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An Overview of Grid-Based Networks and Wireless Sensor Networks

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Abstract

A review of grid-based networks and wireless sensor networks is presented in this publication. A collection of two or more interconnected computer systems is called a network. A collection of specialized transducers connected by a communications infrastructure to monitor and record conditions at various locations is called a wireless sensor network. Temperature, humidity, pressure, wind direction and speed, light and sound intensity, power voltages, pollution levels, and essential bodily functions are among the parameters that are tracked. A computer network with multiple systems connected in a grid topology is called a grid-based network. In order to facilitate real-time sensor data collection and the sharing of computational and storage resources for sensor data processing and administration.

Keywords: *Wireless Sensor Network, Grid Based Network, Routing, Applications.*

1. Introduction

Wireless Sensor Network: Wireless sensor network is one of the most important technologies is used in today world. Wireless network is now available in low cost and consume less power. It is one of the fastest growing field.[3][5]

A sensor network is composed of a large number of sensor node which consist of sensing data processing and communication capabilities. Sensor network protocols and algorithms must possess self-organizing capabilities, where self organizing which means that each sensor node is independent and creates it's on infrastructures according to different situation.

Sensor network transmits only the required and partially processed data. Sensor network have three types:[7][8]

A) Data Centric
B) Hierarchical
C) Location Based

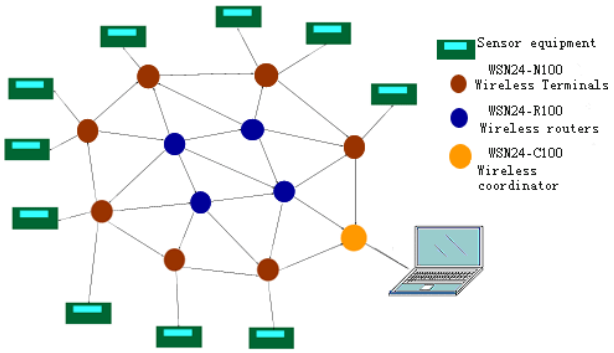

Figure1: Connection between nodes and end terminal by wireless network

Grid Based Network: 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 a regular grid topology, each node in the network is connected with two neighbors along one or more dimensions. If the network is one-dimensional, and the chain of nodes is connected to form a circular loop, the resulting topology is known as a ring. Network systems such as FDDI use two counter-rotating token-passing rings to achieve high reliability and performance. In general, when an *n*-

dimensional grid network is connected circularly in more than one dimension, the resulting network topology is a torus, and the network is called "toroidal".

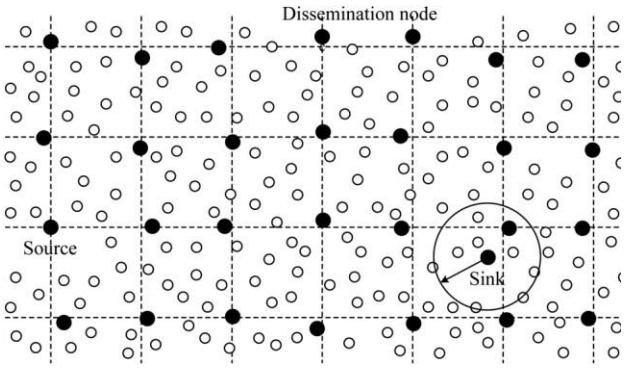

Figure2: Grid Network

2. Challenges in Sensor Network

The challenges we face in designing sensor network systems and applications include:[5]

A) Limited Hardware

Limited amount of hardware resources is used 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.

B) 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.

C) Limited Support for Software Development

The tasks are typically real-time and massively distributed, involve dynamic collaboration among nodes, and must handle multiple competing events. Global properties can be specified only via local instructions. Because of the coupling between applications and system layers, the software architecture must be co-designed with the information processing architecture.

Further wireless sensor network uses a wide variety of applications and to impact these applications in real world environments, we need more efficient protocols and algorithms. Designing a new protocol or algorithm address some challenges which are need to be clearly understood.

D) 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.

E) 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.[5]

3. Application of WSN

Research of sensor network was originally motivated by military application.[1] Current and potential of sensor network includes:-

A) Military Applications: Research of sensor network was originally motivated by military applications. Sensor network widely used in military sensing. WSN can be used for military commands, control, computing, communication, surveillance and targeting. 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.

B) Infrastructure Security: Sensor network can be used for infrastructure security and counterterrorism applications. These sensors provide early detection of possible threats. Improved coverage and detection and a reduced false alarm rate can be achieved by fusing the data from multiple sensors. Sensor networks can also be used to detect biological, chemical, and nuclear attacks.

C) Environment Monitoring and Habitat Monitoring: Environment and habitat is a natural

candidate for applying sensor networks, since the variables to be monitored. 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.[1]

D) Traffic Monitoring: Sensor network have been use of for vehicle traffic monitoring and control for quite a while. The sensor node has a built-in-magnets-resistive sensor that measures changes in the earth's magnetic field caused by the presence or passage of a vehicle in the proximity of the node. Most traffic intersection have either overhead or buried sensor to detect vehicles and control traffic lights . Inexpensive wireless and ad-hoc networks all completely change the landscape of traffic monitoring and control. Cheap sensors with embedded networking capability can be deployed at every road intersection ti detect and count traffic and its speed. The sensor will communicate with neighboring nodes to eventually develop a global traffic picture" which can be queried by human operators.

E) 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.

F) Home and Building Automation: Institute of Computer Technology at Vienn 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. Routing Techniques

In this section, we survey the state-of-the-art routing protocols for WSNs. In general, routing in WSNs can be divided into flat-based routing, hierarchical-based routing, and location-based routing depending on the network structure.[2]

In flat-based routing, all nodes are typically assigned equal roles or functionality. In hierarchical-based routing, however, nodes will play different roles in the network.

In location-based routing, sensor nodes' positions are exploited to route data in the network. A routing protocol is considered adaptive if certain system parameters can be controlled in order to adapt to the current network conditions and available energy levels.

Furthermore, these protocols can be classified into multipath-based, query-based, negotiation-based, QoS-based, or coherent-based routing techniques depending on the protocol operation. In addition to the above, routing protocols can be classified into three categories, namely, proactive, reactive, and hybrid protocols depending on how the source finds a route to the destination. In proactive protocols, all routes are computed before they are really needed, while in reactive protocols, routes are computed on demand. Hybrid protocols use a combination of these two ideas. When sensor nodes are static, it is preferable to have table driven routing protocols rather than using reactive protocols. A significant amount of energy is used in route discovery and setup of reactive protocols. Another class of routing protocols is called the cooperative routing protocols. In cooperative routing, nodes send data to a central node where data can be aggregated and may be subject to further processing, hence reducing route

cost in terms of energy use. Many other protocols rely on timing and position information. We also shed some light on these types of protocols in this paper. In order to streamline this survey, we use a classification according to the network structure and protocol operation (routing criteria). [2]

5. Future Work

We studied about wireless sensor network and grid network. We discussed various issues and routing in wireless sensor network. By the help of this paper we will implement a new approach to improve grid based network using energy optimal routing in wireless sensor network

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