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Routing and Computing in Wireless Sensor Networks

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Abstract: ***The primary function of wireless sensor networks is to predict and collect the data from the main demesne, process the data and then transmit this data to the destination node. Now, for proper functioning, it requires some energy efficient routing protocols so as to make paths between the source(sensor nodes) and the sink node. The path to be chosen should be in such a way so that the lifetime of the network is greatly increased. But the characteristics of environment within which the sensor nodes operate make the routing and computing problems very complex.***

Keywords: Data communication, nodes, routing, wireless links.

I. INTRODUCTION

Broadly speaking, a WSN can be described as a network of nodes that cooperatively sense and may manipulate the environment thus modifying the interaction between person or computers and the surrounding environment**.** The wireless sensor network (WSN) consists of spatially distributed self-dependent sensors to track on physical or environmental conditions such as temperature, pressure, sound, humidity, wind speed and direction, pollution levels and combining this data and forwarded via multiple hops to a main target location that can use it locally or is connected to other networks through a gateway. WSN is made up of nodes – varying from a few to several hundreds or even thousands, where each node is connected to one or more sensors. Each sensor network node usually comprises of a radio transceiver along with an antenna, a microcontroller, an electronic circuit for computing with the sensors and an energy source, mainly a battery.

A. Characteristics of Wireless sensor networks (WSN)

- Mobility of nodes
- Ability to resist coarse environmental conditions
- Communication failures
- Heterogeneity of nodes
- Self-organization and self-healing
- Power consumption constrains for nodes using batteries
- Scalability with respect to the number of nodes in the network
- Low-complexity, low cost and size of nodes.

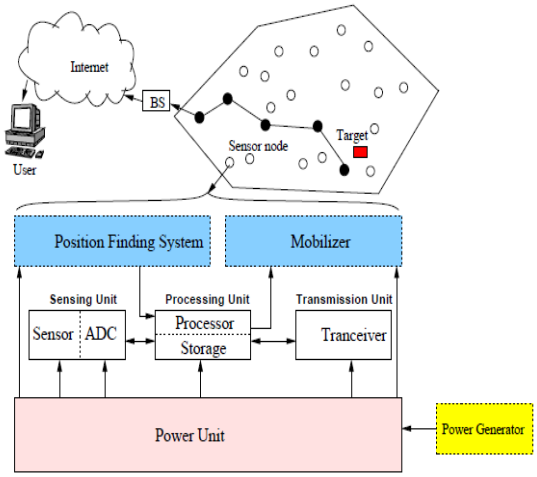

Fig. 1 Components of a sensor node

II. DESIGN CONSEQUENCES AND ROUTING/CONPUTING CHALLENGES IN WSN

The main aim of wireless sensor networks is to carry out data communication while attempting to extend the lifetime of network and prevent connectivity failure by utilizing appropriate energy management techniques. Routing in WSNs is very challenging due to underlying features that differentiate these networks from other wireless networks (mobile ad hoc networks or cellular networks).

- Because of large number of nodes in these networks and the priority of overhead of ID maintenance, a global addressing scheme cannot be established for the formulation of sensor nodes, thus conventional IP based protocols cannot be employed.
- In comparison to other networks, all applications of sensor networks require the flow of sensed data from multiple sources to a particular BS but this does not prevent the flow of data to be in other forms.
- As sensor nodes are tightly stiffened in terms of energy, processing and storage capacities, therefore, they demand careful resource management.
- In most of the applications, nodes in WSNs are generally stationary after deployment as compared to other conventional wireless networks in which nodes are free to move, however resulting in unpredictable and frequent topological changes. But some applications may permit some sensor nodes to move and change their location.
- Since data collection is normally based on the location, therefore, recognization of position of sensor nodes is very important.
- As the data collected by many sensors in WSNs is based on common physical processes, hence there is a high probability that this data has some redundancy.

A. Factors affecting the routing process in WSN

- Node deployment
- Energy consumption without losing accuracy
- Fault tolerance
- Coverage
- Connectivity
- Transmission media
- Data aggregation
- Quality of service

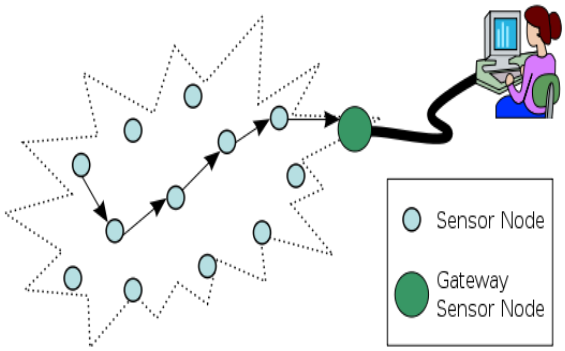

Fig 2. Typical multi-hop wireless sensor network

III. ROUTING STRATEGIES IN WSN

Wireless sensor networks are formed by small devices all of which are communicating over wireless links without any fixed network infrastructure. But because of limited transmission range, communication between any two devices requires cooperation between intermediate forwarding network nodes, i.e. devices act as routers and end systems at the same time. We all know, communication between any two nodes is simply based on flooding the entire network. But for the efficient and effective utilization and performance of such networks, more elaborate routing algorithms are in demand, since energy has to be conserved in low powered devices and wireless communication always leads to increased energy consumption.

The first routing algorithms for wireless networks were topology based routing which was a very traditional approach in which forwarding the decisions were based on information about currently available links between network nodes.

- *Proactive routing strategies:* These strategies keep track on routing information of all the available paths even when these paths are not used but this routing strategy does not perform well when the network topologies are dynamically changing.
- *Reactive routing strategy:* This strategy of routing keeps track of only those routes which are currently in use. But this method may generate a significant amount of traffic when network topology changes frequently due to device mobility or alternating energy conserving sleep cycles.

Routing in wireless sensor networks differs from conventional routing in various ways i.e. there is no infrastructure, wireless links are unreliable, sensor nodes may fail, and routing protocols have to meet strict energy saving requirements. Routing algorithms can be classified as:

- *Topology-based:* Routing algorithms that perform an end-to-end message delivery with host-based addressing
- *Position-based:* If the destination is given by an ID or if destination is a geographic location itself.
- *Data-centric:* Data-centric routing is based on queries that are issued by the sink node to request data. These requests are not addressed to specific sensor nodes, but the sensor nodes that can deliver the requested data will answer the query.

IV. ART OF ROUTING TECHNIQUES FOR WIRELESS SENSOR NETWORKS

Routing protocols for wireless sensor networks are categorized as:

1. Data-centric
2. Hierarchical
3. Location-based

A. Data-centric protocols: In data-centric protocols, the sensor nodes broadcast an service for the available data and wait for a request from an interested sink. Flooding is a simple technique that can be used to broadcast information in wireless sensor networks, however it requires significant resources because each node receiving a message must rebroadcast it, unless a maximum number of hops for the packet are reached, or the destination of the packet is the node itself. Also, flooding is a reactive technique that does not require costly topology maintenance or complex route discovery algorithms. However this technique suffers from various drawbacks: implosion, overlap and resource blindness. Therefore, an improved derivation of flooding called gossiping is used, in which nodes do not broadcast. Instead, they send the incoming packets to a randomly selected neighbor.

There are some other sensor protocols for information via negotiation (SPIN) which can easily overcome the limitations of classic flooding by providing negotiation and resource adaptation. Some protocols under this are:

- Gradient based routing
- Rumor routing
- Constraint Anisotropic Diffusion Routing (CADR)
- Active Query Forwarding in Sensor Networks (ACQUIRE)
- Energy-Aware Routing protocol

B. Hierarchical protocols: The basic idea of this protocol is to extend network lifetime by allowing nodes to communicate exclusively with their closest neighbors, employing a turn-taking strategy to communicate with the Base Station (BS). Hierarchical protocols are based on clusters because clusters can contribute to a more scalable behavior as the number of nodes increases, provide improved robustness, and facilitate more efficient resource utilization for many distributed sensor coordination tasks. (LEACH) protocol is a cluster-based protocol that minimizes energy dissipation in sensor networks by randomly selecting sensor nodes as cluster heads. Protocols under hierarchical scheme:

- Power-Efficient Gathering in Sensor Information System (PEGASIS)
- Threshold-sensitive Energy Efficient protocol (TEEN)

C. Location based protocol: Location-based protocols make use of position information to relay data to the desired regions instead of the entire network. Before a packet can be sent, the position of the destination must first be determined. Typically, a location service is responsible for this task. Existing location services can be classified according to how many nodes host the service. This can be either a specific node or all of the network nodes. Furthermore, each location server may maintain the position of a specific node or all the nodes in the network. In position-based routing, the forwarding decision by a node is primarily based on the position of a packet's destination and the position of the node's immediate one-hop neighbor. The position of the destination is contained in the header of the packet. If a node has a more accurate position of the destination, it may choose to update the position in the packet before forwarding it. The position of neighbors is typically learned through a one-hop broadcast beacon. These beacons are sent periodically by all nodes and contain the position of the sending node.

V. CONCLUSION

Various routing algorithms and protocols have been proposed for data diffusion in wireless sensor networks. When selecting a WSN routing protocol, some other standards also need to be considered such as complexity, energy usage, quality of service, data centric features. Due to specific application based requirements, an all-purpose routing protocol does not exist.

REFERENCES

1. Chiara Buratti, Andrea Conti, Davide Dardari and Roberto Verdone, "An Overview on Wireless Sensor Networks Technology and Evolution", *Sensors* 2009, ISSN 1424-8220
2. J.N. Al-karaki, A.E.Kamal "Routing Techniques in Wireless Sensor Networks: A survey," IEEE wireless communications, Vol.11, No.6, Dec.2004,pp.6-28
3. Hannes Frey, Stefan Ruhrup, and Ivan Stojmenovic, "Routing in Wireless Sensor Networks", Guide to Wireless Sensor Networks, Computer Communications 81 and Networks, 2009
4. Raul Aquino-Sant1, Luis A. Villasenor-Gonzalo, Víctor Rangel Licea, Performance analysis of routing strategies forwireless sensor networks, Rev. Fac. Ing. Univ. Antioquia N.° 52. Marzo 2010

