How to Cite:
Krishna, N. S., & Kumar, B. S. (2022). Deploying mobile cluster heads in wireless sensor network using heuristic protocol. *International Journal of Health Sciences*, *6*(S7), 5279-5294.
https://doi.org/10.53730/ijhs.v6nS7.13128

Deploying mobile cluster heads in wireless sensor network using heuristic protocol

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***Abstract*---**Exploiting mobile base stations in wireless sensor network increases longevity as it is very effective in dealing with the power hole problem. Mobile sinks are elements used to collect data from network sensors nodes. The movement of the sink eventually changes the sensors of a single hop which will prevent the formation of the hotspot thereby improving the life of the network to a critical level. In this paper we propose the Greedy Heuristic Protocol for Data Collection called GHPDC which selfishly selects energy-rich sites for a mobile channel. Apart from this the paper also proposes the formation of Linear Programming which enhances the station duration which will have a direct impact on prolonging the life of the network. The design of the system line takes into account the residual power of the sensor nodes to determine the amount of time for the base station to halt.

***Keywords*---**Wireless sensor network, Linear programming formulation, Optimization model Mobile base station, Greedy heuristic protocol,NetworkLifetime,LPP.

Introduction

The distribution of mobile entities to the wireless sensor network has been well documented in various recent research projects. Mobile entities such as mobile sinks, mobile group heads, cell channels and mobile sensor nodes are also used to reduce the formation of a hotspot between single hop sensors that will have a direct impact on network life [1]. Changing one hop hose regularly will reduce premature death of nerve nodes which will extend the life of the network

Manuscript submitted: 9 May 2022, Manuscript revised: 18 July 2022, Accepted for publication: 27 August 2022

significantly. This paper is about improving the entire life of the network using a number of cellular network heads and a basic cellular channel. The paper suggests an algorithm that will place multiple mobile heads in appropriate network locations at the right time. Due to the heavy load one of the major developments in the Wireless Sensor Network is the use of mobile operators in a variety of applications that have a significant impact on the overall life of the network. This paper discusses improving the lifetime of the Wireless Nerve Network (WSN) through the use of many mobile sinks. We have developed a new algorithm by considering mobile sinks to navigate the pre-determined path. WSN usually combines a large number of powerful sensory and tracking nodes. Since mobility provides, great rewards nodes are often merged to perform a task [3]. In assembling nodes near the sink or cluster head it usually uses more energy than those farther away from the sink. This is because in addition to transmitting their packets, they transmit packets on behalf of other remote sensors. As a result, the sensors near the sink will discharge their energy resources first, leading to holes in the WSN. This will shorten the life of the network. Another way to improve network life is to make the sink run. Many algorithms have also been suggested using multiple cellular sinks to improve overall quality of life. In this paper we have tried to improve the life of the network by looking at more mobile sinks and suggesting a new sink movement algorithm on a pre-determined route. The method we are proposing will undoubtedly improve the life of the network as it attempts to include a large number of sensors that act as hot spots. As the load is well distributed between the sensors there will be no hot spot in the network where the sensors will release their energy soon which will result in the formation of power holes. We also compared our algorithm with existing algorithms.

2Related Works

The use of a couple of sinks to increase the life of the community has attracted many researchers. The cell sinks boom community existence time by way of normally compared to a dry sink phase. In [4] the channel positioning solution space is converted right into a confined set. The proposed paintings [4] revealed that that allows you to attain this (1 −ε), the infinite answer area is transformed into a restricted solution space with the aid of using some optimistic steps (i.e., division of electricity fees by means of the use of geometric sequences.

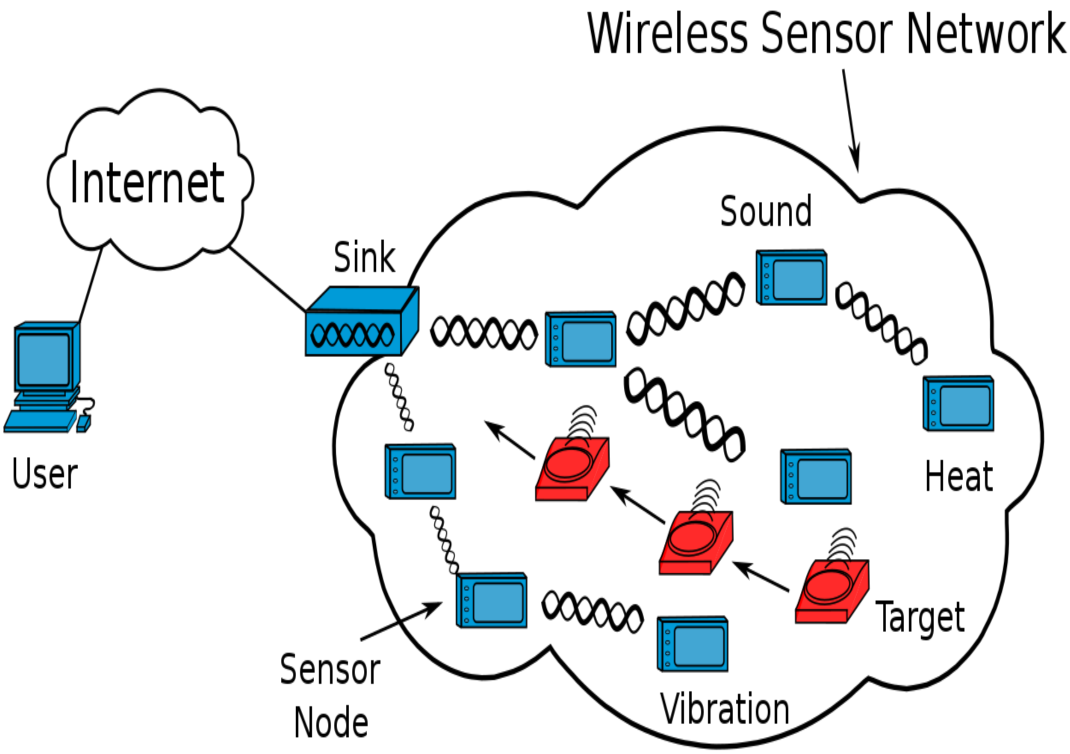

Figure 1 Sensor Network Architecture

The new process was created by the authors to convert the solution space from an endless set to an end and therefore to change the complete line system as clear rather than continuous.

5] has proposed another calculation that decides the following of a versatile channel that follows the visit of a gathering of heads to gather information. The cluster is a bunch of tangible notes to shape groups and a rich area of energy will be chosen as the top of the group. The calculation likewise guarantees that the quantity of jumps on every sensor hub in the group head doesn't surpass two bounces. The top of the assortment is answerable for gathering and putting away the volume heard. At the point when the base station arrives at the one-jump nearness of the aggregate head, the information is communicated to the base station by means of the group head. Disturbance of the proposed action that does exclude defers associated with the essential divert in information assortment.

In [6] the author had stretched out his commitment to the next work which was then examined in [7] and the assortment head region was chosen as the base station meeting point. The proposed calculation for [7] is occasion based information assortment and an essential channel that visits the top of the gathering just while delivering information. Crafted by [8] examines the double-dealing of numerous portable sinks that go in a foreordained manner. The creator partitioned the organization into hexagonal tiles and the sinks were made to match hexagonal tiles for information assortment. The paper utilizes both fixed and adaptable sink time. Adjusting to the circumstance made another Linear Programming Problem which gets a decent standing time for sinks. Recreation tests showed an improvement in network life contrasted with a dry sink segment.

Data collection by compound hop counts is discussed in the works [9,10]. The authors of [Chen et al, 2015] have proposed a new voting-based mobile data collection system called bounded relay hop mobile data collection (BRH-MDG) that has been developed as a performance measure. The lower parts of the sensor nodes have been designated as voting points that store local aggregated data and transmit data to the cellular base station as it approaches. Similarly [11] discussed the new Integer Linear Programming (ILP) model for placing multiple basic channels in a network. Candidates for base channel placement are obtained by ILP model. In addition to providing the construction of an ILP for the placement of many basic channels, the authors also proposed a heuristic protocol in order to find a suitable site for the installation of channel channels. Simulation tests show positive improvements in network life.

Allotment of network space into subcutaneous regions is examined in [12 and 13]. Chen et al has proposed a deep rooted improvement calculation with information move and bounces delays (LOA_DH) in remote sensor-based networks. In LOA_DH, a couple of key boundaries are thought of, and an improvement model is proposed. The creators utilized the Maximum limit way directing calculation to work out the utilization of correspondence power and the hereditary calculation that adjusts people to meet every one of the hindrances used to tackle the effectiveness model. The proposed calculation demonstrates the ideal sink overall setting that will broaden the existence of the sensor organization. Test results show that the proposed advancement model further develops network life and lessens the typical measure of disposed of hub information and the typical power utilization of hubs

In [13] a delayed strategy RP was proposed in area of a versatile sink. In the proposed technique, the objective region is separated into hexagonal cells whose focuses are viewed as potential RP locales. These potential positions are decreased based on a couple of organization boundaries to choose the base number of RPs to make a defer instrument. Broad reenactment is performed with a proposed calculation to contrast its outcomes and a current calculation utilizing a few exhibition measurements, for example, jump number, network life time and a lot more to demonstrate its viability.

The techniques proposed in [14] are called limited hand-off blend TSP-decrease (BR-CTR). Calculation to diminish limit transmission-TSP visits the gathering point of the nerve associations with decrease the quantity of private places. The BR-CTR process is coordinated with the course change framework, which can additionally lessen the arranged traffic stream successfully. Impersonation results show that the proposed calculation has better execution contrasted with existing single jump and multi-bounce information assortment calculations. The objective of the paper [15] is to diminish the scope of information move sensor hubs through tree structure and multi-bounce thoughts. In view of the place of the versatile sink, the distances between the sensor hubs, and the excess force of every sensor hub, the proposed framework pursues a compelling choice to make a course structure. Power utilization is decreased and life time is stretched out to sensor hubs by estimating network load. The recreation results exhibit the superior presentation of the proposed plot and its capacity to strike a sensible impact on power utilization, lifetime organization, transmission, and high transmission.

The primary objective of the paper [16] is to apply the ideas of tree structure and multihops to lessen the transmission distances of sensor hubs. Choices to make a course structure are made in view of the place of the portable sink, the distances between the hubs of every sensor, and the lingering strength of every sensor hub. Network life is improved by lessening power utilization and adjusting the organization load. The experimental outcomes show the basic presentation of the proposed conspire and its capacity to accomplish ideal execution in power utilization, lifetime organization, working limit, and information move.The work in [17] shows that the impact of hub clog is significant, and this element has not been satisfactorily tended to in many researches

Subsequently, a couple of hop count plans mean a nearby course, regardless of whether they expect to think about course more limited courses. In this manner, the creators of [Jerew et al, 2014] have proposed a clever method for working out bounce counts. They consider the quantity of jump where the organization hubs are designed similarly and the more limited way among source and area is chosen. The examination model is approved by reenactment. The reenactment results show a greatly improved improvement in network execution than some other standard framework. All past examination exercises center around further developing organization wellbeing and execution by diminishing the power utilization of every hub.

3 Contributions of the Paper

The purpose of the proposed project is to move the primary base station to the network to collect data from cluster heads with movement capabilities using a greedy algorithm. We classify our contributions as follows.

- The process of distribution and head movement for mobile cluster heads in wireless sensor network
.
- Greedy heuristic protocol for mobile channel to collect data from all heads of mobile collections.
- A Linear Programming Formulation for the Mobile cluster heads for optimizing the stopping time.

4. Network Model and Problem Definition

4.1 Network Model

The network model includes a set of randomly used sensor nodes (N) and an 'M' number of basic cellular channels. Sensor nodes are considered static and their job is to monitor the sensory field to meet their needs. Basic channels are thought to be mobile and can be found in different locations carelessly during network operations. A specific "i" sensor is thought to generate data by value and transmit data to the base channel via a multihop connection. The network structure is shown as graph G = (N, E) where N is the set of all sensory nodes representing the graph vertices and E is the set of all endings. An edge will appear between the two X and Y sensors when both are inside their contact area. The nodes near a particular sensory area are called near nodes and should be Ni. The network model is summarized as follows

- The type of network is considered different. The sensory nodes are thought to be immobile and use a faulty connection with the error free model.
- The base station can move freely from one place to another.
- To facilitate the analysis of time taken from one transport station to another is considered invalid.
- Data transfers and responses are considered to be major energy consuming activities without significant losses
- The battery size of the sensor node is not limited but location detects power (i.e., limited battery capacity)
- The sensors connect to the base channel via a multi-hop connection.
- MAC layer that does not conflict with redistribution.
- Each link is reliable enough and able to transmit data.

4.2 Description of the problem

The problem statement is as follows:

Given a Wireless Sensor Network with N-nodes planted randomly in an area that needs constant monitoring: Design an algorithm for setting up a base cell station and building a timely LPP that will reduce power consumption between single hop sensor nodes thereby improving network life.

As mentioned in previous research the sensors working near the sink / cluster head / channel domain will release their power as quickly as without transferring their packets they send packets on behalf of other nodes to the network. As a result, the single hop sensors soon become depleted and their death makes it impossible for other sensors communicate directly with the sink / header / base station. In order to minimize this lack of power between single hops, it is important to move the base channels / collection heads / sinks from one place to another. Switching the retainers replaces the single hop sensors which will reduce the fullness of the single hop sensor and evenly distribute the load between all the hop sensors in the network. Distribute the load between all the sensor nods will be charged for the entire life of the network on a large scale.

In this paper we use the many cellular channels that will be found in energy-rich areas using a greedy heuristic protocol. The protocol identifies a rich energy area where a basic channel can reside. The primary channel resides in a power-rich environment at the right time T. The best time is obtained using the Line Arrangement Problem.

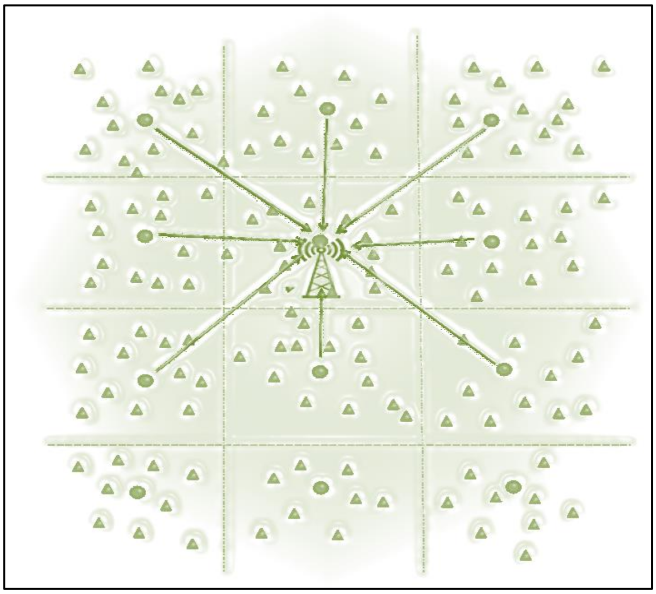

Figure 2 Grid partitioning of network

5. Greedy heuristic protocol for Data Collection (GHPDC)

To start the algorithm, process the following network split is performed

- The network area is divided into square grids the length of each grid is approximately R / 2 where R represents the communication radius of the Cluster head.
- One group header will be placed in the center of each grid.
- If the base station is located near the head of a particular cluster, all cluster heads on nearby grids should be able to communicate directly with the base station. (i.e. 8 cluster heads can send their packages directly to the base station)
- Neighboring grid group heads can convey a message through multihop communication.

This model is shown in Figure 2.At the beginning of each round, the heads of the collection call for a process of merging to form interlocking trees. The residual power of each sensor node is assembled by the cluster head by sending the message SEND_RESIDUAL_ENERGY to the sensor nodes in their cluster. One hop sensor node will send power directly to the group head, while other nodes will transmit through a multi-hop connection. The collection leads after merging the residual energy waiting for a message from the base station. The base station starts collecting its data by asking group heads to send the rest of the energy using the message SEND_GRID_AGGREGATE_ENERGY.

Procedure GHPDC()
Begin
1. Network is divided in to equal size grids
2. One energy rich node in each grid is assigned as Cluster Head;
3. Each cluster head calls Clustering ( ) procedure to form Clusters across the networks
Base station Sojourn( )
End

End

Cluster heads respond by sending a sum of energy to the remainder of their grid. The base station after receiving residual energy from each group head greedily selects a high residual grid to last. The basic channel resides in all the rich powers at the right time "T". The amount of time a channel will stay on a particular grid is determined by the construction of the LPP. When time runs out, the base station moves to the next energy-rich area. After the “x” number the heads of the group re-ask for the residual energy from their grid sensors. The aggregate energy is transferred to the base station which also greedily selects the next rich energy base to remain.The GHPDC algorithm is initiated after an “x” cycle in order to obtain a strong residual resource for the base station to occupy.

```
Procedure Clustering ( )
Begin
   Each sensor initializes My_BS_ID = NULL
andMydist_to_BS = ∞
   BS announces a message incorporating its ID
and says its distance is 1
   BSMESSAGE (ID, BS_Dist =1)
  (Sensor which receives the message can reach
the base station in one hop).
  Each sensor receiving the BSMESSAGE will
do the following
  Begin
      Verified whether Mydist_to_BS is less than BS_Dist
      If true then
       Begin
        My_BS_ID = ID
        Mydist_to_BS = BS_Dist
        Increment the BS_Dist by 1
        Broadcast a new message BSMESSAGE
        (My_BS_ID, BS_Dist)
 End
 Else
        Ignore the message received
End
End
```

```
Base station_Sojourn( )
Begin
1. Cluster Heads sends the  SEND_RESIDUAL_ENERGY message to its cluster
Sensors and aggregates the residual energy of its grid
2.The base station Broadcasts  SEND_GRID_AGGREGATE_ENERGY to all
Clusters heads.
3. Receives the aggregate energy from all cluster heads
4. Greedily picks the energy rich spot to sojourn
5. Sojourns at the location for an optimal time period  "t" as proposed by the
LPP formulation
6. At the expiry of time "t", move to the next energy
rich location
 7. if(number_of _sojourn_position equals "x)
Base station_Sojourn( )
else
GOTO STEP 4;
End
```

6 Optimization Problem

Network life in the GHPDC algorithm is defined as the total duration of the basic cellular network in individual grids. To make the stop time more stable and to extend the life of the network, the formation of the LPP is proposed in the next phase. In the sensor power model the total power used will be the amount of receiving power and transfer power. Required power to transmit, receive and hear beats n are assumed to be those mentioned in [2].The construction of the LPP extends the life of the network by improving the standing time of the mobile channel at each visit point. The LPP takes into account the residual energy of each sensor and evaluates the energy not below the minimum limit. Barriers must be met with sensor nodes in the area where you come from the base station. The base station will stay in place for a good time to maximize network lifetime

Parameters

$\mathbf{t_k}$	Halt time of the base station at a point k
ST	A set containing a set of sojourn points one from each grid
Z	Network Lifetime (in seconds)
$\mathbf{E_{Tr}}$	Transmission energy of a sensor node for the purpose of transmitting one data packet
$\mathbf{E_R}$	Receiving energy of a sensor node for the purpose of transmitting one data packet
Ei	The balance energy with a specific sensor node
$\mathbf{g_i}$	The rate of generated data for a sensor called ni
N	The total number of sensors in the network
M	The sum of base stations deployed in the network
T	The total number of pointsincorporated in the set VC
$\mathbf{g_{ij}}$	The rate of packet data flow from a node ni to another sensor node nj
$\mathbf{N(i)}$	The list of adjacent sensor nodes to another sensor node called i
$\mathbf{E_{min}}$	The minimum energy requirement of a a sensor node

6.Optimization Problem Formulation

The construction of the LPP enhances the life of the network by improving the duration of the base station. Sensor network life time is defined as the total living time of a channel in different locations across a network,

Max Z= $\sum_{i\epsilon ST} t_i$

Subject to

$$\sum_{k\epsilon N(i)} g_{ki} + g_i = \sum_{j\epsilon N(i)} g_{ij} \quad 0 \le i \le N \qquad (1)$$

$$E_i - (E_{Tr} \sum_{j\epsilon N(i)} g_{ij} + E_R \sum_{k\epsilon N(i)} g_{ki}) \ge E_{min}, \qquad (2)$$

$$0 \le i \le N$$

$$t_i \ge 0 \qquad (3)$$

Constraint (1) declares that in any 'i' sensor area, the amount of data packets received from the node k and the amount of packetsproduced by it should be equalized to the amount of packets that are flowing out.

$$\sum_{k\epsilon N(i)} g_{ki} + g_i = \sum_{j\epsilon N(i)} g_{ij} \; 0 \le i \le N \qquad (1)$$

Sub-rule (2) guarantees the minimum demand for residual energy. The power utilized by the sensor for conveying and reception the package must consume energy in such a way that the balance power must remain higher than the minimum power requirement.

$$E_i - (E_{Tr} \sum_{j\epsilon N(i)} g_{ij} + E_R \sum_{k\epsilon N(i)} g_{ki}) \ge E_{min}, 0 \le i \le N \quad (2)$$

Constraint (3) states that the termination time of the base station in a particular residential area should be greater than 0.

$$t_i \ge 0 \qquad (3)$$

7 Simulation Results

The performance of the GHPDC algorithm is simulated with ns2 measurements. The stationary station located at the national network of the network will use additional power between the single hop sensors. This is because single hop sensors without transmitting their data transmit data on behalf

The performance of the GHPDC algorithm is simulated with ns2 measurements. The stationary station located at the national network of the network will use additional power between the single hop sensors. This is because single hop sensors without transmitting their data transmit data on behalf of other sensors in the networks. As a result, the single hop sensors will soon lose their energy leading to their previous death. This makes it impossible for other sensors nodes in other coronas to connect to the base station. Analyzing power consumption can easily be identified by the fact that power is used more in the country network than at the network limits. Similarly, a few papers researched by moving the sink / channel domain near the network boundary. to avoid obstacles in the dry sink area. Moving the base station near the periphery of the network will increase the power consumption of the nerve nodes near the surrounding area. Although this strategy improves network life to a degree, it fails to consider the remaining areas of rich power within the network. A graph of the power consumption of the sink that moves near the periphery of the network is shown in the following image.

In both cases the use of force is performed at a specific location or location or at the edge of a network. Similarly the life span of a network is measured in terms of the number of cycles. Imitation results are shown in Figure 3. The figure shows that the proposed GHPDC algorithm exhibits excellent performance compared to the dry sink model. And the proposed algorithm shows significant improvements in network life compared to the base cellular network. In one case the primary channel is allowed to move near the network boundary and is allowed to collect data. At some point the basic cellular station is allowed to reside in energy-intensive areas of the network where the stop time is not good. In the third phase the base station is allowed to move in accordance with the proposed GHPDC algorithm. The proposed GHPDC algorithm shows significant improvements in network life time compared to the first two phases.

In the above phase the life of the network is measured by the number of rounds the base station is capable of collecting data until the end of the first sensor node is calculated. As an alternative, the lifespan of a network in terms of number of cycles up to the end of 10% of the sensor nodes is analyzed. The second life network graph is shown in Figure 4 where the proposed GHPDC algorithm shows better performance compared to other mobility patterns. Network life is greatly improved in the GHPDC algorithm due to the optimal stationary station time in power-rich environments.

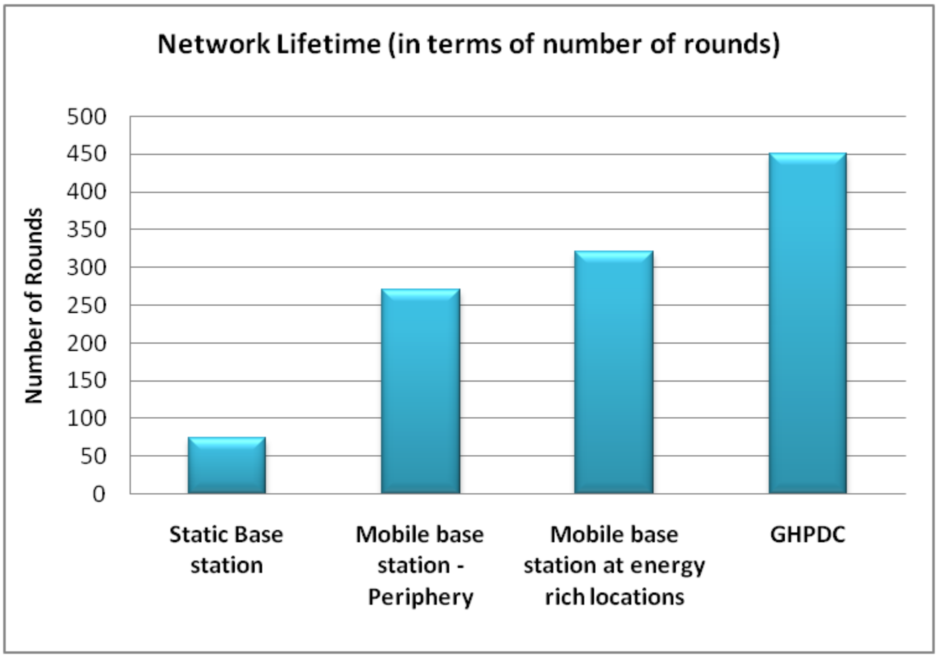

Figure 3Number of rounds before the first node to expire

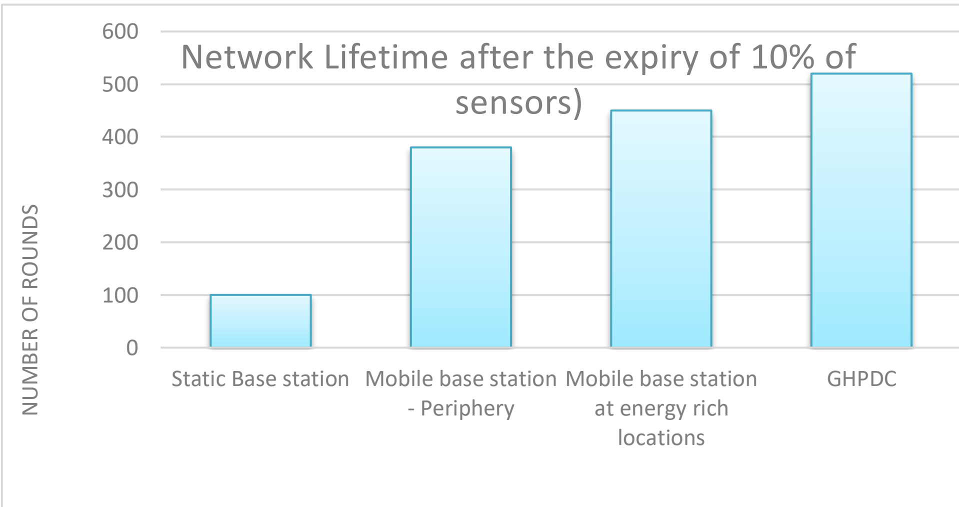

Figure 4Number of rounds after the expiry of 10% of sensor nodes

Optimization of stopping timing has a positive effect on improving the overall life of the network. Similarly, the intermediate power consumption of sensor nodes after a certain number of cycles is also noted. The proposed GHPDC algorithm shows less power consumption compared to other movement models. The power consumption graph is shown in Figure 5. Similarly, the number of live nodes after a certain number of cycles is also marked and shown in Figure 6. It can be seen that the number of active nodes is greater in the proposed GHPDC algorithm than any other. models. Also, the number of dead nodes is also noted and the results are shown in Figure 7. In both cases our proposed GHPDC algorithm shows a good improvement compared to other models.

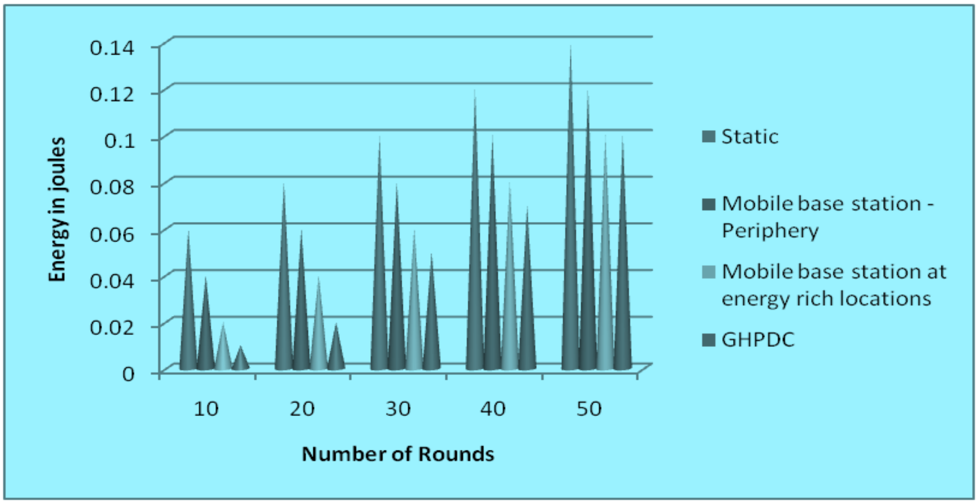

Figure 5 Energy Consumption Graph

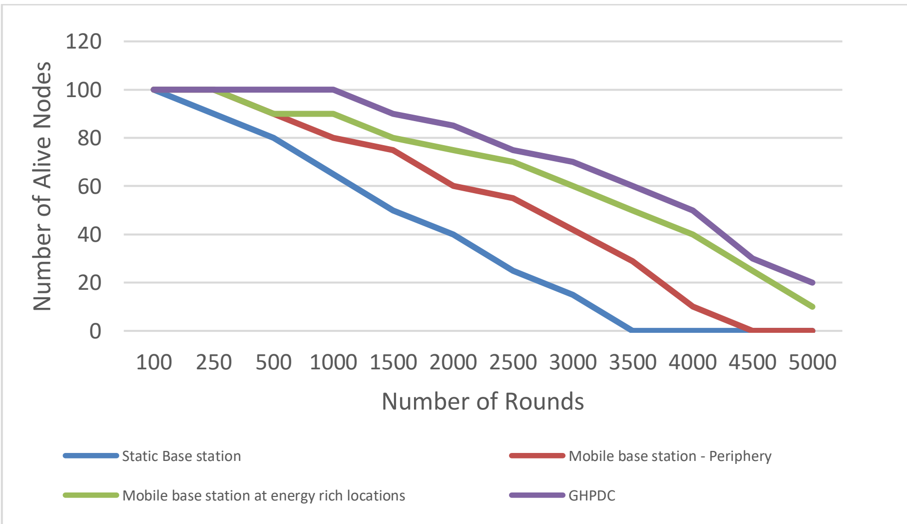

Figure 6 Number of Alive nodes versus Number of rounds

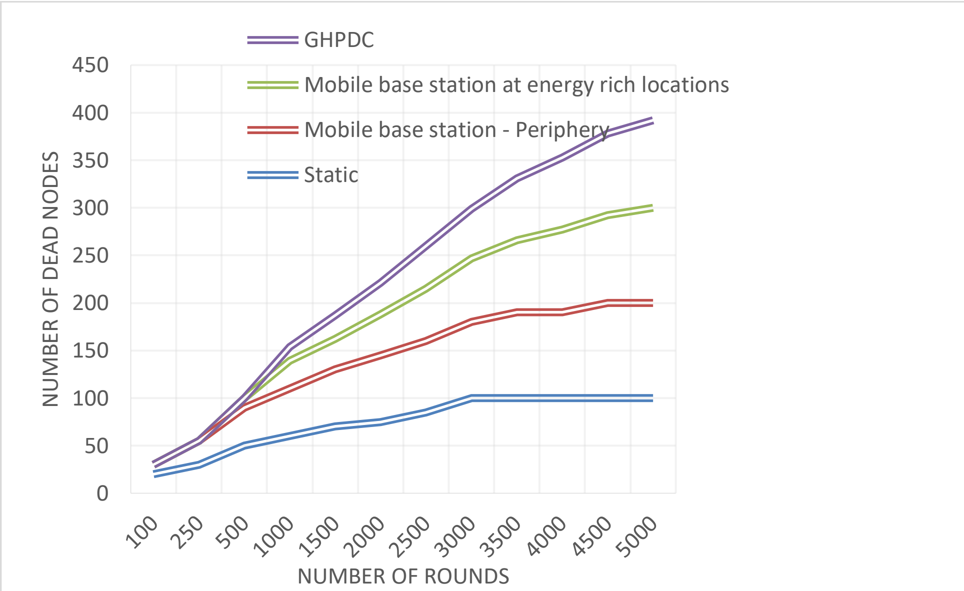

Figure 7Number of Dead nodes versus Number of rounds

Conclusions

The paper proposes a new algorithm called GHPDC that collects data from sensory networks by installing a basic cellular channel. The paper proposes a new algorithm called GHPDC that collects data from sensory networks by installing a basic cellular channel. The algorithm follows a selfish process and selects the richest source of energy for the base channel to occupy. In addition to promoting the novel's idea of setting up a mobile channel in dynamically rich areas, this paper also develops a Linear Programming Formulation that optimizes channel station time. This setting of the stop time is based on the residual sensory energy in the area. Therefore this adjusted stop time will have a direct impact on improving the overall life of the network. Imitation shows a significant improvement in our proposed GHPDC algorithm over other movement models.

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