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An Overview of Routing Algorithms Based On Energy Constraints and Network Life-Span

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Abstract

The arrival of different real time applications made Wireless Sensor Network (WSN) a vital research area in the Networking field. WSN uses Modest sized, auto executing sensor nodes placed in a far location to recognize, gather and operate on the information and pass on to the end user. In a network of this type nodes can move and adjust with the nearby nodes. Because of the movement of the nodes, the network alters its structure randomly and nodes may be included or excluded. In this paper, we will analyze the various basic and compound path-finding protocols in WSN. The study is made based on diverse criteria of interest.

Keywords—WSN, Routing Algorithms, energy constraints, network life-span

I. INTRODUCTION

Fundamentally WSN is a mixture of discrete technologies like wireless communication, information technology and electronics field [1]. Sensor nodes in WSNs are minute sized and can able to intellect, collect and process information while contacting the other nodes in the network, by means of radio frequency (RF) channel. The way of deciding the path between source and destination for information trade is called as routing. In WSN network layer is normally utilized for incorporating the route for arriving data and crafting the routing protocol is one of the toughest task in WSN.

Principally a WSN comprises of two types of nodes. The foremost and main node is the anchor node (beacon node) or seed node or locator. This sort of nodes makes out their own location information via GPS or manual Location which offer the site information to another node. The second node is normal node or Unknown node

whose spot is unidentified [8]. This location is found by means of the beacon nodes. A few parameters related with positioning of nodes are power conservation, precision and safety.

One of the most main phenomenons on sensor nodes is the necessity of minimal energy usage since sensor nodes hold restricted power sources. Hence as usual networks concentrate on giving QoS requirements, the WSN's primary focus must be on power saving. They should have substitution mechanisms that give the end user the alternative of prolonging network life span at the cost of reduced throughput or increased communication delay [6].The sensor nodes possess restricted battery power, contact range and memory etc. In the majority cases, the sensor nodes that figure these networks are deployed arbitrarily and left unattended and are likely to execute their task properly and proficiently.

Due to node exploitation recharging sensor node is in general unfeasible. Therefore, energy saving is one of the important design issue in wireless sensor network. Also, data transmission and reception dominates the energy consumption of sensors [2]. Therefore, ultimate objective behind designing the routing protocol should be energy efficient as possible to prolong the network lifetime. Various hybrid routing protocols have been proposed to meet the application requirements of WSNs

II. GROUPING OF ROUTING PROTOCOLS IN WSN

Routing protocols in WSN have to deal with number of challenges and design issues. WSNs have some restrictions on sensor nodes like inadequate battery capacity, bandwidth restriction, limited working out power and insufficient memory.

Single routing protocol in WSN cannot meet all the application requirements. Thus, many routing protocols are proposed in WSN based on application and network design. Depending upon various classification standards, routing protocols are classified into different categories [3]. Routing protocols in WSN can be categorized depending on network configuration, protocol function and path founding. Figure 1 shows the categorization of routing protocols.

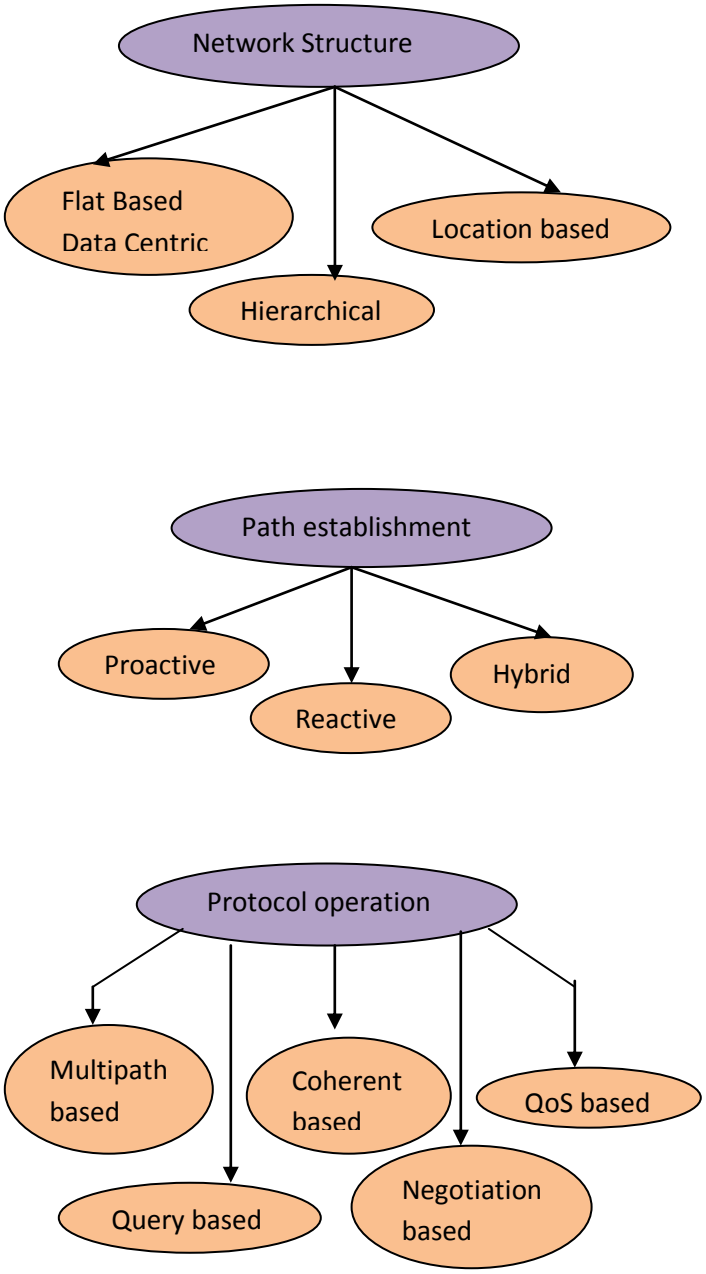

Fig. 1. Grouping of Routing Protocols in WSN.

III. ENERGY EFFICIENCY BASED ON VARIOUS ROUTING PROTOCOLS IN WSN

The chief duty of routing algorithms is to locate the finest route among source and the sink. Every routing algorithm employs hop by hop routing approach. In hop by hop routing plan every sensor node only chooses its next hop neighbor. In this case, the

neighbors having lesser space to sink node can be preferred as the next hop. Hence energy utilization of all algorithms is identical. Every step by step course of action tries to offer fine routing probable. To afford fairness in routing method, routing algorithm should decide on diverse routes connecting sender and the sink in so far as possible. The routing protocols are categorized as Data Centric Protocols [15], Hierarchical Protocols, Location Based Protocols, Network Flow and QoS aware Protocols.

Data Centric Protocols:

In Data centric routing the sink sends a demand to specific area and awaits for recognize from the chosen section. Since data has been requested in type of queries, features are been specified [7]. SPIN, Direct Diffusion, Minimum Steiner tree problem, Rumor routing , Gradient based routing (GBR), Constrained anisotropic diffusion routing(CADR), Active Query Forwarding in Sensor Networks (ACQUIRE) TEEN & APTEEN, COUGAR are the different data centric protocols and mechanisms widely used[7]. The best part of these protocols is data aggregation, relaying of data and reduction of energy expenditure.

Hierarchical Protocols

The major aspire of hierarchical routing is to proficiently preserve the energy use of sensor nodes by relating them in multi-hop relay. Data aggregation and fusion is carried out in concerned cluster, to facilitate reduction in the number of sent messages to the sink.

Low-Energy Adaptive Clustering Hierarchy

(LEACH) is one of the most accepted due order routing algorithms for sensor set-up systems. The scheme is to figure clusters of the sensor nodes depending upon the obtained signal potency and employ local cluster heads as routers to the sink [9]. LEACH is entirely distributed and needs no comprehensive awareness of network. Power-Efficient Gathering in Sensor Information Systems (PEGASIS) is an enhancement of the LEACH protocol. PEGASIS develops chains from sensor nodes in order that every node broadcasts and collects from a nearby node and a single node is chosen from that chain for transmission to the base station (sink). The major disadvantage of PEGASIS is too much delay for far-away node on the chain Min-Woo Park [9] has put forward misused key recognition mechanism for hierarchical routings. The transparency in the cluster heads are considerably diminished by this proposal.

Location Based Protocols

The majority of routing protocols for sensor networks need position information for sensor nodes [4]. It aims at computing the remoteness among two specific nodes with the intention that energy utilization can be approximated. In the majority WSN routing algorithms messages are aimed at from a source site to an end address based on topographical coordinates, not IDs. Sensor systems are spatially installed on an area and routing can be made through an energy resourceful technique.

Network flow and QOS-aware Protocols

Many routing protocols have been developed to discover and retain routes between source and end nodes. The chief intention of the QoS routing protocols is to create a path from a source to the destination that assure the requirements of the preferred QoS. QoS-conscious protocols take into account end-to-end delay constraints while creating the paths in the sensor network [10].

Sequential Assignment Routing (SAR)

(SAR) is the earliest protocol for sensor networks which take account of the view of QoS in its routing selections. It is a table driven multi-path method motivated to attain energy efficiency and fault forbearance. The protocol experiences the transparency of upholding the tables and states at every sensor node particularly when the number of nodes is vast. Weike Chen developed [11],QAC (QoS-based Adaptive Clustering algorithm), which concerns the energy utilization, consistency and the stability of wireless sensor networks by creating a dual cluster-head model.

Power-Efficient GAthering in Sensor Information Systems (PEGASIS)

(PEGASIS) is an energy proficient protocol [12] that gives improvements more than LEACH. In PEGASIS, every node converses only with a nearest neighbor to exchange data. It goes rounds to send the information to the base station, thereby decreasing the quantity of energy used up per round. The nodes are arranged in such a way as to form a chain, that can also be formed by the sensor nodes themselves using a greedy algorithm beginning from a particular node, or the Base Station be able to calculate this chain and relay it to all the sensor nodes In PEGASIS, the cluster head choice does not take into concern neither the residual energy of the nodes nor the position of the base station. PEGASIS has better performance contrast to LEACH [13], but the nodes are clustered into chains which roots to unnecessary data transmissions.

Threshold Sensitive Energy Efficient

(TEEN) is a hierarchical protocol proposed for unexpected changes in the sensed environment [14]. The response of the network in time-critical applications is intensely essential, obliging the network to work in a reactive mode. The sensor network structural design in TEEN depends on hierarchical clustering. The nodes near to upper level clusters are used to transfer data from other nodes that are more away, a process that goes on the next level cluster until the sink is attained.

The key benefit of TEEN is that it performs well in circumstances where unexpected changes in the sensed features arise. On the other hand, in large area networks and when the numeral of levels in the hierarchy is less, TEEN are likely to take considerable amounts of energy, due to long distance transmissions. Furthermore, when the count of levels increases, the transmissions become shorter and there will be a significant overhead in the setup phase, as well as the functioning of the network.

IV. ROUTING PROTOCOLS IN LARGE-SCALE WSNS

With the progress in micro-electronics, wireless sensor devices are manufactured much compact and further integrated. "Large-scale" means mostly large area or high mass of a network. Depending upon that the routing protocols should scale well to the network scope expansion and node density enhances. A sensor node is usually energy-bounded and not able to be recharged, and as a result its energy utilization has considerable changes on the scalability of the protocol.

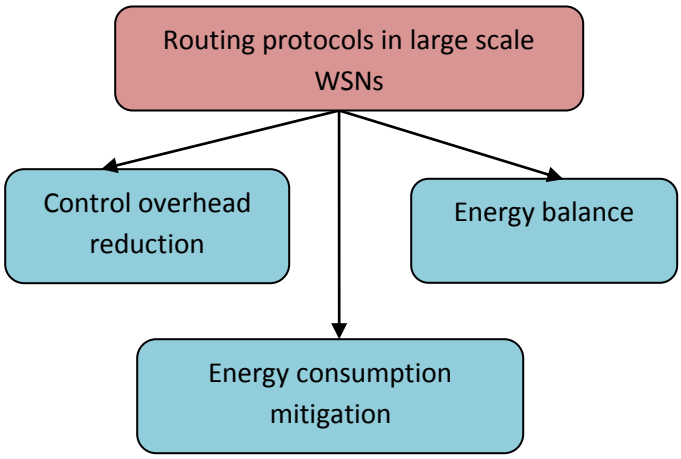

Fig. 2. Large-scale WSNs - Routing protocols: A Taxonomy

Because of the distinctiveness of a large-scale WSN, how to boost the energy effectiveness is a crisis of immense importance. The techniques for improving energy competence like control overhead cutback, energy utilization lessening and energy stability according to their motivation can be classified as shown in Figure 2. Presently the mainstream processes to work out the energy problem in large-scale WSNs are the hierarchical routing protocols. Every nodes of hierarchical routing protocol are segregated into numerous groups with diverse assignment levels.

Control overhead reduction-based category:
These protocols intend to diminish the control overhead to improve the energy competence with the objective of making bigger network longevity [19]. Innovative designs are employed in them to make simpler the route creation procedure and further techniques to replace the routing process, by this the control overhead can be decreased.

***Energy consumption mitigation-based category*:**
The routing protocols in this group intend to lessen the energy expenditure. Various means are made used of to accomplish this objective, such as dynamic event clustering, multi-hop communication, cooperative communication [19] and so on. These techniques can use the energy correctly and reduce wasted energy.

***Energy balance-based category*:**
In this category, the routing protocols are suggested from various points of vision, but with a consistent idea that is energy equilibrium. Whenever a node is allocated some unnecessary and repetitive tasks that has been given to other nodes, the node will take energy unequally and become suddenly useless [19]. It emerges that energy equilibrium-based methods can also develop the energy efficiency of the sensor nodes.

V. CONCLUSION

One of the major challenges in the design of routing protocols for WSNs is energy efficiency. Therefore, routing protocols designed for WSNs should be as energy efficient as possible to prolong the lifetime of each of the sensors, and so the network life span. We have proposed energy efficient new hybrid routing protocol (EEHRP) in WSN. It will enhance the network life time.

Energy efficient techniques and strategies in wireless sensor network are limited but rapidly growing set of research results. The concept, strengths and drawbacks of these protocols are also discussed. Energy efficient techniques using optimization techniques are also described. There are still many challenges that need to be solved in sensor networks. Optimization of network topology, own design techniques current state of art, Providing low latency, real time assurances, negligible bandwidth constrictions in wireless sensor networks is a very challenging problem given the nature of the network. It is worthy to research in the future. The future research should focus on the sensor deployment problem considering more practical environment with most energy-efficient communication framework.

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