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A SURVEY:- ROUTING PROTOCOLS CLASSIFICATION IN WIRELESS SENSOR NETWORKS

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Abstract:- *Wireless sensor networks consists of hundreds and thousands number of small minute nodes with sensing, computations and wireless communication capabilities. The sensor node screens the physical and environmental condition, such as temperature, pressure, motion, fire, humidity and many more .wireless sensor network is applicable to many areas like environment & wildlife monitoring, security & military surveillance, healthcare and many more. the limited battery life of sensor nodes in wireless sensor network is a challenging issues.so to increase the energy of sensor nodes routing protocols play a vital role in wsns.in this paper we present a survey of dissimilar routing protocols in WSNs. We first guess the design challenges for routing protocol in WSNs and further discuss different routing protocols.*

Keywords:- *sensor node, WSNs, routing, base station, energy*

INTRODUCTION

wireless sensor network contains a large number of sensor nodes that is used to monitor areas ,collect and report data to the base station .these sensor have the ability to communicate either among each other or directly to an external base station. a greater number of sensors allows for sensing over larger environmental regions with greater accuracy[1]. A base station is a source-rich device having unlimited power, communication and storage capability. It may be a static node or a mobile node based on the applications and scenarios[2]. It can communicate with the sensor nodes, to assemble the data and sends to the user via existing communication system or the Internet.

A WSN is a collection of sensor nodes which are deployed in a sensor fields which collect and route data packets to the Base Station. A sensor node can be scattered into four basic parts, viz. the sensor unit, a processor unit, a transceiver unit, and a power unit [7][8]. Localization is the heart of the routing principle in WSN. The position finding system helps the sensor A node to discover its position in the environment. The power unit gives the constant power supply to the sensor nodes which is the prime objective area of the intruders.

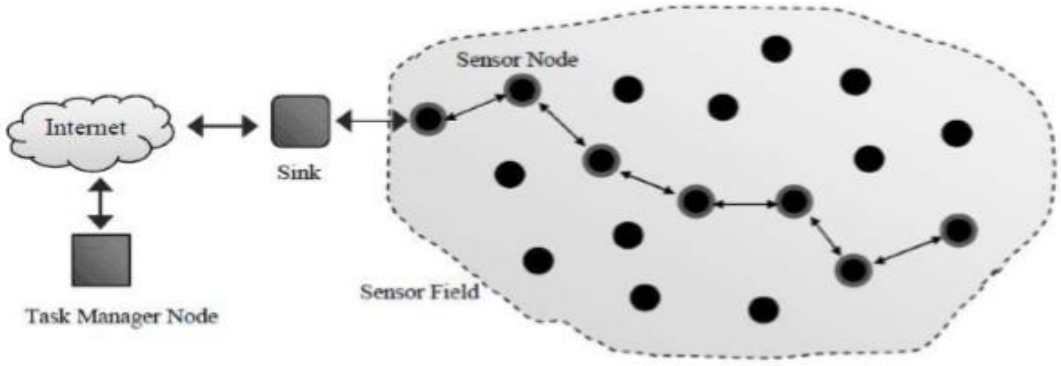

Fig. 1: Architecture of WSN

1.1Wireless sensor network architecture:

In WSNs network architecture involves of four main parts sensor nodes, sink, task manger, and security manager.

Sensor Nodes: These are the heart of the network. They are in-charge of collecting data and route this information back to a sink.

Gateway/Sink: A gateway enable to the communication between the sensor nodes (Field devices).The gateway are also called access points.

Task manager: A task manager is managing the operation, administration, security, and maintenance of all sensor nodes in a network.

Security manager: the security manager is responsible for the security of nodes in a network and management of keys[4].

2. ROUTING IN WSNs

Routing in WSNs is very stimulating due to its inherent characteristics that distinguish these networks from other wireless networks like mobile ad hoc networks or cellular networks[3] .first, due to the moderately large number of sensor nodes.it is not possible to build a global addressing pattern for the deployment of a large number of sensor nodes as the overhead of ID maintains is high thus traditional IP based protocols may not be useful to WSN.

2.1 DESIGN ISSUES AND CHALLENGES FOR ROUTING IN WSN

In the highly dynamic and energy control network, it is a challenging task to develop a routing protocol. The design of the routing protocol can be affected by many characteristics influenced by the WSNs.e.g. .limited energy supply, limited computing power and limited bandwidth of the wireless links connecting sensor nodes[8]. These factors must be astounded before efficient communication can be achieved in WSNs. A few issues and challenges for routing in WSN are discussed below:

Energy Constraint:-
The sensor nodes are battery-powered devices, hence have limited energy. A large amount of energy is consumed during data transmission. Furthermore, a significant amount of energy is consumed during the route discovery and its conservation phase. The lifetime of then network directly depends on the total energy depletion by each node [7].If a sensor node's energy reaches below a certain level, it will become nonfunctional and affects the performance of the network.

Node Deployment:-
The sensor node deployment entirely depends upon applications and affects the performance of the routing protocols. .The deployment can be either deterministic or randomized.in deterministic deployment, the sensors are manually placed and data is routed through pre-determined paths[5]. In the random deployment, the node location is not predefined and generally, thrown from an aircraft in the hostile or unattended area.

Mobile Node Information:-
After the sensor node deployment generally ,the nodes are static. However, in some applications, the nodes are mobile. There should be a proper way to locate those mobile nodes to communicate with the static node. In some applications, the sink is moving within the network for data collection. So the routing protocol should be able to inform the sink location to the nodes within the networks.

Sensor Node Location:-
It is one of the design issues of routing protocol the location of sensor node is required in many applications like monitoring, tracking event detection etc. Most of the suggested protocols assume that the sensors either are fortified with global positioning system (GPS) receivers or use some localization technique [10] to learn about their locations.

Scalability:-
The number of sensor nodes are deployed in sensing area. a routing scheme must be able to work with this large number of nodes .sensor network routing protocols should be accessible enough to respond to events in the environment.

Data Aggregation:-
Data aggregation is the combination of data from different resources according to a certain aggregation functions like, identical suppression, minima maxima and average. Data aggregation technique has been used to attain energy efficiency and data transfer optimization in a number of routing protocols. For this technique signal processing methods are used.

Fault Tolerance:-
Some sensors nodes may be fail or be blocked due to lack of power, physical damage or environmental implication. If number of nodes are failed MAC and routing protocols must accommodate to formation of new links and routes to the data collection base stations.

3. ROUTING PROTOCOLS IN WSNS:-

Routing in wireless sensor networks is different from conventional routing in fixed networks in various ways. There is no infrastructure, wireless links are unreliable, sensor nodes may fail, and routing protocols have to meet strict energy saving requirements[9]. Many routing algorithms were developed for wireless networks in general.in order to streamline this survey we use a classification according to the network structure and protocol operation. This classification is shown in the figure.

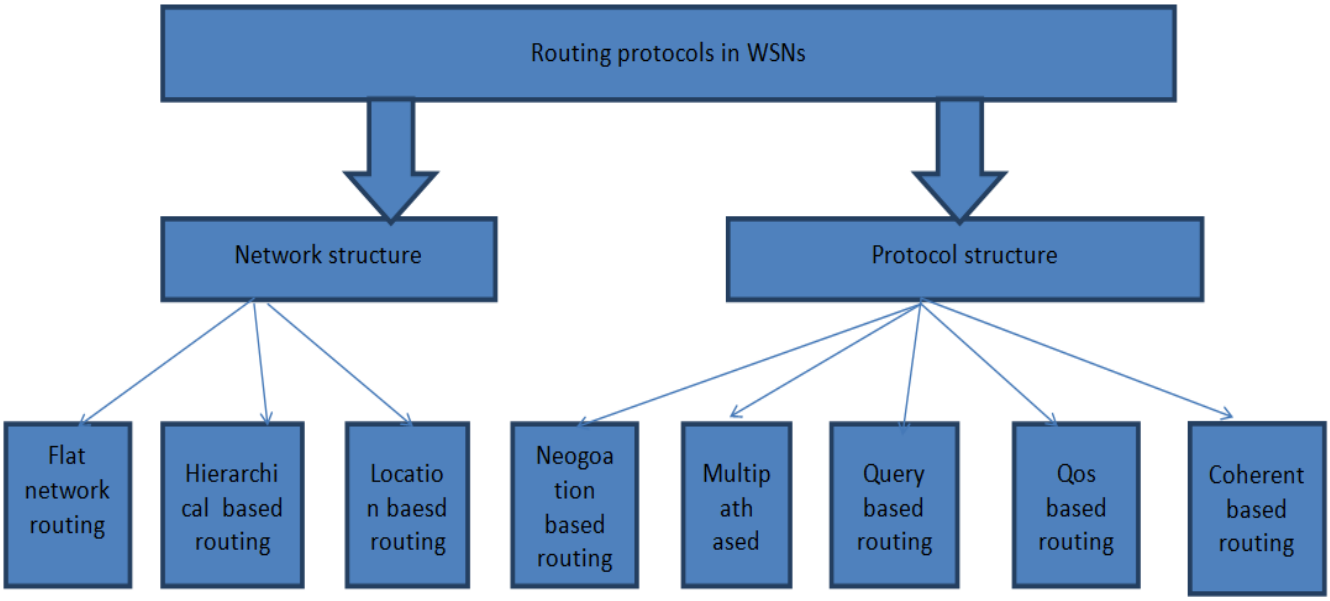

figure no-2
classification of routing

In the rest of this section we present an overview of the main routing paradigm in WSNs. We start with network based protocols.

3.1Flat Routing Protocol:-

In flat networks, every node usually plays a similar role and further collaborate together to perform the sensing task. This state further led to the data centric routing, where the BS sends queries to certain regions and waits for data from the sensors located in the selected regions. spin and directed diffusion are two protocols .

SPIN (Sensor Protocols for Information via Negotiation):
The plan behind SPIN is to name the data using high level descriptors or meta-data. Meta-data are swapped among sensors before transmission via a data advertisement mechanism, which is the key feature of SPIN.
Every node upon receiving new data publicizes it to its neighbors and interested neighbors, means those that don't have the data, retrieve the data or information by sending a request message[5]. SPIN's meta-data negotiation resolves the classic issues of flooding such as redundant information passing, therefore achieves a lot of energy efficiency

Directed Diffusion (DD):
DD is another protocol which is developed after the SPIN. Directed Diffusion aims at diffusing data through sensor nodes by utilizing a naming scheme for the data. DD utilizes attribute-value pairs for the data and also queries the sensors on the demand basis by using those pairs.
In order to make a query, an interest is defined using a list of attribute-value pairs such as objects name, geographical area ,duration, interval, etc. This interest is further broadcast by a sink through its neighbors. Every node which receives this interest can do caching for later use. The nodes also had the flexibility to do in-network data aggregation.

3.2Hierarchical Based Protocols:-
In hierarchical protocols, nodes are grouped into clusters with a cluster head. A cluster head mainly has the responsibility of routing from the cluster to the other cluster heads or to the base stations. Data routes from a lower clustered layer to a higher one. Even though, it hops from one node to another and covers larger distances. This approach moves the data faster to the base station.

Low-energy adaptive clustering hierarchy (LEACH):
LEACH [8] is the most popular energy-efficient hierarchical. Based protocol .LEACH is a cluster-based protocol, which includes scattered cluster formation. LEACH randomly selects a few sensor nodes as cluster heads (CHs) and rotate this role to equally distribute the energy load among the sensors in the network. In LEACH, the cluster head (CH) nodes compress

data arriving from nodes that belong to the respective cluster, and send a collected packet to the base station in order to diminish the amount of information that must be transmitted to the base station.

Power-Efficient Gathering in Sensor Information Systems (PEGASIS):
In [11], an enhancement over LEACH protocol was proposed. The protocol, called Power-Efficient Assembly in Sensor Information Systems (PEGASIS), is a near optimal chain-based protocol. The basic idea of the protocol is that in order to extend network lifetime, nodes need only communicate with their closest neighbors and they take turns in communicating with the base-station.

Threshold-sensitive Energy Efficient Protocols (TEEN):
In TEEN, sensor nodes sense the medium continuously, but the data transmission is done less frequently. Thus, the sensor network design in TEEN is based on a hierarchical grouping where closer nodes form clusters and this process goes on the second level until the BS (sink) is reached. TEEN is useful for applications where the users can control a trade-off between energy efficiency, data accuracy, and response time energetically. TEEN uses a data-centric method with hierarchical approach. Important features of TEEN include its correctness for time critical sensing applications.

APTEEN:-
APTEEN [4] is an improvement to TEEN to overcome its limitations and aims at both capturing periodic data collections (LEACH) and reacting to time-critical events (TEEN). Thus, APTEEN is a mixture clustering-based routing protocol that allows the sensor to send their sensed data periodically and react to any sudden change in the value of the sensed characteristic by reporting the corresponding values to their CHs. APTEEN guarantees lower energy dissipation and a larger number of sensors alive [4].

3.3Location Based Protocol:-
The location based routing protocol uses location information to guide routing discovery, for maintenance as well as for data forwarding. It further enables directional transmission of the information and avoiding information flooding in the whole network[9]. Location information is required in order to calculate the distance between two particular nodes so that energy consumption can be estimated and reduced. Alternatively, the location of nodes may be offered directly by communicating with a satellite, using GPS (Global Positioning System), if nodes are fortified with a small low power GPS receiver.

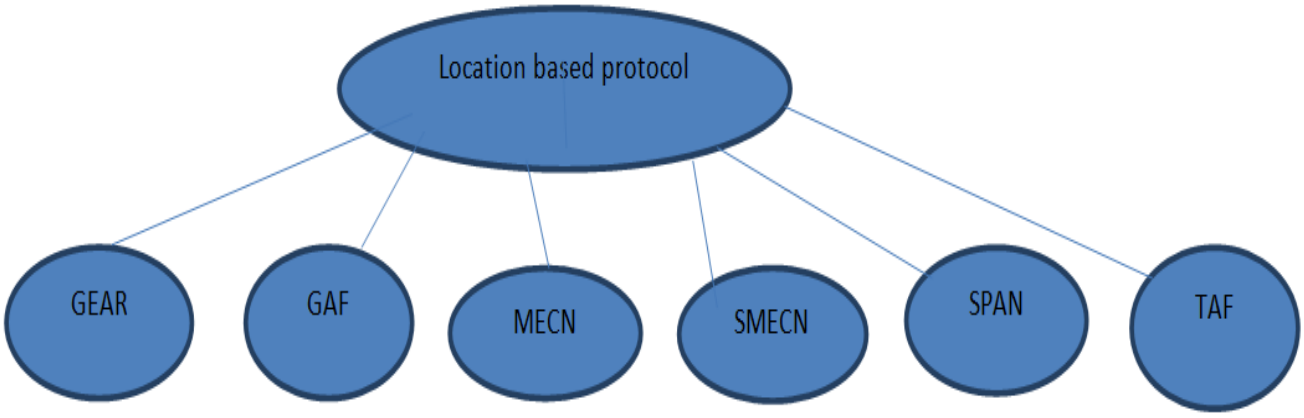

Fig no.3

Geographic Adaptive Fidelity (GAF)
GAF [2] is an energy-responsive location-based routing algorithm designed primarily for mobile ad hoc networks, but may be applicable to sensor networks as well. The network area is first divided into fixed zones and form a simulated grid. Inside each zone, nodes work together with each other to play diff erent roles.

Geographic and Energy Aware Routing (GEAR):-
The protocol, called Geographic and Energy Aware Routing (GEAR), uses energy aware and geographically-informed neighbor selection heuristics to route a packet towards the destination region. The key idea is to curb the number of interests

in directed diffusion by only in view of a certain region rather than sending the interests to the whole network. By doing this, GEAR can conserve more energy than directed diffusion.

SPAN:-
Another position based algorithm called SPAN [3] selects some nodes as coordinators based on their positions. The coordinators form a network backbone that is used to forward messages. A node should become a coordinator if two neighbors of a non-coordinator node cannot reach each other directly or via one or two coordinators (3 hop reachability.

Minimum Energy Communication Network (MECN):
In a protocol is proposed that computes an energy-efficient sub network, namely the minimum energy communication network (MECN) for a certain sensor network by utilizing low power GPS. MECN identifies a relay region for every node.

3.4 Routing Protocol Based On Protocol Operations:

In this classification, we review routing protocols which are further based on the protocol operation.

Routing Protocols Based on Protocol Operations	Main Quality	Examples
Multipath based	Used in single paths, fault tolerance will be increased at the expense of augmented energy consumption	Direct Diffusion.
Query based	Propagate a query for data from a node through the network.	DD and RR protocol.
Negotiation Based	Use high-level data or information descriptors to remove redundant data transmissions through negotiation.	SPIN protocols.
Quality Based	Balances between energy consumption and data quality.	(SAR) and SPEED Protocols
Coherent Based	Forwarded to aggregators after processing like duplicate suppression.	Multiple winner algorithms.
Non Coherent Based	Locally process the raw data before sent to another nodes for further processing.	Single Winner Algorithm (SWE)

Table no.1

4. CONCLUSION

Routing in sensor networks is an emergent areas of research with a limited, but rapidly growing set of research results. The ultimate objective behind the routing protocol design is to keep the sensors operating for as long as possible, thus prolonging the network lifetime.
In this paper we have surveyed a detail description of routing protocols in wireless sensor networks. Generally, the routing techniques are separated into network structure and protocol operation based routing protocols. In network structure, routing protocols are classified into three categories such as Flat based, hierarchical based and location based routing protocols. Furthermore, some protocols are also classified into multipath-based, negotiation-based, query-based, coherent based, QoS-based and non-coherent based routing techniques based on the protocol operation. Although many of these routing techniques look promising, there are still many challenges that need to be solved in the sensor network

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