capacity. In [27] introduce a fog infrastructure consisting of many BS nodes in this work. Researchers attached sensors towards the respective BSs after districting gathering regions including all BSs. Hops and power consumption were investigated to address the hotspots challenge for all those given sensors. BSs synchronized the transmission of sensor cloud storage. The challenge was found to be NPhard, thus they devised an analysis of the model with several verifiable features to solve it. Researchers also created a sophisticated sensor transportation system that took hops and energy expenditure into account. Researchers evaluated their approach to a number of standard approaches. Rigorous testing demonstrated that the model strategy surpassed devise strategies by a wide margin.

3. Challenges Description

The following are some of the most typical issues with wireless smart dust network systems:

- To design a dispersed clustering technique with a greater amount of BSs, with the goal of minimizing the arithmetic mean between the BS as well as smart dust nodes [28].
- Information was transmitted in a cross arrangement in the WSN, in which each hub advanced its
 data to the neighbor hub closest to the BS. The preceding approach cannot be deemed highly
 effective because securely placed hubs may sector over the very same information.
- An accurate position algorithm is created to determine the placement of smart dust nodes using BS information [3].
- Data integration often entails a layered revolutionary between selection and observations using smart dust nodes that includes quantitative and chronological computations, as well as weighted normalized issues [29].
- Data constraint is used in the existing techniques to reduce garbage data, regulate traffic, and delay in data fusion, but it uses greater energy and resources.
- Conventional energy usage technologies have a very massive price [30].
- Due to erratic modification of mobility sink nodes, the stability period is quite short.

The primary concerns raised in previous studies [15] have been sector used previously, and they seem to motivate us to build a methodology for the WSN.

4. Proposed Tactic

Smart Dust faces new challenges when they use a flexible sink notwithstanding their inclinations. The main challenge is promoting a flexible smart dust BS location to the smart dust nodes. Every smart dust ought to be aware of the smart dust BS location because it can send its data to the smart dust BS. The inundation computation is the simplest technique for dealing with this problem. These methods suggest that the flexible smart dust BS should broadcast its location throughout the system on a regular basis in

order to inform smart dust nodes about the smart dust BS location. Periodic position updates from of the smart dust BS, but at the other hand, can result in high strength use and increased system breakdowns. The continuous driving mechanisms can reduce position information from the smart dust BS. A navigation estimate based on the mobile smart dust BS is effective if it keeps the system's energy usage and delay to a minimum. The main goal is to provide an energy-efficient integrated navigation system based on optimized movable smart dust BS upgrade. As a result, the smart dust BS position is generated to the smart dust nodes located at the rings rather than all of the smart dust nodes inside the network in inserted directed. By sending request packets to the adjacent circle, the remaining smart dust nodes can find most current smart dust BS position. The purpose of every message is fulfilled, as evidenced by the response. The best fuzzy-based clustering method will be used for this. The Adversarial grey wolves can perform the enhancement.

4.1 Clustering of Smart Dust Nodes and Cluster Centroid Estimation

The clustering technique reduces the number of movable smart dust nodes that lose power. Let S denote the smart dust nodes, i.e., SD = $(sd_1, sd_2,..., sd_i)$, whereby (1 < = i <= n) is the total amount of smart dust nodes.

Set SD additionally includes descriptions of the smart dust node positions. The smart dust nodes are aggregated using "Kernel based Fuzzy C methods" just on basis of storage quality and price (KFCM). The Radial Basis Function (RBF) kernel is employed in this example. The fuzzy grouping and RBF functions are used to create the weighting factor of our suggested KFCM.

4.1.1 Kernel based Fuzzy C means

The feature set of a RBF kernel-based KFCM method is shown below.

$$J(P,U,C) = \sum_{i=1}^{c} \sum_{j=1}^{n} u_{ij}^{m} k(p_{j},u_{j}) + k(c_{i},c_{i}) - 2k(p_{j},c_{j})$$
(1)

The value of every variable is given by m, while the linear function is designated by k inside the given in Eq. (1) fuzzy partitioning matrices indicated by U. The system divided the dataset into two categories in this case. In comparison to the standard kernel, the RBF produces less noisy adaptability, improved results, and allows for semi cluster centers calculation. Traditionally, those computations [8] used the RBF component as its bit size every so often.

The RBF kernel is utilized here because it produces better outcomes and uses non-complex variations to calculate the cluster centers ci and reduce the noise susceptibility.

$$u_{ij} = \frac{\frac{(1-k(p_{j},c_{i}))^{\frac{-1}{(m-1)}}}{\sum_{l=1}^{c} (1-k(p_{j},c_{l}))^{\frac{-1}{(m-1)}}}}{(2)}$$

$$c_{ij} = \frac{\sum_{j=1}^{n} u_{ij}^{m} k(p_{j}, c_{i}) p_{j}}{\sum_{l=1}^{c} u_{ij}^{m} k(p_{j}, c_{i})}$$
(3)

Algebraic kernel was also examined in this study. The classifier is enhanced well by updating the fuzzy partitioning matrices and cluster centers ci for improvement to use the algebraic parameter. The revised characteristics are received as soon as the improvement is performed.

$$u_{ij} = \frac{(k(p_{i,p_j}) + k(c_{i,c_j}) - 2k(p_{j,c_i}))^{\frac{-1}{(m-1)}}}{\sum_{l=1}^{c} (k(p_{i,p_j}) + k(c_{i,c_j}) - 2k(p_{j,c_i}))^{\frac{-1}{(m-1)}}}$$

$$(4)$$

$$c_{ij} = \frac{\sum_{j=1}^{n} u_{ij}^{m} p((p_{j}, c_{i}) + 1)^{q-1}}{\sum_{j=1}^{n} u_{ij}^{m} k((c_{i}, c_{i}) + 1)^{q-1}}$$
(5)

4.1.2 Embedded Routing

Assume an only one smart dust BS in the mobile smart dust system to illustrate the proposed methodology. Integrated Forwarding is a suggested method that uses a movable smart dust BS and virtualized atmosphere made up of several smart dust nodes that generate a few attached sector from central axis of the arranging region. There are two types of hubs below: standard smart dust nodes and switching smart dust nodes. The sector or circles were constructed by such switching smart dust nodes. Those sectors aren't actually shaped like a ring, although they are completely closed rings that encircle the region's centroids.

Every sector's central focus is in the center of the smart dust node zone. When commencing the Integrated Routing approach, a couple decided sectors are constructed. Figure 1 shows smart dust environments following three circles have developed. The reason for arranging such sectors would be that the smart dust enclosing between (for instance, switching smart dust node) keep a record among the most current smart dust BS position and response to smart dust BS position requests received by normal smart dust nodes. Each cluster broadcasts to the cluster center before it has info for disseminate to a dropping smart dust node. The closest switching on the sectors broadcasts the sink's most current position. All of the centroids are aware of the nearby smart dust nodes and its actual positions thanks to the geographical computations. The building of the virtualized infrastructure, which would be depicted in the following category, is the first stage in the Integrated Routing computation. Only a few sectors are used in Integrated Routing. Throughout this computation, the number of rings is an important factor. Because switching smart dust nodes consume a lot than the rest of the smart dust nodes in the environment, a higher number of sectors mean higher power or energy consumption in the framework.

The low number of sectors, on the other hand, increases the chances of a hot spot incident. Consider the radio range of the smart dust nodes in the environment to determine the restriction. Allow the distance between two plates to be comparable to the disseminating range of smart dust nodes, with r representing the smart dust nodes radio range and X estimate the total square area.

The difference between the panels is its spanning, which is used to distinguish each. In order for a smart dust router hub to communicate with another switching smart dust node, it must have two other switch smart dust nodes in its communication range. As a result, the switching smart dust nodes on a given circle may not form a concentric circle. Regardless, they create a private circle that encircles the region focal centre. A continuous circle is also known as a Sector in this context. Following the organization of the smart dust node (X/2 r), and rings, the rings are constructed as follows:

Inside a network connection, $N=\{N_{s1}, N_{s2},..., N_{sn}\}$ be would be an aggregation of smart dust centers, where sn represents the number of radio hotspots. As a first glance, each smart dust centers appears to be the same. In light of r and X, each center in the set determines the amount of sectors that should be constituted. At a certain moment, it calculates its better ways based upon that region's midpoint and compares it to the capacity of every sectors. The aim of this technique would be for the core to determine which sector is nearest to that and consider it a possibility for becoming a switching center within this circle. Have nearestsector; be the nearest sector's distance to N_{s_i} , and sector-distant; be the distance between the nearest sector and N_{s_i} . It uses a data-distant signal to inform its neighbours about nearestsector; and sector-distant;. Each smart dust nodes waits including all data-distant signals out of its neighbours before proceeding. At a certain moment, each smart dust node considers its neighbours sector-distant, where nearestsector; is the same as nearestsector. Just after comparison with nearby smart dust nodes, the smart dust hub is changed to a switching hub if indeed the spacing to the surface is the smallest.

4.2 Information updating in movable Sink

The sector primary purpose is to store latest position of a sink in the switching hubs. Whenever a conventional hub decides to send data towards the hub, it first obtains most current position by requesting this from the nearest switching hubs with in nearest sector. The hub then uses the routing strategy to transmit the messages to BS. As a result, the sink should inform the switching hubs of its location. The sectors can be divided into two clusters, including the mobile BS and the moveable smart dust nodes, in just about any system condition. Whenever a dropping smart dust node changes its position, it sends a packet, data-revise-location message that includes its new venue. The aim is a smart dust node outside of the spectrum or on the outskirts of the locality that is chosen since it will teach the primary assemblage about the BS destination's sectors. The other informational target is the location's main focus that will educate the second cluster about the sectors.

This method guarantees that such statement will pass from one hub of every sector drive in the scheme. Each piece of information was sent on its manner to its destination till it reaches a hub. Whenever these information please at a switching hub, it skips the BS and forwards the information to the destination.

The switching hubs subsequently distribute the revised position of the BS to other smart dust nodes in their sector by delivering a message to adjacent routers hubs. If a switching hub has formally acquired the data-distribute-position-information, it discards it and forwards it to the neighboring switching hubs; otherwise, it discards this and forwards it to the nearby switching hubs. The element for BS position upgradation is shown in Fig. 2.

4.2.1 BS information broadcast

Whether any cluster centre has to convey messages to the BS after the sectors have been formed, it must first use the adjacent sector to determine the BSs latest current position. Each hub in the model is capable of locating the nearby sector because it is aware of own position as well as the size of the environment. It can recognize the closest sector by calculating the sweeping of every sector in the network as well as its own acceptable methods from central focus of the locality, and afterwards comparing those two parameters. Each hub sends data-request-position information to provide the most current BS positioning after the adjacent sector has been determined. The hub identifies the data aim to the location center if it is outside of the adjacent sector. If the hub is located inside the adjacent sector, it identifies the data target to a position outside of the sector. As a result, the information will be delivered to the adjacent sector. Whenever a shifting hub receives data-request-position information, it informs the common hub of most recent decline place by delivering data-request-location information to a common hub.

Following the acceptance of the response, the conventional smart dust hub is aware of most current BS placement and perhaps uses the routing strategy to send this data to the dropping. Each smart dust hub in the remote smart dust network delivers its discovered data to the cluster head(CH). Finally, the data through one cluster centered is collected by the BS, and in order to save transmitting time, this research ejected the duplicate info from basic data and then forwarded to the BS.

There seems to be a chance the sector will be damaged if a router hub wears away. As a result, whenever a router smart dust node passes on, a module is anticipated to modify the integrated sectors. The switching hub, which becomes obsolete, chooses an acceptable conventional hub to succeed it. The grey wolf optimization model is used to select the best descendant in this case.

4.2.2 Adversarial GWO

In general, a bunch of grey wolves was monitored, as well as the GWO methodology [26] employs the stunning for hunting idea. The suggested GWO methodology is influenced by grey wolf foraging actions and social dominance in environment. It works similarly to certain other contextual, with the GWO methodology starting with a community of randomly generated wolves. Approximately 5–12 packs of wolves are able to coexist with certain restrictions imposed by the head wolf. If the present network node is decreasing, the OGWO is utilized to choose the best succession router smart dust node. This will be determined based on the gateway smart dust nodes intensity level.

4.2.3 Antagonism Action Learning (AAL)

Tizhoosh created the Oppositional related learning method to improve the computing efficiency and resolution ratio of several evolutionary approaches. It is impossible to estimate the quantity optimal result for a pseudorandom population count; hence the resources duration to obtain solution is so long. Together with population demographics, opposing numbers are established in AAL. Because the insertion of such opposite numbers it really discovered whether AAL can obtain an optimal result in the shortest duration. Consider that α , β and φ are different types of wolves. The φ wolves are mentioned in relation to the GWO method's application approach. The centre wolf's tertiary and secondary locations are becoming extremely important, and have supplied just few victim pursuing strategies. Algorithm 1 defined some well process of GWO activities. The much more important aspect and function of a GWO approach is predator nearby, tracking, and leaping.

Predators are encircled. The overarching concept is understood in order to pursue it, as well as the technical i activity of phases are discussed in terms of circumstances. Therefore, the vector factor \vec{A} and \vec{X} are incidental by $\vec{A} = \vec{2}\vec{a} \cdot \vec{c_1} - \vec{a}$ and $\vec{X} = \vec{2} \cdot \vec{c_2}$, the $\vec{c_1}$ and $\vec{c_2}$ vectors encompass a position through the intervening [0, 1]. Vector evaluation of $\vec{a} = a_1(1 - i/i_{\text{max}})$ are diminish starting 1 to 0 through the maximum quantity of i_{max} iterations.

$$\overset{\leftarrow}{T} = |\vec{X}. \vec{Y}_a(i) - Y(i)| \tag{6}$$

$$\overset{\leftarrow}{Y}(i+1) = \vec{Y}_a(i) - \vec{A} \vec{C} \tag{7}$$

Searching For the β and φ wolves, the head, α , β and φ option are necessary. On the matching spot, the greatest configuration location to be stored in the package and wolf estimations can be modified. In the subsequent circumstances, the numerical explanation of the modified locations is discussed.

$$\overrightarrow{C}_{\alpha} = | \overrightarrow{X}_1. \overrightarrow{Y}_{\alpha}(i) - Y(i) \overrightarrow{Y} |, \overrightarrow{C}_{\beta} = | \overrightarrow{X}_2. \overrightarrow{Y}_{\beta}(i) - Y(i) \overrightarrow{Y} |, \overrightarrow{C}_{\phi} = | \overrightarrow{X}_3. \overrightarrow{Y}_{\phi}(i) - Y(i) \overrightarrow{Y} |$$
 (8)

$$Y_1 = Y_{\alpha}(i) - \overrightarrow{A}_1(\overrightarrow{C}_{\alpha}), Y_2 = Y_{\beta}(i) - \overrightarrow{A}_2(\overrightarrow{C}_{\beta}), Y_3 = Y_{\phi}(i) - \overrightarrow{A}_2(\overrightarrow{C}_{\phi})$$

$$Y_3 = Y_{\phi}(i) - \overrightarrow{A}_2(\overrightarrow{C}_{\phi})$$

$$Y_4 = Y_{\phi}(i) - \overrightarrow{A}_2(\overrightarrow{C}_{\phi})$$

$$Y_5 = Y_{\phi}(i) - \overrightarrow{A}_2(\overrightarrow{C}_{\phi})$$

$$Y_7 = Y_{\phi}(i) - \overrightarrow{A}_2(\overrightarrow{C}_{\phi})$$

$$Y_8 = Y_{\phi}(i) - \overrightarrow{A}_2(\overrightarrow{C}_{\phi})$$

$$Y(i+1) = (Y_1 + Y_2 + Y_3)/3$$
 (10)

Swooping down The percentage is disrupted either by iterative position of the movable value *a* directly ordered with phase of GWO. The predator pursuing is limited more by vectors' respect, which has been warped between 2a to 2a using $|\vec{A}| < 1$. Again for assault on target the search for hunting can generate extra revenue $|\vec{A}| > 1 >$.

Algorithm GWO

Input

Investigate population variable A_n , result 0, the result from higher to lesser limit $\{U_{a1},...U_{an}, L_{a1},...L_{an}\}$ upper limit iteration.

Result

upper most jump parameter Y_a

- 1. Initiate the quantity of grey wolf resolution $Y_r = \{y_1, y_2, ..., y_n\}$ at this point $r \in A_n$ and $Y_b \in \{U_{aq}, L_{aq}\} \forall_q \in [a]$.
- 2. Initiate a, A, X and i=1
- 3. Calculate the each search parameter fitness $f(Y_r)$, therefore $(p \in \{A_n\})$
- 4. Y_{q} = main finest search parameter.
- 5. Y_{β} = derivative finest search parameter.
- 6. Y_{ϕ} = tertiary finest search parameter.
- 7. while(i<greatest iteration) do
- 8. for each search parameter do
- 9. Promote the current search parameter position in equation 6.
- 10. end for
- 11. promote a, A and X
- 12. evaluate each search parameter fitness
- 13. promote $Y_{\alpha},\,Y_{\beta}$ and Y_{φ}
- 14. i=i+1
- 15. end while
- 16. return Y_α

5 Investigational Outcomes

This part contains the research findings as well as a commentary of the findings. This study's productivity and efficacy are contrasted to those of other methods. The simulated factors are shown in Table 1.

Table 1
Simulation

| Factors | Value |
|----------------------|----------|
| Smart dust nodes | 600 |
| Area | 600X600 |
| Data package size | 40bytes |
| Control package size | 100 bits |
| Broadcasting range | 100 m |
| Opening energy | 3.0 J |
| Velocity of BS | 7m/s |

5.1 Investigational system

This method was created in NS2. The algorithm's potency is assessed using metrics like computational time, latency, Transmission rate, network lifespan, and energy consumption.

5.2 Assessment procedures

The following parameters are used to evaluate the suggested methodology's productivity and efficacy.

5.2.1 Latency

Latency is the amount of time it takes for data to travel from source to recipient. It is timed in seconds.

5.2.2 Transmission rate

Transmission rate is defined as the number of packets of data transmitted to the receiver per second.

Transmission rate = Total broadcasted data(kb)/broadcasting time(s) (11)

5.2.3 Network lifespan

It could be determined by primary communication link depending on period or duration use, with the energy restriction for transmitting a packet being dropped.

Table 2 investigation of Latency and Transmission rate

| No.of Smart Dust Nodes | Latency | Transmission rate |
|------------------------|---------|-------------------|
| 50 | 0.0285 | 1523 |
| 100 | 0.0492 | 1671 |
| 150 | 0.0973 | 1153 |
| 200 | 0.1735 | 1986 |
| 250 | 0.4271 | 2821 |

Table 3
Investigation of Computational time

| No.of Smart Dust Nodes | Overall Computational Time |
|------------------------|----------------------------|
| 50 | 11.25 |
| 100 | 20.15 |
| 150 | 29.75 |
| 200 | 37.63 |
| 250 | 45.81 |

5.3 Investigation of Performance

Numerous success factors of the outcomes are tabulated in Tables 2 and 3 to determine the efficiency of the suggested system. It is visible from below. The effectiveness is assessed by adjusting the number of nodes. The proposed approach has a bring benefits of 2042.4 Kbps.

The approximated system analyses the time complexity by adjusting the number of nodes. The smart dust nodes are 50, 100, 150, 200, and 250 in this case. To complete the packet transfer for all smart dust nodes, the maximum processing time for with this research is 45.81s.

6 Network Lifespan

This can be established by original communication link depending on period or time use, with the energy limitation for transmitting a packet being decreased.

6.1 Evaluation

Several current approaches, including such OGWO [30], VGB [31], Nested Routing [32], and many others, are used to assess performance including such energy utilization, network lifespan, and latency. Evaluate the power usage of the various strategies in terms of regular energy usage every smart dust node and total energy usage in the network. The typical power use per smart dust node refers to how much energy

each smart dust node consumes on a regular basis. The computations are run to determine their regular power consumption per smart dust node and the system. It represents power consumption for 400 smart dust nodes till the central smart dust node dies. Figure 3 shows how it works.

Analyses to determine their average power consumption per smart dust node and complete system power consumption for 400 smart dust nodes till the major smart dust node is removed. The suggested technique consumes a smaller amount of energy than current Nested Routing algorithm. Since the suggested system uses fewer circles to enlighten the smart dust nodes about more current BS location, it uses less energy.

The effectiveness of different approaches on network longevity is described in Fig. 4. Integrated Routing is more efficient than other methods for couple of reasons. Primarily, the smart dust nodes communicate minimum BS position requests and responses, whereupon the demands are shared among multiple discs, which both reduce energy usage. A further technique, VGB, will be less than the suggested technique because the data transmission of the overpass smart dust nodes is highest, having caused these smart dust nodes to lapse earlier and later than just a particular timeline, there's no other worthy candidate to be picked as just a point of convergence smart dust node, reducing the calculation's lifespan of the network.

Figure 5 depicts the network longevity after 75 percent of the smart dust nodes have expired. This figure suggests that the Integrated Route optimization computation has a longer system lifespan than other computation because the use of multiple rings hotspots the concern area nearer to the simulated space, and the "Adjusting the Structure of Embedded Rings" computation repairs the rings and prevents those from busting. When the decline accelerates, the approaches generate additional packages for routing refurbishment. The production of new information adds to the system latency. Along certain ideas, as the BS velocity is increased, the system latency grows. In any event, Fig. 6 compares mobile BS velocity evaluation to other approaches now in use. The suggested research surpasses current techniques. Since the discs are constituted with particular point from those other discs and returned to its original spot successively in the proposed technique, the traffic delays exacerbated by the modification of BS spot in the surroundings and the traffic delays engendered by acquiring the BS spot from discs are distributed accurately throughout the system. By modifying the smart dust nodes, the methodologies are first filtered for analyzing latency. The period it takes for information to be streamed over the scheme from a smart dust node to the BS is referred to as latency. The latency is equal to the average latency of total packet transmitted by the BS, which is a large quantity. The research of several approaches is depicted in Fig. 7. As the number of smart dust node centre points grows, so does the time it takes for the system to respond. As there are a few integrated circles as with the capability of transmitting the request position of BS decline to the closest region rather than just solitary circle, the suggested research has a lower latency than the previous OGWO, VGB, and Nested ring techniques. As a result, Integrated Routing responds to BS drop position requirements more quickly, reducing latency.

7 Conclusion

An efficient data collection methodology for smart dust is suggested in this research work. Different evaluation parameters, such as latency, network lifespan, processing time, energy consumption, and throughput, are used to assess the success of the suggested technique. Several conventional algorithms, such as OGWO, Nested routing, VGB, and other methods, are contrasted to the proposed methodology. The proposed approach is evaluated by means of latency, processing time, lifespan, and other factors in determining its effectiveness. This research will be expanded with different clustering algorithms in order to successfully combine mobile BS smart dust nodes.

Declarations

Ethical Approval and Consent to participate

Not applicable

Human and Animal Ethics

Not applicable

Consent for publication

Not applicable

Availability of supporting data

Not applicable

Competing interests

The author declare that they have no competing interests.

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Authors' contributions

The Author contributed entire manuscript.

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Figures

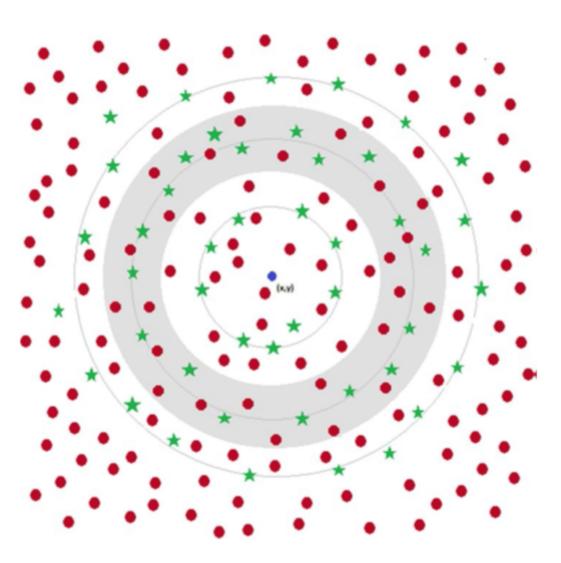


Figure 1
Integrated routing circular region Structure

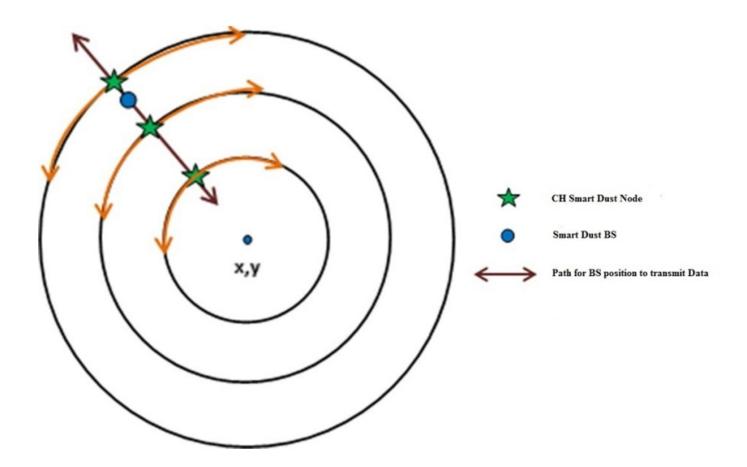


Figure 2Updating of moveable BS spot

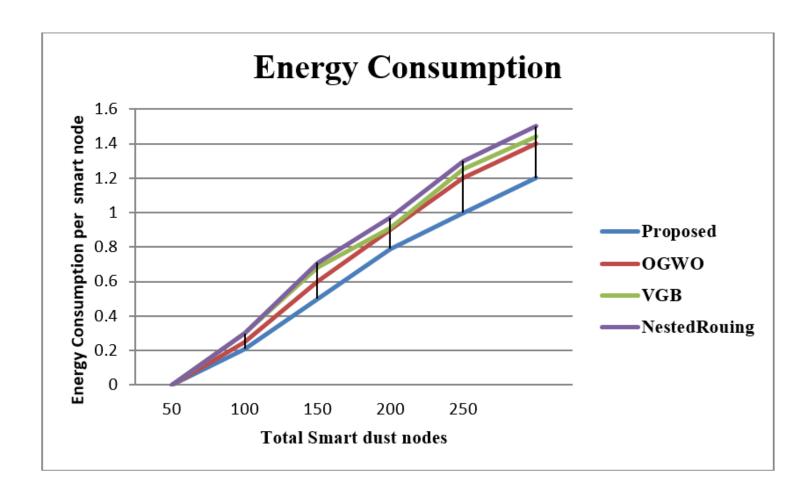


Figure 3

Investigation of avg. energy utilization among smart dust nodes.

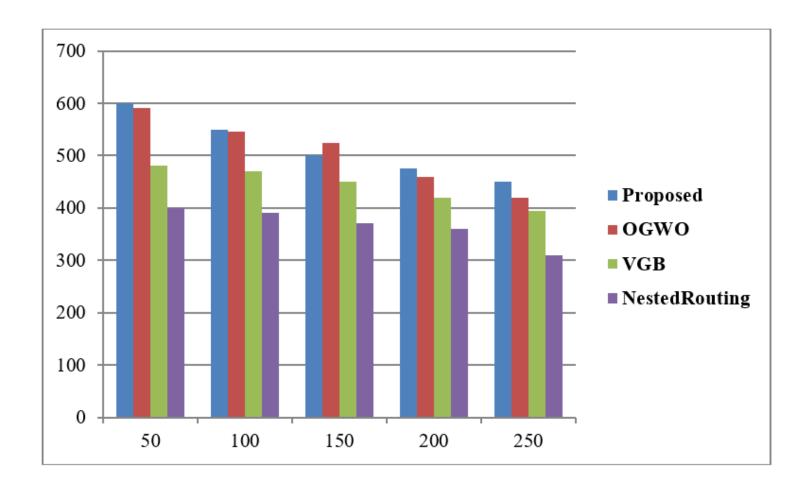


Figure 4Duration of initial smart dust node dies

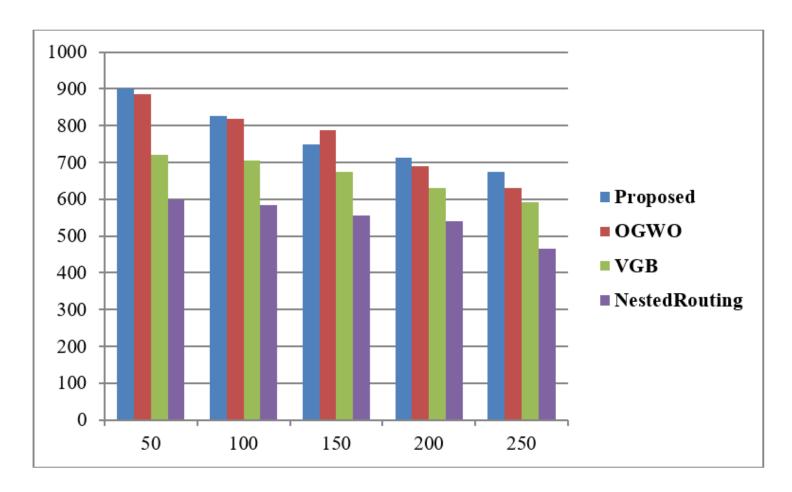


Figure 5
Seventy five percent of smart dust node dies.

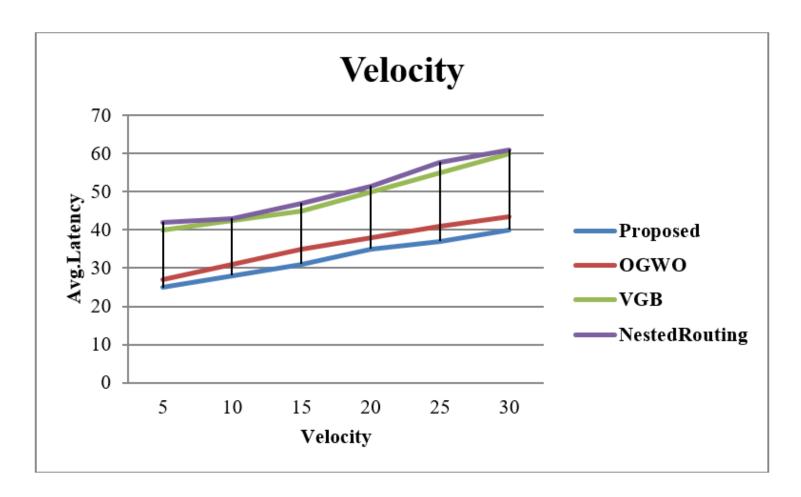


Figure 6Analysis of velocity of BS.

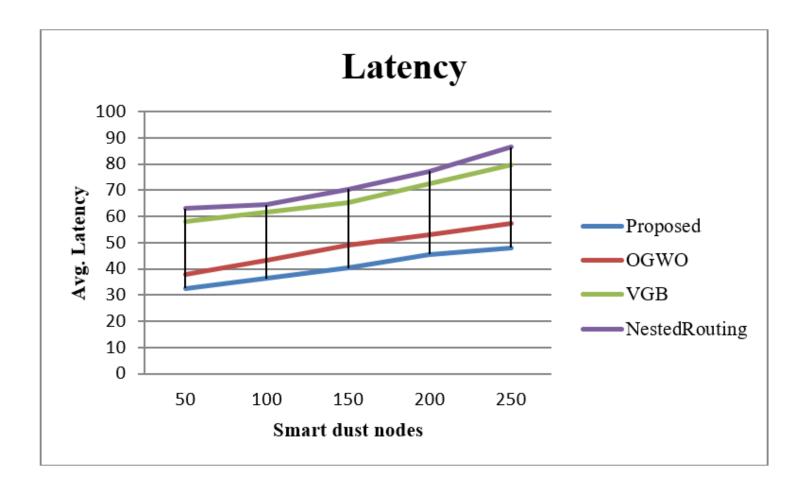


Figure 7Comparison of Latency