Review of Routing in wireless sensor network using grid topology

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Abstract-
grid in such way that grid that is away from the sink has more number and larger size of sensor nodes. CH is performed in each grid rotation. CH collects data after the formation for next hop data transmission and to its next level neighbor grid. The amount of energy utilization is significantly reduced by this approach and hence the network lifetime is increased. The process involved for the finding of the next hop to enhance the network lifetime, in making the grid and cluster formation can be further contrive. Pathak, et al. [10] proposed weight based clustering algorithm for routing in mobile ad-hoc networks. The cluster formation method is proposed which is based on the node degree and bandwidth and selection of cluster head. In this approach when two clusters come across then they merge and make a single cluster. In this merging process one cluster takes the responsibility of other and other cluster withdraws the role. The proposed approach improves the stability and minimizes the packet loss.

***Keywords*—grid,wsn,optimization**

I. INTRODUCTION

In research world Wireless Sensor Network (WSN) is rapidly growing and now days for research scholar this is an emerging area. In environmental applications like earthquake information, animal tracking, weather information etc. WSNs are used. WSN are also used in business applications, hospitality, Military applications, security, and Military application. With limited storage space, data gathering, integrated sensing and processing ability the WSN is the collection of the tiny sensor nodes equipped. From sensing areas every tiny node has limited battery power which is used to sense the data. For the wireless sensor network the basic requirement is reduce the total energy consumption of the sensor nodes, while sensor nodes have limited battery power with limited lifetime then ultimately increase the survival time of network. During data sensing the battery of sensor nodes cannot be change in the sensor network areas [1, 6]. In various fields from commercial and industrial to military areas WSNs are used. Economically these have ability to communicate, energy, viable, constrained memory and computing power. For computations by energy consumption the lifetime of node and network are directly influenced. With the nodes using hop-distance connectivity comprising of wireless communication links the data is transmitted towards the base station, in an insecure communication medium they communicate and they often operate unattended, where in a secure manner the data need to be sent. In wireless sensor networks basic security services are provided by the pairwise keying process. A low-power domain is typical public-key cryptography, using key encryption algorithm uses cryptanalysis to extract information for the secure transmission. As symmetric or asymmetric the cryptographic algorithms can be classified. In the network the nodes are deterministic; for key distribution and secure communication the network uses clustering technique. Different keys maintain by the all nodes in a cluster, but with the base station every node uses same key for different communications [2, 8]. A wireless sensor network (WSN) has the ability of communicating, sensing and computing and is a group of spatially scattered hundreds or thousands sensor nodes. In physical spaces it embedded; from the environment continuously gather a big amount of data. Thereafter in many domains such as monitoring, scientific investigations, tracking and more WSN is beneficial technology. With a certain topology in an area any WSN incorporate several sinks or single, several or single sources and many sensor nodes are organized. Such as humidity sensor, pressure sensor, sound sensor, temperature sensor, et cetera the sensor nodes can contain different. From the environment that it embedded in When this sensor nodes sense elements, data by using the processing units inside the sensor nodes through the analogue to digital converter module the analogue signal is converted in to digital, after that for processing the data is send to the base station. To the base station Wireless sensor node can communicate directly and also it can communicate with each other.

The following components are contained by the sensor network:

- Collecting Data: during transducers that has the ability of acquisition and sensing.
- Transport Data: during the adhoc/wireless channels.
- Processing: to analyzing the data that has ability.

A. WSN Architecture

There are three main components in WSN: nodes, gateways and software. Spatially distributed measured node's interface with sensors to monitor assets. The collected data transmit to gateway wirelessly, and can operate independently. It is connected to a host system where we can collect data, process, analyze and present our measurement data by using a software. To extend WSN distance and reliability special type of measurement node is used such as router node. WSN is a widely used system because of its low costs and high efficiency [9, 10]. In a typical wireless sensor network (WSN), sensor nodes consist of sensing, communicating, and data processing components. Sensor nodes can be used in numerous industrial, military, and agricultural applications, such as transportation traffic monitoring, environmental monitoring, smart offices, and battlefield surveillance. In these applications, sensors are deployed in an ad-hoc manner and operate autonomously. In these unattended environments, these sensors cannot be easily replaced or recharged, and energy consumption is the most critical problem that must be considered. The sensor is a small device which is used to detect the amount of physical parameters, event occurring, measures the presence of an object and then it converts the electrical signal value according to need it actuates a process using electrical actuators.

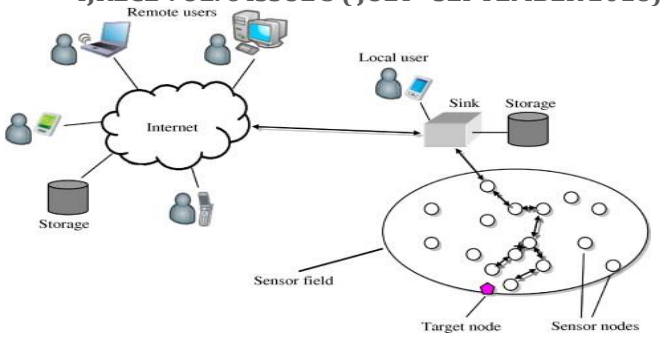

Fig.1 WSN Architecture

B. WSN TOPOLOGY

There are three type of WSN used for communication purpose which is termed as star topology, mesh topology, and tree topology [11]. When every single node is connected with gateway directly this network is termed as star topology and in tree topology every node is connected with a single node which is kept at the top of the tree and termed as tree topology and at last mesh topology, in this connection data transfer4 is done from one node to another node in a radio transmission range. In this this type of connection an intermediate node is required for transmission purpose. There are number of advantages and dis-advantages of these topologies:

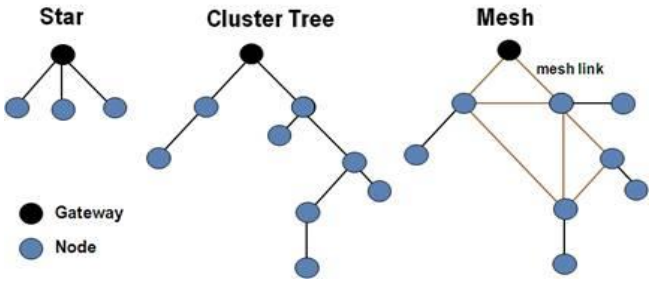

Fig.2 Topologies Networks

C.WSN: DESIGN ISSUES

Following are the main design issues in the WSAN which affects the performance of the system.

- **Network Dynamic**
  Routing of the messages between the nodes in WSAN is more challenging task for the node stability and route stability. Stability factor is an important optimization factor with energy and bandwidth. The event can be static or dynamic it depends on the application.

- **Node Deployment**
  Node deployment in the wireless sensor actor network is deterministic or self-organizing. The nodes and sensors are deployed manually in deterministic approach and predetrministic paths are used for data routing. In self organizing nodes are scattered randomly in ad-hoc manner.

- **Data Fusion**
  The combination of data from different sources using a function such as min, max and average. These functions are done on sensor nodes for data reduction. Achieving the energy-efficient data fusion approach is a major problem for the heterogeneous network [1].

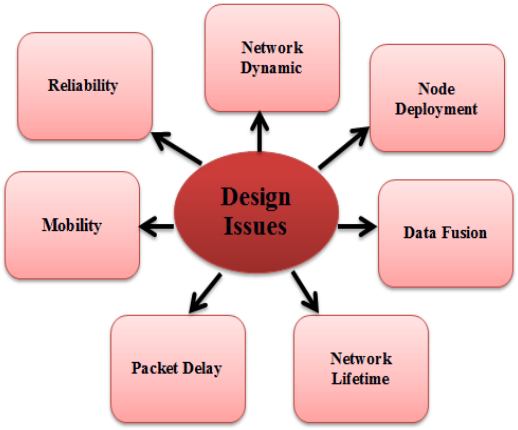

Fig.3 Design Issues of the WSAN

- **Network Lifetime**
  The life time of the WSAN is limited due to the functioning of actor nodes from battery source. Basically the life time is defined as the percentage of dead nodes below thresholds.

- **Packet Delay**
  The actor node's function in WSAN is to act on the sensed data quickly and perform the required operation. It is also a design issue to design the protocols which does not considers any delay in network and nodes gives best response.

- **Reliability**
  The reliability of the nodes is giving the correct response by the actor nodes. Every actor nodes has a predefined time period in which it reconstructs the event, understand its intensity, location and coverage. Sometime the data sensed command may ne lost due to congestion, bad connectivity and bit error.

- **Mobility**
  In WSAN, nodes are used to reduce the delay, complete the task on time and also distributed failure recovery [1].

II. RELATED WORK

The countless number of studies target upon WSN technology resulting in accurate results. The paper presents the analysis of various methods of data-mining established in the recently. Some of the magnificent researches are as follows:

Jannu et.al. [1] for clustering and routing problems in WSNs a distributed grid based algorithm called GFTCRA is presented in this paper. In a distributed way for runtime management of the faulty cluster an efficient mechanism is also presented. In the routing path without creating any loop the routing algorithm is designed in such a way that it can cope up the sudden failure. Than the two fault tolerant clustering algorithms namely GBR and LPGCRA in terms of number of dead sensor nodes, average energy consumption and in term of network lifetime shown through the experimental results. Jiang, Dingde, et al. [2] introduced the multicast routing algorithm with minimum energy consumption in wireless sensor network. In this algorithm network is classified into different number of clusters and after this routing is performed by cooperation among the clusters and reducing the energy consumption. This protocol provides the

Author's Name	Year	Algorithm Used/ Technology Used	Outcomes
Jannu et al.	2014	Energy Efficient Grid Based Clustering And Routing Algorithm	The two fault tolerant clustering algorithms namely GBR and LPGCRA in terms of number of dead sensor nodes, average energy consumption and in term of network lifetime shown through the experimental results.
Jiang, Dingde, et al.	2015	Collaborative Multicast Routing Algorithm	This protocol provides the optimal cross-layer design for getting information from different layer and different nodes. The results show that the proposed algorithm is effective and efficient.
Abdul Waheed Khan et.al.	2015	Virtual Grid Based Approach	A set of the communication rules are proposed that the routes reconstruction process there by requiring only a limited number of nodes to re-adjust their data delivery routes towards the mobile sink.
Lalitha, K., et al.	2017	Clustering And Combinational	The combinational routing is followed when data is sent between cluster head to sink. This approach enhanced the scalability and network lifetime as compared to existing approaches.
Li, Chunlin, et al.	2018	Leach Protocol	In this work the nodes are divided into two types the first that transfers the data by using heterogeneous node and other belong to second kind. The LEACH-C algorithm is used for clustering the common nodes per round. The results of the algorithm provide a stable and prolong network with balanced energy consumption between the nodes.

optimal cross-layer design for getting information from different layer and different nodes. The results show that the proposed algorithm is effective and efficient. Khan et. al. [3] to minimize the routes reconstruction cost of the sensor nodes while maintaining nearly optimal routes to the latest location of the mobile sink a Virtual Grid based Dynamic Routes Adjustment (VGDRA) scheme is proposed in this paper. A set of the communication rules are proposed that the routes reconstruction process there by requiring only a limited number of nodes to re-adjust their data delivery routes towards the mobile sink. Lalitha, K., et al. [4] proposed grid based clustering and combinational routing in the wireless sensor networks. In this work, virtual grid is constructed according the size of transmission range and grid size. The cluster head selection is based on the midpoint of the grid. Data within the grid is forwarded by using localized single path strategy. The combinational routing is followed when data is sent between cluster head to sink. This approach enhanced the scalability and network lifetime as compared to existing approaches. Li, Chunlin, et al. [5] worked on the heterogeneous wireless sensor network and solves the issues related to these networks by applying the routing approach. This type of network are expensive it is necessary to balance the energy consumption between the nodes and maintain the network lifetime. In this algorithm optimal numbers of heterogeneous nodes are computed and select the cluster heads per round. In this work the nodes are divided into two types the first that transfers the data by using heterogeneous node and other belong to second kind. The

Table.1 Inferences Drawn

LEACH-C algorithm is used for clustering the common nodes per round. The results of the algorithm provide a stable and prolong network with balanced energy consumption between the nodes. Logambigai et al. [6] presented the energy efficient routing algorithm in grid based wireless sensor network by using the fuzzy rules. These fuzzy rules are used to preserve the energy on sensor nodes and increase the lifetime of the network. The numbers of hops are reduced by finding the optimal route by using the grid

coordinator. The work is performed on the simulator and performs the routing algorithms and performs effectively and enhances the network lifetime. Manjunath CR et al. [7] two phases are comprised by the key management in this paper: for mutual communication node between the nodes establishing pair wise link keys and for the nodes providing certificates. For symmetric key encryption and for

a common secret key a secure Public key Cryptography based solution is derived. This approach is used for the resource utilization and scalability of WSN. Behind the proposed scheme there is a simple concept, to provide a form of different security the security analysis has proven. In the future work to provide higher security for sensor nodes in massive the certificate can be extending by changing the content in such way. Meng, Xiaoliang, et al. [8] proposed Grid-based Reliable Routing approach for creation of virtual clusters on the square grids. The next hop selection is based on the quality of inter and intra cluster communication quality. The route selection in this approach provides effective channel quality. The results of this approach enhanced the reliability and provide energy efficiency on random nodes of the clusters. Pant et. al. [9] based On EEBCDA a multi-hop routing protocol is proposed in this paper. As on
EEBCDA it divides the sensors network into unequal grid in such way that grid that is away from the sink has more number and larger size of sensor nodes. CH is performed in each grid rotation. CH collects data after the formation for next hop data transmission and to its next level neighbor grid. The amount of energy utilization is significantly reduced by this approach and hence the network lifetime is increased. The process involved for the finding of the next hop to enhance the network lifetime, in making the grid and cluster formation can be further contrive. Pathak, et al. [10] proposed weight based clustering algorithm for routing in mobile ad-hoc networks. The cluster formation method is proposed which is based on the node degree and bandwidth and selection of cluster head. In this approach when two clusters come across then they merge and make a single cluster. In this merging process one cluster takes the responsibility of other and other cluster withdraws the role. The proposed approach improves the stability and minimizes the packet loss. Paul et.al. [11] with limited sources of battery power the sensor nodes are placed at remote places and are equipped, to make the system more energy efficient proper energy efficient routing algorithms as well as clustering protocols are highly needed. In this paper such as energy efficient clustering algorithm has been presented. Here, into small squares of cluster areas the entire are has been divided and for each cluster in each round a separate cluster head has been assigned. In MATLAB 2015 the proposed algorithm has been simulated and through a large number of rounds environment and its performance has been studied.

III. WSN: ALGORITHMS

A. Bacterial Forging Algorithm: Bacterial Forging algorithm is a nature inspired algorithm and based on the behavior of E.coli bacteria. This algorithm provides the multi-optimal function optimization. BFO is based on the chemotaxis behavior of the bacteria. Chemotaxis is basically a process in which bacteria moves by taking small steps in search of nutrients. Following are the steps that follow in BFO.

Chemotaxis: In this process movement of bacteria is performed using swimming and movement of the bacterium represented by

$$\theta^i(p+1,q,r) = \theta^i(p,q,r) + a(i)\frac{\Delta(i)}{\sqrt{\Delta^T(i)\Delta(i)}}$$

Here p, q, r describes the ith bacterium at p chemotactic, q is reproductive, and r is the elimination dispersal. A (i) is size of step taken in random direction Δ is unit length vector.

Swarming: E.coli arranging them in a travelling ring for nutrient gradient.

Reproduction: In this approach least optimal solution is rejected and effective solution is considered.

Elimination and dispersal: Updated and effective solutions are taken and rest is eliminated.

B. PSO

PSO stands for particle swarm optimization**.** PSO is a stochastic optimization algorithm which is based on the behavior of birds. It works similar to the genetic algorithm. In PSO is initialized with a group of random particles. In every iteration, each particle is updated by the two "best" values. The first best solution shows the fitness of the particles and this called as pbest. The second best value is tracked by the optimizer is the best value. This value is called as global best (g best).When a particle takes part of the population as its topological neighbors; the best value is a local best and is called lbest.

IV. INFERENCES DRAWN

Table.1 presents certain inferences drawn from the literature survey carrying an idea or the conclusions drawn from the reasoning and the evidences. A comparison has been done using the different surveys. of inferring things based on what is already known.

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