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REVIEW ARICLE

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Review Paper on Network Layer for WSN

Gurpal kaur Dhalio
Student of MCA-III
Department of computer science
Guru Nanak College Budhlada
Jeetgarh, India
Kgurpal1@gmail.com

Abstract:-As we know WSN is an important application such as remote environment target tracking and monitoring which is used for wireless communication , integration of information sensing , small message size and fast computation and as well as WSN more Intelligent because it is used various nodes and sinks which they can communicate with one another to form a network . The main purpose of my survey on WSN with network layer is improved efficiency and effectiveness of previous paper which is related with WSN protocol. The main goal of my survey is present network layer and its standard routing protocol and discuss appropriate routing algorithms , services, responsibility for sensor networking , design issues , performance and also discuss functioning of network layer communication protocol in simple and easy way as well as we provide WSN architecture with its types and application and also discuss two main constraints because resent paper or literature provide network layer protocol in briefly with other protocol such as physical , data link and application layer therefore it become so complex to properly understood specially network layer communication protocol. So this paper especially focuses on N/W layer for WSN.

Keywords:-Wireless sensor network; network layer; design issues; performance; functioning; routing protocol; survey.

1 .INTRODUCTION

WSN stands for wireless sensor network. In this type networking everything done by wireless system . WSN facilitate the development of very smart sensors . these sensor nodes small with limited processing and computing resource and inexpensive compared to traditional sensors.

A wireless sensor network is as follows:→firstly , in this system sensor nodes can sense , measure , gather information from environment and based on some local decision process which is transmit the sensed data to the user.

→ In WSN combined large number of nodes therefore WSN occur in two categories : structured and unstructured . An unstructured WSN contains dense collection of nodes these sensor nodes deployed in ad-hoc manner into the field . But a structured WSN deployed nodes in pre-planned manner and main advantage of structured WSN is that some nodes can be deployed with lower network maintenance and management cost and some nodes can be deployed at specific location for the purpose of coverage but the ad-hoc deployment always in uncovered region.

→ WSN used for wide range of application and wireless communication protocol.

→ Sometime in sensor networking position of sensor nodes need not be engineered or pre-determined.

→ WSN allow densely deployment of nodes.

→ Sensor network protocol and algorithm must process self organizing capability.

→ The topology of sensor network changed very frequently and sensor nodes use broadcast communication mechanism with limited power, computational capacity and memory .

→ The main feature of WSN is cooperative effort of sensor nodes.

→sensor nodes fitted with an on-board processor .

Now we present a figure in which sensor nodes scattered into a sensor field. Sinks are more useful sensor networking for data ommunication between sensor field and end user. Fig.1. shown below :

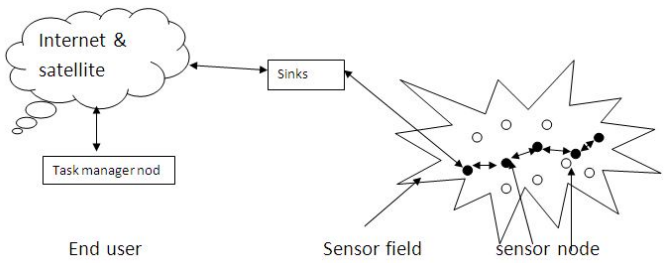

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Fig.1.sensor nodes scattered into sensor field

Unlike traditional networking , a WSN has its own design and resource constraints . Design constraints are application dependent and based on monitoring environment and resource constraints consists short communication range and limited amount of energy processing , storage and low bandwidth in each node .

The remainder of the paper is organized as follows :

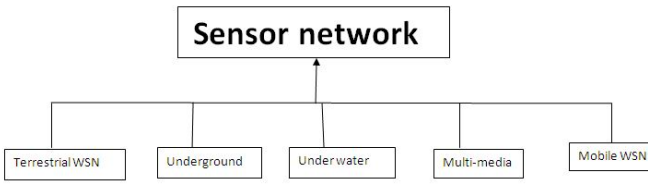
In section 2, we present some important application of sensor network . In section 3, describe five potential types of WSN . In section 4, present architecture of WSN with neat diagram and in section 5, present WSN communication protocol with fully diagram and provide detailed description about network layer and related concepts . In section 6, discuss routing protocol with its proper category . we conclude our paper in section 7.

2. OVERVIEW OF SENSOR APPLICATION

Sensor network application are mainly divided into two categories : monitoring and tracking. In monitoring application consists indoor and outdoor environmental monitoring such as health, wellness , power, inventory location, factory and process monitoring. But in tracking applications consists only tracking objects such as animal, human and vehicles.

3. TYPES OF WSN

In current days WSN deployed mainly on land , underwater and underground but its depend on environment. So WSN distribute into five types shown below in fig .2.



In terrestrial WSN include hundreds to thousands of inexpensive wireless sensor nodes deployed in a given area, both in ad-hoc or in pre-planned manner. This type must be able to reliable communication and effectively communicate data send back to the base station. In underground WSN consists number of sensor nodes in a cave which are used to monitor underground conditions and in this networking additional sink nodes are located above ground for sending information from sensor nodes to the base station. It is expensive and reliable communication through soil, rocks, water and other mineral content. Underwater WSN consists number of sensor nodes but fewer nodes deployed because nodes are more expensive and vehicles deployed under water which is used for exploration and gathering data from sensor nodes. Multi-media WSN enabled for monitoring and tracking of events in the form of audio, video and imaging. It is used low cost sensor nodes and nodes deployed in pre-planned manner. These nodes interconnect with each other over wireless connection for data communication .Mobile sensor networking have collection of nodes that move their own and interacts with physical environment and able to sense, compute and communicate like static nodes.

4. ARCHITECTURE OF WSN

WSN infrastructure helps us for easy to understand all key issues of sensor networking. Sensor network architecture have three main parts such as: first part is system , second part is communication protocol and last part contain all services of WSN. So an effective sensor technology shown below in figure.3.

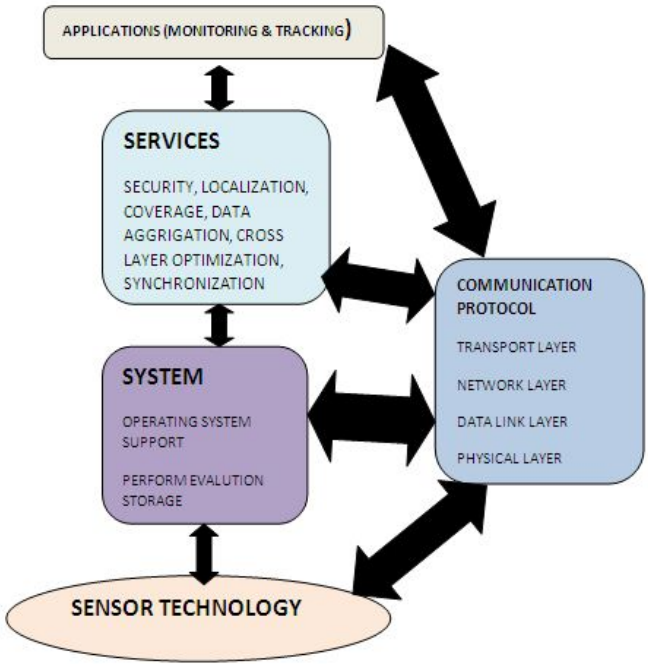


Fig.3. Architecture of Sensor technology

So to see above figure carefully and easily known about every issue of wireless sensor network and fulfill all requirements about wireless networking. Apply sensor network technology to industrial application will improve business processes as well as open up more problems for researchers.

As we know the communication protocol consists of five standard protocol layers known as protocol stack for packet

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switching. The protocol stack used by the sink and all sensor nodes. These stack combines power and routing awareness, integrates data with networking protocol communicate power efficiently through the wireless medium and promotes cooperative efforts of sensor nodes. The protocol stack have application layer, transport layer, network layer, data link layer and physical layer with power management plane, mobility management plane and task manage plane is given below in fig.4.

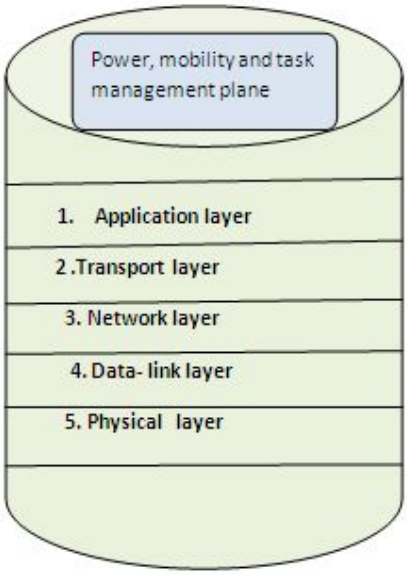

Fig.4. Protocol stack of sensor network

In this survey, we study and research focus that revolves around network protocol layer with routing protocol to meet the specific requirements of the WSN. The power, mobility and task management plane monitors the power, movement and task distribution among the sensor nodes. These planes help the sensor nodes coordinate the sensing task and lower the overall power consumption.

5. NETWORK LAYER

One important function for WSN of the network layer is to provide internetworking with external networks such as other sensor networks, command and control system and the internet. In one scenario the sink node can be used as a gateway to other networks which is shown below in figure 5.In fig.4.network layer is third lowest layer of the protocol stack of sensor network. In sensor networking the network layer is concerned with getting packets from the source machine all the way to the destination machine. To achieve its goals the network layer must know about the topology of the communication subnet and choose appropriate routes and avoid the overloading. All work done through sensor nodes which is scattered in sensor field as shown in fig.1. The network layer of sensor networks is usually designed according to the following principle or responsibilities:

- Routing: This is most defining principle of network layer. Routing means the movement of data across a series of interconnected networks.
- Packet encapsulation: Network layer normally encapsulates data for effective sensor networking.
- Sensor networks are mostly data centric.
- Power efficiency is always important principle.
- Logical addressing function used IP protocol for sensor network and location awareness.
- It is responsible for error handling and diagnostics to WSN.
- In sensor network it is used for fragmentation and reassembling.

5.1. Network layer services/issues

Now we will briefly discuss mainly two services of network layer such as:

- Packetizing: The first duty of the network layer is definitely packetizing means encapsulates the payload in a network layer packet at the source and decapsulating the payload from the network layer packet at the destination.
- Routing and forwarding: This is the second most important issue for sensor networking. As discussed above responsibility routing means data send from source to destination using sinks between sensor nodes. Forwarding means the action applied by each router when a packet arrives at one node to another.
- Error control, flow control, congestion control, quality of service and security some other important issues of wireless sensor network.

5.2. Design issue of network layer

Commonly four types design issue of network layer. such as:

- Service provided to transport layer
- Implementation of connectionless services
- Implementation of connection oriented service
- Virtual circuit and packet subnet

5.3. Performance measurement

Performance of network layer can be measured in terms of delay, throughput and packet

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loss. But congestion control is very important issue that can improve the performance.

6.INTRODUCTION OF ROUTING

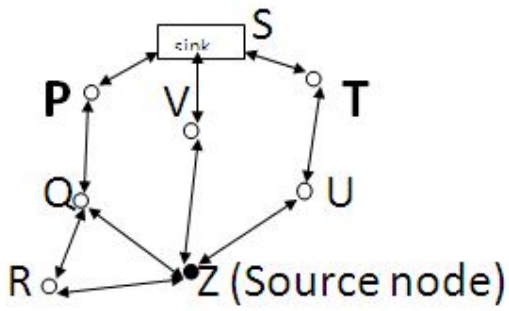
At the network layer, the main purpose is to find ways for energy-efficient route setup and reliable relaying of data from the sensor nodes to the sink so that lifetime of the network is maximized. Rou-

Ting is very important scheme for WSN. Routing in sensor networks has some important challenging

Due to these challenges, many new algorithm and protocol have been proposed for the problem of routing data and these routing mechanisms have considered the characteristics of sensor nodes along with the application and architectural requirements. Since the performance of the routing protocol is closely related to the architectural model or design issue such as network dynamics, node deployment, energy considerations, data delivery models, node capabilities and data aggregation or fusion. So all these design issues or goals have been considered for sensor networks that is depending on various applications.

One of the following approaches can be used to select an energy efficient route. We use fig.5. To present each of these issues, node Z is the source node that senses the phenomena. It has been following 4 possible routes to communicate with the sink such as:

Current protocols	*Description*
Flooding and gossiping	Relay data in sensor network without need of any routing algorithm or topology. broadcast data to all neighbor nodes & gossiping sends data to one randomly selected neighbor
sensor protocols for information via negotiation(SPIN)	Data dissemination protocol & sends data to sensor nodes only if they are interested
Directed diffusion	Sets up gradients for data to flow from source to sink during interest dissemination
Energy-aware routing	Energy- efficient protocol
Rumor routing	Variation of direct diffusion protocol
Gradient-based routing	Changed version of direct diffusion protocol
CADR	Maximize the information gain protocol
COUGAR	Distributed query based protocol



In above figure 5 show network layer with routes communication (sink and source nodes) with four routes such as:

- Route1 :sink-P-Q-Z
- Route2:sink-P-Q-R-Z
- Route3:sink-V-Z
- Route4:sink-T-U-Z

6.1 Routing protocols

Almost all routing protocol can be classified into three categories data-centric, hierarchical and location based although there are few distinct ones based on network flow or quality of service (QOS) awareness shown in fig.6. :

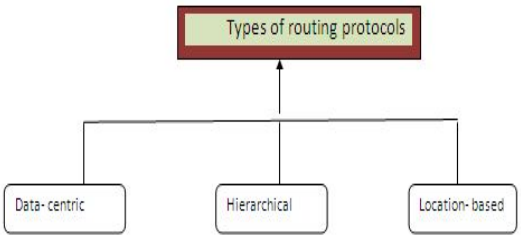


Fig.6. Classify routing protocols

Now we will summarize each routing protocol under the proper category. Our purpose is to help better understanding of the current routing protocol for wireless sensor network.

6.1.1. Data-centric protocols

Data-centric protocols are query based and depend on the naming of desired data which helps in eliminating many redundant transmissions. So in data-centric routing, the sink sends queries to certain regions and waits for data from the sensor located in the selected region. Data centric protocols given in table 1.

Table1. An overview of current research data-centric protocol

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Protocols	Description
ECN & SMECN	MECN Maintain and set up a minimum energy network for WSN and an extension to SMECN
GAF(Geographic adaptive fidelity)	Increase the n/w lifetime as the no. of sensor nodes increase
GEAR(Geographic & energy aware routing)	Through direct diffusion conserve more energy

6.1.2. Hierarchical protocols

The main goal using to these protocols are clustering the nodes so that cluster heads can do some aggregation and reduction of data in order to save energy. Whole working of hierarchical protocols with clusters shown below in fig.7

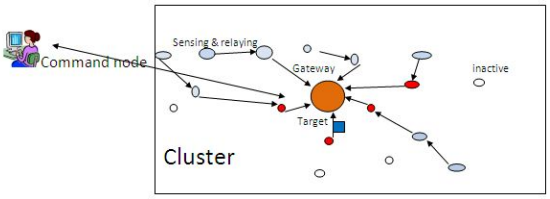


Fig. 7, Shows an example of sensor and routes within cluster for a target-tracking application. Some currently used hierarchical protocols given in table 2.

Table 2 Overview of hierarchical protocols

6.1.3. Location-based protocols

Location based protocol utilize the position or location information to relay the data to the desired regions rather than the whole network. In most cases location information is needed to calculate the distance between two particular nodes so that energy consumption can be estimated. Sensor nodes deployed on a region, location information can be utilize routing data in an energy efficient way. Location based relay region shown below in fig.8

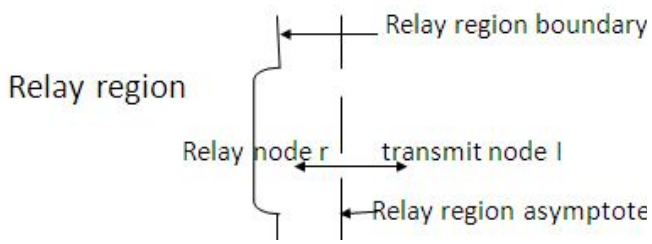


Fig.8. relay region of transmit-node pair (I and r)

In order to stay with the aim of the survey, we limit the scope of coverage to only energy aware location protocols given in table 3.:

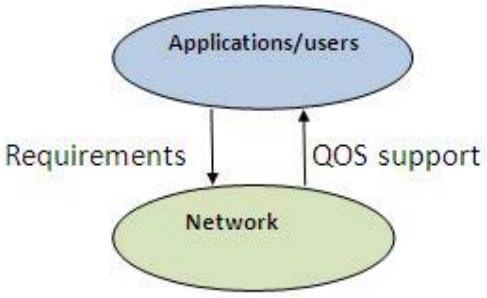
Table3. An overview of location based routing protocols

6.1.4. Network flow and QOS-aware protocols

The last category includes routing approaches that are based on general network-flow modeling and protocols that are strive for meeting some QOS requirements along with the routing function. Quality of services requirements are entirely depend on traditional data network and ad-hoc networking so that it is less use in wireless sensor network compare to first three types of protocols. But although most of the protocols proposed for sensor network fit our classification, but some pursue somewhat different approach such as network-flow and quality of service. In this approaches route setup is modeled and solved as a network flow problem. QOS-aware protocols consider end-to-end delay requirements while setting up paths in a sensor network. A sample QOS model shown below in

Protocols	*Description*
Leach	Forms cluster to minimize dissipation
PEGASIS & hierarchical-PEGASIS	PEGASIS used for improvement of leach protocol and an extension to hierarchical-PEGASIS
TEEN & APTEEN	This protocol responsive to sudden changes in sensed network and an extension to APTTEEN
Energy-aware routing for cluster based WSN	It is based on three-tier architecture and sensor grouped into clusters prior to network operation
Self-organizing protocol	The architecture support heterogeneous sensors

fig.9



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protocols	description
Maximum lifetime energy routing	Main objective is maximize routing lifetime
Maximum lifetime data gathering	Model set up data routes for maximize data gathering power of network
Minimum cost forwarding	Find minimum cost path in a large sensor network
SAR	It is first protocol for sensor network that include notion of QOS in its routing decision
Energy-aware QOS routing protocol	This protocol proposed for finds least cost and energy-efficient path and extend routing approach
SPEED	Provide soft real time end-to-end guarantees toWSN

Table 4 an overview of network flow & QOS protocols

Our work is differing from other survey as follows:

- Firstly, our work is especially focus on WSN, its network layer and current routing protocols.
- Every concept of these three topics describe separately in a simple, short and clear way and language so that understood by everyone.
- WSN discuss with its types, application, constraints and neat architecture.
- Also compare and contrast various current routing protocols and WSN types when does research on network layer for WSN.
- Finally, provide a conclusion of my research topic network layer with its routing protocol.

7. CONCLUSION

In this section we conclude our whole working which done in above six sections. Through or to see above discussion we can say that WSN or sensor network have the flexibility, high tolerance, low cost, high sensing fidelity and rapid deployment main characteristics which helps to create many new and exciting application areas for remote sensing. Although in this research work our specially survey on network layer and its useful routing protocols. Network layer provide internetworking with external network such as other sensor network and it is used energy-efficient routing which is used for maximized network lifetime. Routing protocols in WSNs may be separate depend on the application and network architecture. In this paper summarized data routing in sensor networks and classify the approaches into three main category such as data-centric, hierarchical and location based and also discuss few other traditional network flow and QOS modeling technology. So we sure in the future, this wide range of application and protocol area of WSN will make sensor networks an integral part of our daily life or lives.

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