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Bisection Based Heuristic Technique to Resolve Sink Mobility in WSNs

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Abstract-Sensor nodes of WSN have some degree of source of energy whilst they miles deploy in actual moment surroundings. The whole network depend upon this power to detect an event, collect information from surroundings, data aggregation and talk with base station or else sink to supply the collect statistics. The important challenges are how to increases the network lifetime using less power resource. Paper has shown that nodes close to the sink expend their influence energy faster than the nodes because of heavy operating cost messages from nodes that some distance far away from sink node. Sensors nearly sink are mutual by larger sensors to sink path therefore consume extra energy. The problem is known as hotspot problem, ends in a premature disconnection of the network. Hence Mobile sinks help achieving uniform energy-intake and implicitly offer load-balancing all the way through the network and the "Hotspot" trouble is alleviate. As well, they show of network can be better in terms of lifetime higher coverage and short reply time.

Keywords--- Wireless sensor networks, Sink, Mobility, Networks, Cell.

I. INTRODUCTION

Wireless sensor community is composed of several sensor nodes deployed over a geographical location to collect and process data that can be forwarded to base stations or sinks that may be similarly transferred to the outer global for specific applications via net or satellites. Each sensor node is collected of many sensor devices such as transceiver with inside receiver or associated to an outside of receiver, a microcontroller, an electronic circuit and an energy source, generally a power is a form of energy harvesting. A sensor node using many resource constraints, like some degree of memory, set authority, signal processing, calculation and communiqué abilities; hence it can sense only a little portion of the environment then, a group of sensors collapse by each other can achieve a much bigger task efficiently. Cost and size constriction on sensor nodes result in equivalent limitation on sources like as power, recollection, speed of calculation and communiqué bandwidth. The topologies of WSNs can different by multi hop wireless mesh network to simple star topology.

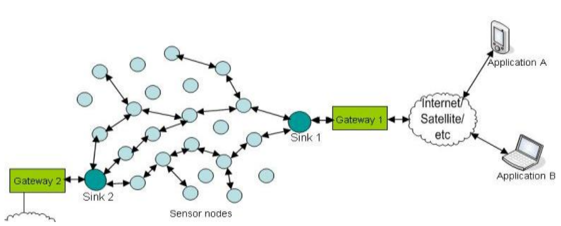


Figure 1: Architecture of WSN.

The following terms are essential for kind in a WSNs..

Sensor Nodes-- Strategy with low processing, memory capacity and limited power supply.

Data Sink-- It has higher capacity than familiar sensor nodes, more dealing out power, unlimited power supply. It joined to the end-user application.

Communication Link-- It is a bidirectional link connecting two sensor nodes that is used for exchanges information. There is a communiqué link between a pair of nodes if they are with in transmission range of each other. The term is sometimes abbreviated as link.

Routing path -- It is a path where packets use to move from supply node to the data sink.

Neighbors ---Two nodes are neighbors of each other if there is a communication link involving the two nodes.

Features

Following features of a WSN

- Energy intake constraint for nodes the use of batteries.
- Dynamic community topology.
- Cross layer layout.
- Maintaince of nodes.
- Variety of nodes.
- Ease of use.

- Self agency.
- Ability to face up to harsh environment conditions.
- Ability to address node failure.

Mobility
In mobile IP that is a mobile agent that called as router that make easy internet traffic forward for a mobile node when its place is changed to someplace other than its residence network**.**

Importance of mobility
The popular reason for which mobility was introduce in WSNs is to decrease the no's of hops required to send data from nodes of sensing to the base station. Then, sinking the delay and delay the network lifetime by reducing the amount of power required to send and accept communication as a result, it can be accomplished that the routing protocol used when introduce mobility to WSNs have great impact on the network performance. According to Reddy, two schemes were consider when study about mobility in WSNs namely, **location management and handoff management.** The former is disturbed with rerouting packets while the other focus on how to use location information of nodes in order to improve the routing protocol because, node mobility affects nodes positions, route to be follow by messages and in order nodes have about their neighborhood.

Mobility In WSNs.
SINK In WSN, ninety% of the entire energy is dedicated for the communiqué concept and it is also proper in WSN that electricity usage through communiqué is proportional to square root of distance among the sensor nodes. So, greater power is fed on when nodes are some distance far from the sink node. In MSWSN sensor nodes are statically installation in the sensory subject to feel the scenario and the sink node pass through the network dynamically to search for the sensors that geared up to send facts and move toward them. The important concept for this sink mobility technique is to transfer the weight of records deals out and energy intake from the sensors to the sink which will make bigger the network lifetime as sink nodes are usually a whole lot more effective in computational power and strength deliver. considering the fact that distance is the principle component to determines electricity usage in facts communication, active moves of sink nodes towards the sensors bring about condensed verbal exchange distances, and less intermediate nodes to ship facts. As a end result, the strength usage tend to be greater similarly allotted inside the community and the "Hotspot" problem is alleviated so that the show of network may be better in terms of lifetime and quality of provider.

Implementation of sink mobility in WSNs.
Sink mobility is a unique case of node mobility. Using sink mobility as a substitute of a static sink, for collect the data generally network performance increases. There are three important parts drawn in in implementing Sink Mobility to WSNs for improving the lifetime of network.

Node movement of Sink-- This element deals with traversal of the all over network area by the sink node as crash to call some areas will potential direct to information loss. Additionally, it is essential to use the energy in an well-organized way when moved the sink node diagonally the deploy area.

Data packets routing-- Researches shown that great quantity of energy consumed during data transmission from antenna to-sensor and antenna-to-sink. As a result an capable to transmitted path cover by the mobile sink will growth the energy consumption in the system and save more energy.

Data gathering-- The major aim of WSN is to collect data from the deployed sensor nodes. So it is of main concern how the sink collects the data capably and without any wait from still sensor nodes even as sink node is stirring. As the sink is moved location of the sink will be changes .As a result sensor nodes can only send the data packages to sink when sink is available in its range.

II. RELEATED WORK

Various researchers told and showed that big scale sensor networks the important challenge for limited data is coming from the that fact sink and other resources does not knowing about the other end that is prior. H. Luo, J. Cheng, S. Lu, and L. Zhang(2005) grid structure in a good way reality is that sensor are stationary and aware to the location that allow to every data to make grid based structure. E. Ben Hamida and G Chelius(2008),According to E.Ben Hamidadescribes vertical nodes that divided the ground of deployment into two the same portion. The nodes of strip are called as in-line nodes. Sensing message are sent to line and destroy from storage of data. A.Erman, A.Dilo, and P. Havinga(2012)told that sensing data was sending towards the nearest border lines then propagates through the centre sink and nodes are in border lines will changes the information and then stored the data. Questioning are forwarded through the centre cell. A.W.Khan, A.H. Abdullah and M. A. Razzaque , J. I. Bangash(2015) tolds that replicates results display compact routes rebuild cost and improved network lifetime of the VGDRA. Thakshila Wimalajeewa, Member IEEE, and Pramod K. Varshney(2017)told that to implement but improving the network life but more latency and high cost.DineshKumar Sah,Tarachand Amgoth(2018)told that It permits data sharing the various non-adjoining layers and compensates the performance and reliability.

III. PROPOSED APPROACH

Motivation

In WSNs, operate the sink mobility reflects is a better method to stability the power of nodes dissipation. The data transmission and mobile sink routing is a challenging task and capable in research field for the resource constrains of sensor nodes suitable to the dynamic network topology. A wide-ranging and capable solution apply to solve many natural troubles related with WSNs collectively with the latest troubles connected with mobile sinks. The sinks expand the active goods of WSNs (node deaths, ad-hoc topology) with various topological changes introduces by the sink mobility.

Proposed Solution

The proposed algorithm is based on bisection technique of the deploy area for cyclic data collection from WSN. It aims to optimize the energy utilization of the nodes then overall communiqué overhead by optimizing the path length for data aggregation. In this algorithm, the deploy area is bisected and each triangular bisected area, centroids are being located to form a ring trajectory covering the whole area.

Terms and Assumptions

Before explaning the method of our proposed scheme, firstly highlight the a variety of assumptions of the sensor networks and terms used in sensor network. We assume the following network characteristics

- There are M sensor nodes randomly distributed in an $L \times L$ sensor field.
- Nodes are at random deploy and whole remain static.
- All nodes are homogeneous structural design & identify its location information by GPS module or specific localization technique.
- The intra-cluster sensed in sequence is extremely inter related, thus data aggregation procedure can be used to combine many inter related signals into only length-fixed packet.
- The communiqué path is symmetric.

There are various terms are essential for understanding the operation of a routing protocol in a WSNs.

- ***Sensor Nodes***-- Tools has low dealing out and recollection capacity, and some degree of power supply.
- ***Data Sink***-- It has superior capacity than general sensor nodes additional processing power and infinite energy supply. It attach to the end-user .
- ***Communication link***-- It is bidirectional link between nodes that is used for exchange in sequence. There is a communiqué link between a pair of nodes if they are in broadcast range of each other.
- ***Neighbour***-- Two nodes are neighbours of each other if they carried communication link between the two nodes.
- ***Hop Count***-- It is the direct distance between a node and a sink, measured in hops. A packet movements two hops if it travels to a node or with another node.
- ***Routing Path***--- It is a path where packets are use to travel from source node to the data sink.
- ***Child and Parent Nodes*** ---- Every sensor node has a vector point to a neighbour node, representative to which neighbour of that data packet is forwarded. The sending node is the child node and the receiver node is the parent node
- ***Descendants---*** The descendant nodes (sometime called downstream nodes) .

Table 1: Notations used in Research

Symbol	***Description***
R_c	communiqué range of each sensor node
L	Side of the deploy area
M	Total number of sensor nodes deployed in the network
N	Optimal number for bisections
Bs	Total number of Bisections
A	Length of side of lower leftmost triangle of the total area after bisection
B	Length of side of lower leftmost triangle of the total area after bisection
C	Length of side of lower leftmost triangle of the total area after bisection
$\angle A$	Opposite angle to side ‘a’
$\angle B$	Opposite angle to side ‘b’
$\angle C$	Opposite angle to side ‘c’
M	Length of median drawn to side ‘a’
R	Radius of circle after n^{th} bisections joining centroids of all the triangles
θ_i	Angular position of i^{th} centroids
r_{CH}	Radius of region around centroid for finding cluster heads in each bisected triangular area

Structure Constructed Virtually

A planned method constructed the virtual ring structure by firstly they bisecting the field of sensor into various equally sized triangular regions and then joining with centroid of every triangular region based on the communiqué radius of field of sensors and the length of the deploy sensored area. The main idea behind that partioning is to balanced distributed the load on part of cell-header nodes that accordingly output in increase the system duration. To calculated the optimal no’s of bisections and the cluster-heads, we planned the various heuristics: Given L the length of deployed area and R_c communication radius of the sensor node, the proposed method partitioned the sensor field into 2^Nuniform triangular regions using Equation 1, where N is the optimal number of bisections that has to be done.

$$2\pi * \frac{2\pi r}{2^{n+1}} \leq R_c (1)$$

Following the network partitioning, they will allots a set of nodes call as cluster. Initial in each bisected triangular region, the closest node to the centroid of triangle is perform as the cluster-head. These nodes uses the information of sensor field's dimension calculate the centroids location of all the triangular region using Equation 2

$$\theta_i = \begin{cases} \frac{360°}{2^{N+1}} \; ; where\ 1 \leq i \leq 4\ for\ N = 1 \\ \frac{360°}{2^{N+2}} + \frac{360°}{2^{N+1}} \; ; where\ 0 \leq i \leq 2^{N+1} - 1\ for\ N \geq 2 \end{cases} \quad (2)$$

That's way to decreases the communiqué cost in the cluster head election, only that nodes took part
in the election whose space to the centroid of the bisected triangular region is
less than a certain threshold as defined in Equation 3.

$$r_{CH} = \frac{1}{10} * \frac{2\pi r}{2^{N+1}} (3)$$

The sets of cluster head node mutually and nodes makes a ring like virtual back structure as shown in figure 2. After the cluster head election and establish adjacencies, communiqué path are setup considered as the mobile sink .

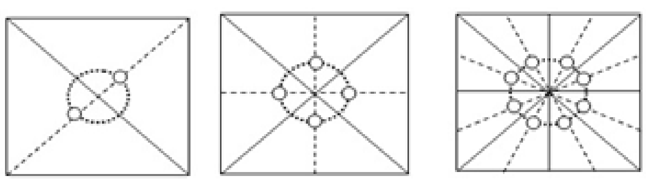


Figure 2: Location of centroids and ring trajectory made by centroids.

Algorithm for virtual structure construction

Input: R_c, L, M
Output: N, r, r_{CH}
Initial condition: k=1

Step1: Parameters of the triangle are defined as

$$a = \frac{l}{2^{k-1}}\ , = \frac{l}{\sqrt{2}}\ , \angle A = \frac{360°}{2^{k+1}} \text{ and } \angle C = 45°$$

Step2: Calculate all other parameters of the triangle using triangle properties and sine triangulation rule.

$$\angle B = 180° - (\angle A + \angle C) \text{ and } c = \frac{b * sinC}{sinB}$$

Step3: Calculate length of median

$$m = \frac{1}{2}\sqrt{2(b^2 + c^2) - a^2}$$

Step4: Calculate radius of circle for k[th] bisection and compare

$$r = \frac{2}{3}m$$

If $2\pi * \frac{2\pi r}{2^{k+1}} \geq R_c$
Increment k by 1 and repeat steps 1 to 4
If $2\pi * \frac{2\pi r}{2^{n+1}} \leq R_c$, then N= k

Step5: Calculate total number of bisections and angular positions of centroids in each bisected area.

Bs= 2^N

$$\theta_i = \begin{cases} \frac{360°}{2^{N+1}} \; ; where\ 1 \leq i \leq 4\ for\ N = 1 \\ \frac{360°}{2^{N+2}} + \frac{360°}{2^{N+1}} \; ; where\ 0 \leq i \leq 2^{N+1} - 1\ for\ N \geq 2 \end{cases}$$

Step6: Calculate radius for finding the cluster head selection in each bisected triangular area

$$r_{CH} = \frac{1}{10} * \frac{2\pi r}{2^{N+1}}$$

IV. MATHEMATICAL FORMULATION

Calculation of Optimal number 'N' to bisect the deployed area

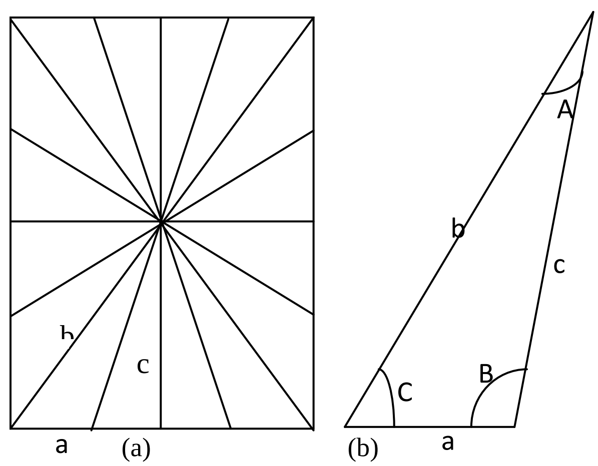


Figure 3: (a) Representation of deployed area bisected for N=3
(b) Representation of lower leftmost bisected triangular area

In our approach, the ring trajectory is formed by joining the centroids of each triangle formed after the bisection of the wireless sensor As the centroids divides the median in a ratio of 2:1. So the radius of the ring trajectory formed will be two third of the length of the median traversed from the point of intersection of the bisections to side as shown in figure above i.e., $r = \frac{2}{3}m$

Given M number of nodes deployed in an area of L*L m^2,
Number of Bisections= 2^N where N≥0
Number of Bisected Area= 2^{N+1} where N ≥0
Number of cluster heads= 2^{N+1} where N ≥0

Dual Path Concept

In a ring topology, there are only two ways to reach from one node to another i.e. Primary and secondary. So each node chooses the path reducing the overall overhead of the remaining nodes and conserving energy. Also, for re-routing there is decision-making between two paths only.

For any two adjacent nodes:

Primary route length= 1

Secondary route length= 2^{N+1} -1

For two extreme nodes:

Max. Path length= 2^{N}

Dynamic Path Modification

Its way to manage with active network topology caused by mobility of sink , that nodes are required to group that delivers the data routes accordingly with the new position of mobile sink. The proposed method defines the set of transmit policy so that only those cluster-heads took part in the routes simplified adjustment procedure that actually needs to manage the path. The transmit rules summarized as follows:

Rule1:-. A start cluster-head number one sink finding to begin with confirm whether or not the after that-hop is previous set to the mobile sink or not however the cell sink become earlier being setup as its next-hop, the main cluster-head does no longer transmit sink's region replace.

Rule2:- A begin group head creature one-hop as of the mobile sink set the mobile sink as its next-hop and distribute the knowledge with the previous originate the head of cluster and its descendents cluster-head.

Rule3:- The preliminary originate cluster-head gets the sink and updated the region from the prevailing originate cluster head, it adjusts the path of records transport with the aid of adjusting the modern originate cluster-head as its next-hop toward the sink.

Rule4*:-*The downstream node cluster-head gets sink location updation it assessments wherein the sender cluster head is same as its preceding next-hop or unique. If it is equal, the downstream node cluster-head falls the sink's vicinity updation packet and does no longer transmit its more furtherly to the subsequent downstream cells of header.. This procedure is common flip over all the descendents cluster-head regulate their data delivery path toward modern-day area of the cell sink.

Rule5: The downstream node cluster head at the extreme opposite end has choice to send data the and mobile sink either clockwise or anticlockwise to the mobile sink, whereas other nodes choose to send data through primary routes which contain less number of hops to reduce the delay and data aggregation to improve the network lifetime.

V. IMPLEMENTATION AND RESULTS

Simulation Framework

Simulation is done to evaluate the performance of our algorithm in MATLAB. The sensor nodes are deployed randomly over a large area of the network. The performance of the algorithm is based on the metrics- average residual energy of the sensor nodes in the network.

Introduction of MATLAB

MATLAB stands for MATrix LABortary

It is interpreted language and having scientific programming environment.It is good tool for the manipulating of matrices.It has great visualization capabilities.It is easy to learn and simple to use.

Key Features

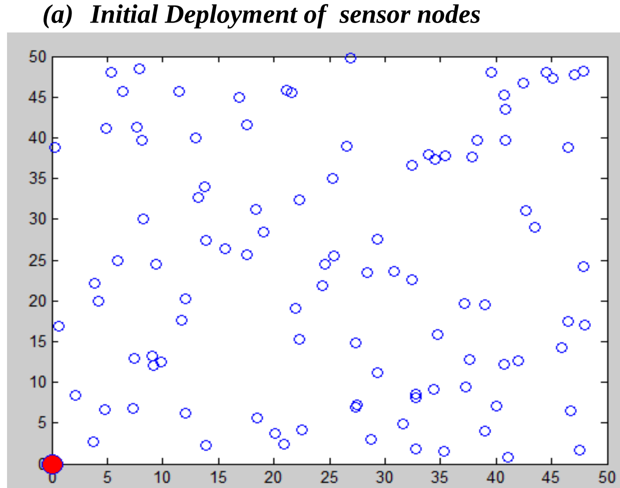
- High-levellanguage for mathematical calculation and application development.
- Simplification and manipulation of symbols expressions.
- Plotting of analytical functions in 2D and 3D.
- Variable –precision arithmetic.
- Symbolic expression conversion to MATLAB, Simulink, C, Fortan.
- Unit system for specific converting and computing.

Simulation & Results

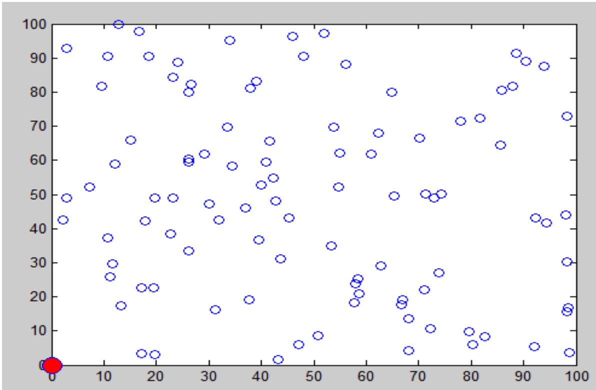
The simulation results using MATLAB. We have various length of the deployed area and communiqué range of the sensor nodes keep other parameters stable where sensor nodes are deploys at random in the sensor field. The mobile sink moving approximately the sensor field anti clockwise and at times broadcast the call packets.

Snapshots

(a) Initial Deployment of sensor nodes



(a)



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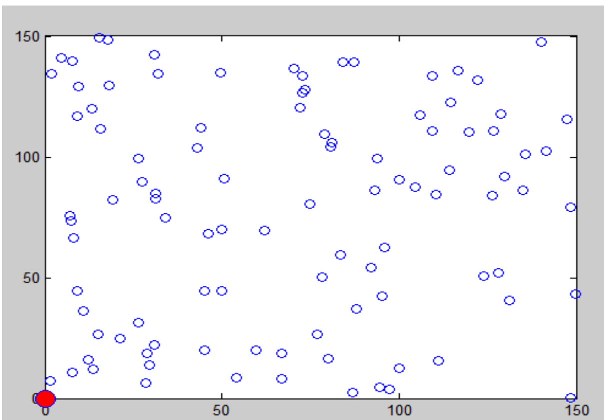
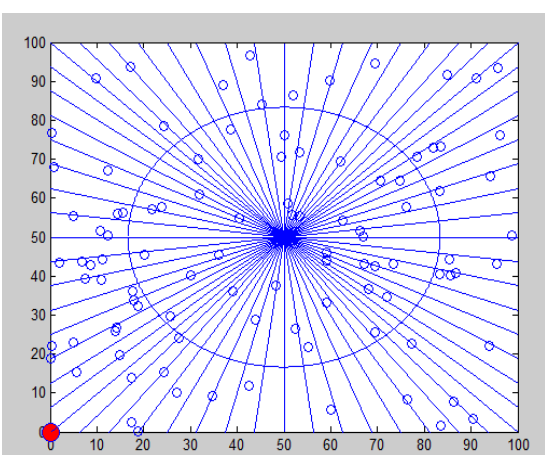


(c)

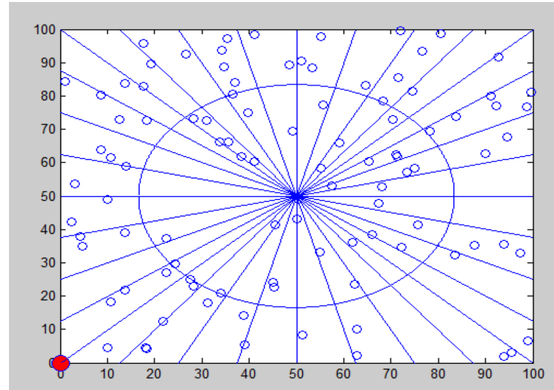
*Figure 4 : Deployment of sensor nodes in (a)50*50 m^2 (b) 100*100 m^2 (c) 150*150 m^2*

Dependency on Communication Radius when length of Deployed Area is kept constant

As per our algorithm when length of the deployed area has been kept constant as 100 units and the communication radii of the sensor nodes is being increased from 50 units to 125 units, then the optimal number of bisections has decreased as shown in figure.



(a)

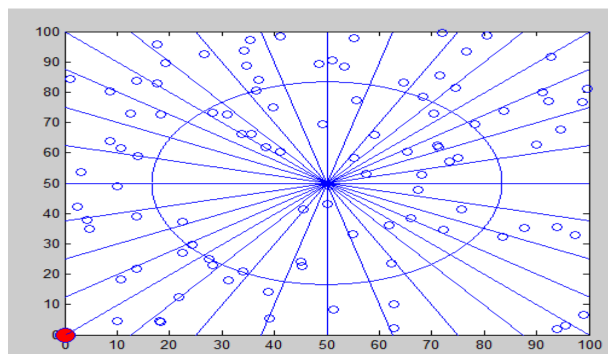


(b)

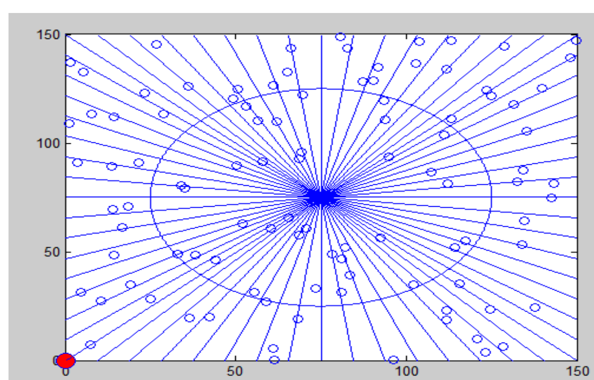
Figure 5 :Ring trajectory when length of deployed area L=100 units and communication radius (a) R_c=50 units (b) R_c=75 units

Dependency on length of deployed area when communiqué radius of sensor node is kept constant

As per our algorithm when the communiqué radius of the sensor nodes has been kept constant as 75 units and length of the deployed area is being increased from 50 units to 150 units, then the optimal number of bisections has increased as shown in figure



(a)



(b)

Figure6 : Ring trajectory when communication radius R_c=75 units and length of deployed area (a) L=100 units (b) L=150 units

Analysis

Results are obtained for random distribution of the nodes over the different network areas and by varying the range of the sensor nodes and number of sensor nodes. Our proposed algorithm is compared with the VGDRA algorithm to assess the effectiveness of the proposed algorithm.

Average energy Consumption per round

Average energy consumption per round shows the part of total energy distributed in every round throughout the network lifetime. Fig. 7 compares the average nodes' energy consumption of the proposed algorithm with the base paper schemes VGDRA for different number of nodes deployed in the fixed area network. where our proposed algorithm number of bisected regions and number of cluster heads are the function of length of deployed area and communiqué radius of the sensor nodes., the nodes within the short distance to the centroids of the bisected triangular area take part in cluster head selection thereby reducing the communication cost. In our proposed algorithm, as the cluster heads are in the communication radius of each other so further energy consumption decreases due to direct communication.

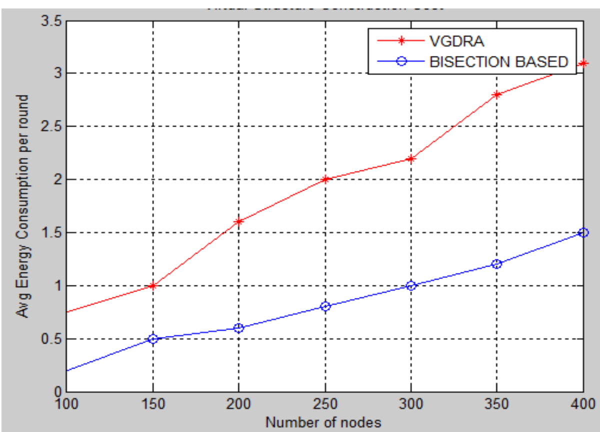


Figure7: Comparing the average energy consumption per round for different no's of nodes

The network lifetime

The lifetime of community can be anticipated in specific ways. First way can be explained because the time away from in which the nodes will deployment till the preceding node dead due to power strolling falls or other may be explained as the time gone. In our experiments, we predicted the network lifetime in phrases of the range of rounds of the mobile sink across the sensor subject until the primary and remaining node inside the network dies because of energy depletion. The proposed set of rules and VGDRA approach keep tune of the left at the back of strength of cluster head and mobile header nodes resp. and slowly decide on new header nodes thereby extend the network lifetime. furthermore, as compared to VGDRA, the deliberate scheme incurs less community manage overhead as every cluster head desire among paths i.e. main direction and secondary course. The analysis is finished on the basis of quantity of nodes and area of deployed community and diverse instances are being studied to make a trendy end that the proposed algorithm affords stepped forward community lifetime as compared to VGDRA which offer reason for our technique of bisecting the sensor area into one of a kind nos of triangular area and forming a hoop trajectory.

Case-1 Number of Nodes are fixed and Area of Deployed Network is variable

In this case, network lifetime is estimated by keeping number of nodes fixed as 100 and area of deployed network is varied from 100*100 $unit^2$ to 350*350 $unit^2$. In VGDRA, the grid structure construction depends upon number of nodes deployed which is constant, so grid structure will be same for all cases and as the area increases, distance covered by each node increases and hence energy depletes at a faster rate and hence the time elapsed till first and last node dies decreases and network life time decreases. In our proposed algorithm, as the area of deployed network increases, number of bisection increases so there are more cluster formation which decreases the distance travelled by each node to send data to the cluster head which distributes energy consumption and hence our proposed algorithm provides better network lifetime than VGDRA as shown in figure 8

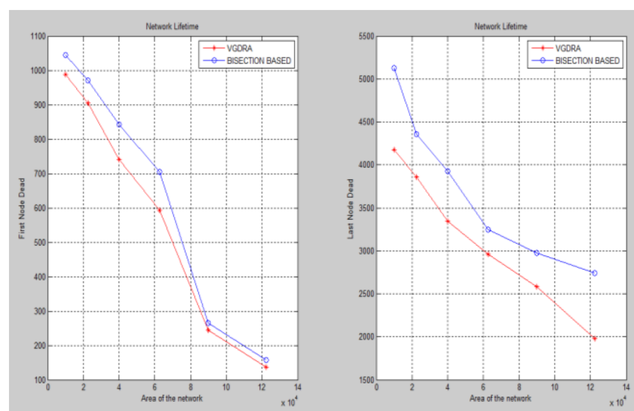


Figure 8: Comparing the network lifetime in terms of number of rounds around the sensor field for different area network keeping number of nodes fixed..

Case-2 No's of Nodes are variable and Area of Deployed Network is fixed

In this case, network lifetime is estimated by keeping area of deployed network is fixed at 200*200 and number of nodes are varied from 100 to 350. As no.s of nodes increase, the network lifetime improves for the same area as more nodes are available per unit area for cluster head selection to maintain the uniformity of energy consumption. In VGDRA, the grid structure construction based on the no's of nodes deployement so the number of nodes increases the grid structure changes hence the path length for the data packets to be delivered also increases. In our proposed algorithm, bisection are independent of number of nodes so the path length remains same for the variation in number of nodes hence less energy is consumed in the communication process and hence provide improved network lifetime the VGDRA as shownnfigure9

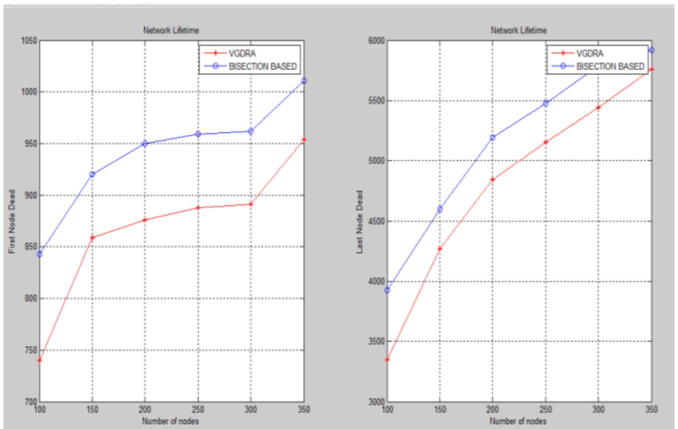


Figure 9: "Comparing the network lifetime in terms of number of rounds around the sensor field for different number of nodes keeping network area fixed".

Case-3 No's of Nodes and Area of Deployed Network both are variable

Case-3a) No's of Nodes and Area of Deployed Network both increases

In this case, network lifetime is estimated by varying both number of nodes and area of deployed network in same manner either increasing or decreasing. The number of nodes are varies from the (100 to 350)and area of the network is varied from(100*100)unit^2 to 350*350 unit^2. In VGDRA, the grid structure construction depends on the no's of nodes deployed so as the number of nodes increases the grid structure changes hence the path length for the data packets to be delivered also increases. Furthermore, if area also increases the inter node communication distance increases hence the lifetime of the network decreases. In our proposed algorithm, as the area of deployed network increases, number of bisection increases so there are more cluster formation which decreases the distance travelled by each node to send data to the cluster head which distributes energy consumption. Furthermore, as number of nodes increases, the nodes per bisected area increases which increases the distribution of energy consumption, hence improves the network lifetime over VGDRA as shown in figure10

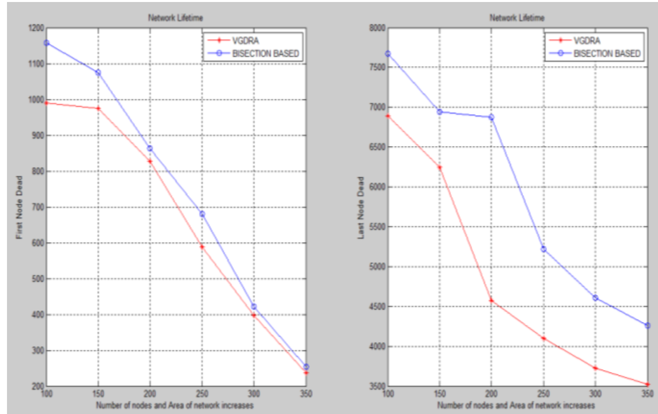


Figure 10: Comparing the network lifetime in terms of number of rounds around the sensor field for increasing both number of nodes and area of deployed network.

Case-3b) No's of Nodes increases and Area of Deployed Network decreases

In this case, network lifetime is probable by unreliable both no's of nodes and area of deploys network in opposite manner i.e. one increasing and other decreasing or vice-versa. The number of nodes are varied to the (100 to 350)then area of the network is varied from (100*100) unit2 to (350*350)unit2. In VGDRA, the grid structure construction based upon number of nodes deployed so as the number of nodes increases the grid structure changes hence the path length for the data packets to be delivered also increases. Furthermore, if area decreases, no's of nodes presented per unit area increase also communication distance decrease which shows lesser consumption of energy and lifetime improves when number of nodes increases and area of network decreases.. In our proposed algorithm, as the area of deployed network decreases, number of bisection decreases. Furthermore, as number of nodes increases, the nodes per bisected area increases which increases the distribution of energy consumption more uniformly, hence improves the network lifetime over VGDRA.

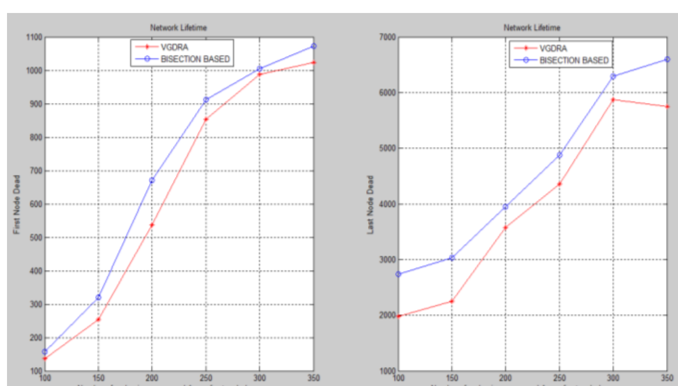


Figure 11 : Comparing the network lifetime in terms of number of rounds around the sensor field for increasing number of nodes and decreasing area of deployed network.

VI. CONCLUSION AND FUTURE WORK

The proposed algorithm incur less communiqué price during maintance to the closest optimal path to the present location of the mobile sink. In this algorithm, mobile sink will regularly collect data by moving around the periphery of the deployed area. Our proposed algorithm division the sensor field into virtual bisected triangular area and construct a ring structure comprise of cluster head nodes located at the centroid zone of the bisected area. The mobile sink moving nearest to the sensor field keeps on change the location and interrelate with the nearest border-line cluster for collection of data. This algorithm use the concept of dual path, to send data from one node to another, there is only two possibilities hence reconstruction can be opted out of these two routes only which decreases the overall communication overhead and hence optimize the path length. It improves the network lifetime by reducing the average path length for any pair of nodes in the ring trajectory to transceive data with the mobile sink moving along the given deployed area boundary. Using the set of communiqué rules, for limited no's of the cluster head tooks part in the path of reconstructing process therefore by reduces the whole communiqué cost. In terms of nodes energy consumption, finally results disclose improved act of our proposed scheme for various network sizes.

Future Work:

Presently, proposed algorithm is only applicable to the square topology of deployed sensor area. It can further be extended for different network structure topologies like rectangular, hexagonal, etc.

It has been assuming that the density of sensor nodes is high enough such that there is always atleast few sensor node in the bisected area and single sensor node in to collect head zone of every partition. Hence, our algorithm is designed for very high density networks.

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