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Grid Network and Energy Optimal Routing In WSN

Anamika[*1], Ms. Sunita[2], Ms. Neha Goyal[3]
[*1,2,3] PDMCEW College, MDU,Rohtak, India
anamikacool6@gmail.com

Abstract

Wireless sensor networks is collection of small nodes which sensing capability, computation and communications capabilities. Energy awareness is an essential design issue in WSN. Routing protocols in WSNs might differ depending on the application and network architecture. A grid network is a type of computer network having a number of (computer) systems connected in a grid topology. In Grid network, each node is connected with neighboring nodes along one or more dimensions. Grid network, known as a toroidal network when an n-dimensional grid network is connected circularly in more than one dimension. In this paper, We will study about wireless sensor network and design a algorithm using grid network with energy optimal routing. By this, we can make our network more efficient.

Keywords: wireless sensor network ,grid network, flooding algorithm.

Introduction

A type of wireless networking which is worked on number of sensors and they are connected with each other for performing some task for checking and balancing the various factors of environmental . This kind of networking is called Wireless sensor networking. Wireless sensor network is a collection of various sensors which monitor the environment or system by measuring physical parameters[1].In wireless sensor network, a sensor (detector) is a converter that measures a physical quantity and converts it into a signal which can be read by an observer or by an (today mostly electronic) instrument. The sensors have ability to gather the acts of sensing, data processing, and communicating components together[1].

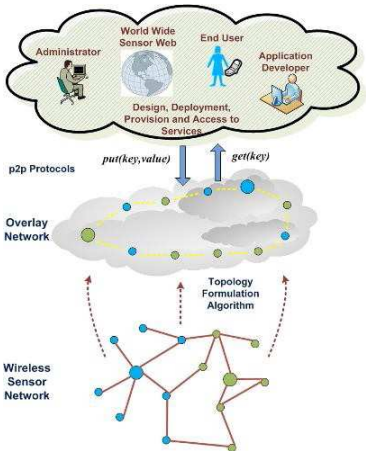


Figure1: Wireless Sensor Network

(A)SENSOR NETWORK CHALLENGES

1.Limited hardware

The amount of hardware resources is used in limit to optimize the maximum output is one of the biggest challenges of sensor networks. Each node in sensor network has limited processing, storage, and communication capabilities, and limited energy supply and bandwidth.

2.Limited Support for networking

Peer-to-peer network is used with mesh topology. Network is dynamic, mobile and equipped with unreliable connectivity. No routing protocols or register has been used. Therefore, node itself acts both as a router and as an application host.

3.Energy consumption without losing accuracy:

In a multi hop WSN each node plays a dual role as data sender and data router. The malfunctioning of some sensor nodes due to power failure can cause significant topological changes and may need rerouting of packets and reorganization of network.

4.Ad-hoc Deployment

In some applications, ad-hoc deployments of sensor nodes are required with respect to some specific area. The sensor nodes are randomly installed without prior knowledge of infrastructure and topology. In such situation, it is the responsibility of sensor nodes to identify its connectivity and distribution among nodes.

5.Fault-Tolerance

A sensor node may fail due to some physical damage or lack of energy. It is up to the communication protocols to lodge these changes in the network.

6.Scalability

Generally Hundreds or thousands of sensor nodes are to be deployed in most of the applications. This is the responsibility of the protocols to scale enough to communicate with such large number of sensor nodes.

7.Quality of Service

In some real time sensor applications as soon as the data is sensed, it must be delivered in certain period of time, before it becomes obsolete. QOS is the major parameter for such applications.

8. **Unattended operation**

Many sensor applications require human intervention only during the time of deployment. If further changes or reconfiguration is needed, this all be done by the nodes themselves.[9]

(B)APPLICATION OF WRIELESS SENSOR NETWORK

1.Industrial applications

Industrial applications are one of the potential areas of WSNs[10]. A project related to container tracking and monitoring started in 2007 at Institute of Computer Technology, Vienna University of Technology. The main idea of the project is to monitor the containers and report the status of containers to the end user in case of unusual events (e.g., acceleration above a certain threshold).

2.Environmental and Habitat Monitoring

Environmental monitoring is considered as the driver application for wireless communication technologies[11]. Environment monitoring comprises chemical and biological sensors monitoring the different hazards to the human society, pre and post earthquake sensors, and tracking wildlife. Durability and lifetime of sensor networks are important challenges in environmental sensing because of possibly harsh environmental conditions and unattended operation, for example, sensor nodes placed in areas where temperature is less than -50 Celsius will require special kind of casing which can resist extremely low temperatures.

3.Home and Building Automation

Institute of Computer Technology at Vienna University of Technology has taken a leading role in the area of home and building automation. Building automation can cut energy cost, and provide comfort and security (surveillance). Lon Works and EIB: Installation Bus system discuss communication and automation principles for buildings. Smart Kitchen and WSSN (Wireless Self-sustaining Sensor Network) project is a step ahead in this direction. WSSN used energy scavenging technique (solar cells) to supply energy to the sensor node and developed their own sensor nodes called Tiny Motes.

4.Automotive

Automotive sensors include comfort sensors within a car. For instance, tire pressure monitoring sensors, air conditioning sensors, and oil sensors. Automotive sensors on roads and highways in combination with in-car sensors can produce good applications including smart parking, congestion or accident detections ahead.

5.Civil Infrastructure Monitoring

Sensor networks are useful in monitoring of building and other civil infrastructure like bridges and roads. Structure Health Monitoring System involves deployment of sensors across the civil infrastructure which is used in infrastructure maintenance. The only way of maintenance of the infrastructure used to be manual inspection of the site followed by recommendations of the site engineer. With WSNs combined with decision support systems, building inspection to find structural problems can be automated.

6.Health Care

Wireless-Vital-Signs- Sensors sensor nodes are capable of collecting heart rate, oxygen saturation, and EKG (electrocardiogram) data and relay it to the sink node which stores the data in the patient's record. Smart Sensors and Integrated Micro-Sensors is a health related project, which entails biological and chemical sensors, radiation sensors, ultra sonic cancer detection, robotic surgery, neurological implants and smart shunts. One group is also working on artificial retina which comprises 100 micro sensors to allow patients with limited vision to see more clearly.

7.Military Applications

Smart Dust project was initiated to provide applications relevant to military. As sensors can be deployed in a large amount very rapidly with self configuring capabilities, sensor networks can play an important role in wars. It may detect the movement or position of the enemy or estimate their presence in a certain area. It may be used for surveillance of a dangerous area without intervention of humans, detection of biological and chemical attacks, and detection of land mines[12].

8.Security Applications

Sensory networks can be used in cases of unauthorized access to the buildings or misuse of facilities provided. Home security system based on sensor networks and a robot is presented in solving environment in early childhood education. The main aim of the project is to explore the middleware and

architectural constraints and requirements driven by such applications.

Previous Work

The key challenge in sensor networks is to maximize the lifetime of sensor nodes due to the fact that it is not feasible to replace the batteries of thousands of sensor nodes. that's why, computational operations of nodes and communication protocols must be made as energy efficient as possible. Among these protocols data transmission protocols have much more importance in terms of energy, Since the energy required for data transmission takes 70 % of the total energy consumption of a wireless sensor network[2]. Area coverage and data aggregation [5] techniques can greatly help conserve the scarce energy resources by eliminating data redundancy and minimizing the number of data transmissions. Therefore, data aggregation methods in sensor networks are extensively investigated in the literature [5], [6], [7] and [8]. In this paper, we are going to discuss a network having nodes connected using grid topology. In grid topology, each node in the network is connected with two neighbors along one or more dimensions. this kind of network is called grid network.

In a WSN environment, where nodes can be created at random in large quantities. The network topology may vary due to sensor failures or energy efficiency decisions, assigning and maintaining hierarchical structures is impractical. The maintenance of routing tables and the memory space required to store them is not affordable for the energy and resource constrained WSNs.

Reactive protocols such as AODV [7] and DSR [8] solve some of these problems but for large networks, they depend on flooding for route discovery. Furthermore, DSR requires the management of large route caches and large packet headers to store the path.[4]

Routing protocols for WSNs should be lightweight in both processing power and memory and should require minimal message overhead. They should be able to route packets based on information exchanged with its neighborhood and should be resilient to node failures and frequent topology changes. For these reasons, routing in sensor networks has focused on tree-based or geography-based protocols .[3]

(A)ROUTING TREE**:**

After gathering data by sensors which sent to the sink, with some aggregation along the path. As the query propagates through network, each node remembers its parent and forward messages/originates. Directed Diffusion is a variant that routes packets along the edges of a DAG rooted at the sink and allows for multipath data delivery. Routing trees are very easy to construct and maintain but this approach is not suitable for more complex applications which require end-to-end communication.

Especially, broadcast-based routing schemes such as AODV, DSR and directed diffusion have a weakness of highly power assumption due to massive broadcast message which cause to deliver duplicated messages. These duplicated messages reduce bandwidth over network which increases the collisions of messages. As a consequence, a series of these events reduce the network lifetime overall. Taking above problems, our aim is find a proper routing method which maintains efficient bandwidth.

We defined characteristics, problems and consumption energy for transceiver in large scale wireless sensor networks . Especially, we know that the broadcasting storm is a severe problem for network's lifetime.

At that time, the amount of consumption energy to broadcast is about:

Etotal = (Erx* the average number of neighbors + Etx)*

N(1) (1)

As equation (1) means, the total energy directly depends on the number of all nodes(*N*) and *the average number of neighbors*. So, the total energy consumed for one broadcast is big so that it can rapidly reduce network's lifetime.

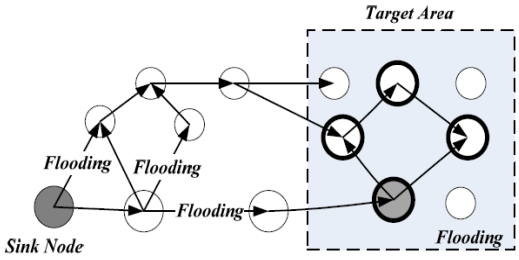


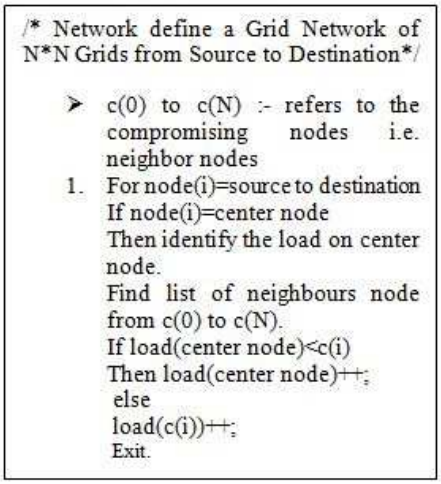
Figure2:Broadcasting with Flooding Scheme

```
if (M is delivered in unicast mode)
if (N is in the target area)
Broadcast M with 2 neighbor nodes
else
Deliver M to next node
end if
else (M is delivered in Broadcast mode)
if (N is in the target area && N is in M's
payload)
Broadcast M with 2 selected neighbor
nodes
else
Drop M
end if
end if
```

Figure3: Flooding Algorithm

Proposed Algorithm

The proposed algorithm we will use for energy optimal routing in wireless sensor network using grid network. In this algorithm we follow the following step:-


/* Network define a Grid Network of N*N Grids from Source to Destination*/

- c(0) to c(N) :- refers to the compromising nodes i.e. neighbor nodes

1. For node(i)=source to destination
   If node(i)=center node
   Then identify the load on center node.
   Find list of neighbours node from c(0) to c(N).
   If load(center node)<c(i)
   Then load(center node)++;
   else
   load(c(i))++;
   Exit.

Figure4: Proposed Algorithm

Future Work

We studied about wireless sensor network and grid network. We discussed various issues in wireless sensor network. We will implement proposed algorithm for solving the main challenge energy efficient network with the help of grid network.

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