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A Review Paper on Energy Capable Routing in Wireless Sensor Network

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ABSTRACT

This day's wireless sensor networks draw the attention of researchers more due to their admired applications in environment monitoring systems, radiation uses and nuclear-threat detection applications; weapon sensors for ships; battlefield reconnaissance and surveillance; military power, control mechanism, intelligence centre, communications and targeting systems and biomedical applications. Wireless sensor network provides cheap cost solution to various world problems. Sensors are low cost devices with limited storage, computational power systems. Several security mechanisms for sensor network must be energy efficient as security is the major concerned when they will be used in large scale as sensors have limited power and computational capability and should not be computational intensive. In this review paper we study the various energy-efficient secure routing methods for WSN.

KEYWORDS: *WSN, LEACH, Energy, Efficient, Routing*

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I. INTRODUCTION

Wireless sensor networks (WSNs) consist of tiny devices, which have a battery, a sensor, a microprocessor and a radio transmitter component. The application area of WSNs can be classified into two general classes: monitoring applications and tracking applications. While the first class of applications includes habitat monitoring, building monitoring, machinery monitoring and greenhouse monitoring etc., the second class includes animal tracking, vehicle tracking and goods tracking insupply chains etc. Due to this large range of application area, performance metrics in sensor network are strictly application-specific. However, 'unattended operation of the network for long time' or 'long network lifetime' can be determined as a common performance requirement for the most of the applications. In general, network lifetime can be defined as time span until the network is considered nonfunctional. Infact, as in performance metrics, perception of no functionality is also application- specific for sensor networks. A sensor network can be considered as nonfunctional if data delivery delay exceeds a threshold, or if the coverage of the monitoring area is less than the preferred level, or if the network is partition due to the energy deficiency of some bottleneck nodes.

The application area of WSNs can be classified into two general classes as monitoring and tracking applications. Based on the type of monitoring or tracking environment or assets, sensor nodes may be deployed unstructured or structured based. An example for the unstructured WSN may be dropping sensor nodes from an airplane for surveillance of a field. In this type of WSN, network maintenance such as managing connectivity is difficult since there are large numbers of nodes. If all or some of the sensor nodes are deployed in a pre-planned manner as in structured WSNs, network maintenance is easier since fewer nodes are placed at specific locations: an example may be a structural monitoring such as buildings or bridges. However, unattended operation requirement may exist in both scenarios once they are deployed.

Most important characteristics of wireless sensor networks

A. Large number of nodes in the network
B. Mostly many to one communication pattern
C. Limited resources (battery powered, processing capability etc.)
D. Difficult network maintenance especially in unplanned deployment of sensornodes in the area (eg. throwing from an airplane)
E. Once they are deployed, there exists a requirement of unattended operation and organization of the network for long time. Resource limited feature of WSN distinguish sensor networks from other ad hoc networks and from the performance point of view, unlike ad hoc networks, performance metrics is strictly application specific for sensor networks.

II. NETWORK LIFETIME

In general, network lifetime can be defined as time span until the network is considered nonfunctional. A sensor network can be considered as nonfunctional if data delivery delay exceeds a threshold, or if the coverage of the monitoring area is less than the preferred level, or if the network is partition due to the energy deficiency of some bottleneck nodes. The lifetime of the sensor network is defined as the time period until the first node runs out of battery (minimum individual node lifetime) or a certain percentage of the network nodes go at (nth minimum individual node lifetime), as in . The existing definitions in the literature the network lifetime is defined as time span which allows maximum amount of data delivery to the sink node and achievable maximum amount is restricted by the nodes' initial energy level.The network lifetime as the time spans this allows nodes to deliver the maximum amount of data to the sink node. Maxi- mum amount of data delivery meant that nodes spend most of their time in reception and transmission modes instead of idle and sleep mode. For example, if there is no networking activity (transmission and reception), the battery lifetime of the nodes will be longer (their battery last in longer time) due to lower energy consumption of idle mode, but network lifetime will be zero because transmitted data to the sink node will be zero.

Time Efficiency

Time efficiency is ability of the sensor network to perform its duty under the required time limits. In fact, this performance metrics have broad range to be considered as fulfilled. While for some application such as monitoring of intruder time efficiency has big importance, for others like temperature monitoring it does not have that importance.

Sink Oriented Connectivity

In ad hoc networks, connectivity is considered as a metric that shows the ability to transmit data from any source nodes of network to destination node. Therefore, the size of the largest connected component in the network represents an important performance metric in ad hoc networks. However, in sensor network where connectivity around a based station is the most important, the size of the connected component is not sufficient. Therefore, for distinguishing from the ad hoc networks,it is called as "sink oriented connectivity". It must be noted that this definition assumes that the basic communication model of wireless sensor network is many- to-one type. In case of clustered network, the size of the largest connected component can be taken as a performance metric to ensure data delivery.

Scalability

Scalability is the ability for the network to accept new nodes without impacting the application requirement. Communication algorithms or protocols for sensor network need to provide scalability. Due to energy restriction of sensor network, new nodes need to be added to extend the network lifetime or provide higher level of reliability.

Energy Efficiency in Wireless Sensor Net-work

In most applications, sensor nodes are restricted in energy supply. Al- though energy harvesting from environment is also possible in some applications, this is out of scope of this study. In order to achieve the primary goal of energy efficiency in de- sign of wireless sensor networks, the main energy dissipation sources are identified in a sensor node component and sensor networks.

The power consumption of the sensor node radio subsystem depends on the operational mode. Many sensor node device vendors provide low-power mode option for the radio. A radio can be typically in four different modes of operation; transmission, reception, idle, and low-power (sleep) mode. Aim of the low-power mode is putting the radio in this mode when node is not participating any networkingactivities. In fact, when a node is in idle mode (neither receiving nor transmitting), power consumption is the same as in reception mode. However, sensor nodes perform a cooperative task in the network as relaying the traffic to the base station as well as sending their own data. Therefore, sensor nodes need to listen to the radio channel for any possible relaying task.

Collision is another major source of energy waste, if more than one node send packetat the same time, the transmitted packet is corrupted and discarded. Consequently,the retransmission of packets is needed and that increases energy consumption. Therefore, collision free channel access is an important goal in the design of sensor network.

In organization of the nodes for cooperative tasks, there is a need for control packet exchange. This should be kept as low as possible to use the energy for useful data packets.

III. POWER AWARE ROUTING IN WSN

Main task of a routing protocol is to deliver the sensed data from source sensor nodesto a single or a few sink nodes. Due to ad hoc nature of the sensor networks, there is no fixed network infrastructure and the nodes have many possible paths to maintain connectivity to the sink node. Therefore, energy consideration plays an important role choosing the optimum path to access the sink node. In networking, the routing problem can generally be interpreted as avow problem. There are several definitions of network lifetime, this study focuses on the network lifetime definition in terms of energy deficiency of the nodes. Many existing sensor node devices provide the transmission at different power levels, hence it is possible to choose between multi- hop or direct communication. In general, multi-hop routing will consume less energy than direct communication because transmission power of a wireless radio is proportional to distance squared or even higher order based on the type of theenvironment. However, there might be some bottleneck nodes in the multi- hop paths which may create the network partition since their battery will be exhausted earlier. The energy consumption model plays a key role on defining the link costs. There is one mostly used energy consumption model in the literature.

$$e\ x\ \ = a.\ e^{\alpha} + c$$

where e(x) represents the power required for transmission across a distance x. fi is the path loss exponent and gets the value of 2 for free space and 4 for fading channel, a and c are constants.

IV. LITERATURE REVIEW

Alshowkan, M. and Elleithy, K.; Alhassan, H. investigated the current security mechanisms in wireless sensor networks as well as reducing power consumption. LEACH protocols provide an energy routing protocol. The improved secure and more energy efficient routing protocol called Lightweight Secure LEACH has been adopted. Authentication algorithm has been integrated to assure data integrity, availability and authenticity. This investigation provides the improvement over LEACH protocol which makes it more secure and extra energy efficient for reducing the effect of the overhead energy consumption from the added security measures.

Haneef, M.; Zhou Wenxun and Zhongliang Deng presented the deployed redundant nodes in to account which cover major fraction of energy depletion in the network which is efficient routing algorithm based upon the frame work of LEACH.A many of redundant data is present in wireless sensor network due to widely deployed nodes. For checking the presented methodology simulation has been done using Matlab. Results show that MG-LEACH had performed better LEACH on the basis of Network life time.

Yu Miao; Bai Guang-wei and Shen Hang had proposed the performance analysesof classical low-energy adaptive clustering hierarchy routing algorithm. Investigation has been done on the limitations of the LEACH in terms of energy balance and networks scalability. The proposed work is that the cluster-heads are elected by a probability based on the ratio between residual energy of each node and the average energy of the network.

Saravanakumar, R., Susila, S.G. and Raja, J. have analyzed the basic distributed clustering routing protocol LEACH, then proposed a routing protocol and the data aggregation method in which the sensor nodes form the cluster and the cluster-head elected based on the residual energy of the individual node calculation without re- clustering and the node scheduling scheme is adopted in each cluster of the WSNs. ACTIVE and SLEEP mode, the energy efficiency has been increased about to 50% than LEACH protocol. The proposed routing protocol significantly reduces energy consumption and increase the total lifetime of the WSN.

Muhamad, W.N.W. and Naim analyzed the Wireless sensor networks lifetime is either superficial or impractical, which can prevents us from thoroughly understanding the efficiency of these proposed routing protocols. This work has beendone to maximize the lifetime of the WSN. LEACH routing protocol is increased the network lifetime by 65.2% compared to DC and MTE.

Wei Bo, Hu Han-ying and Fu Wen improved LEACH protocol for data gathering and aggregation in wireless sensor networks. LEACH includes distributed cluster formation, local processing for reducing global communication, and randomized alternation of the cluster- heads. This research work protocol uses multi-hop routing instead of 2-hop routing in LEACH, and related algorithm was proposed. Results show that improved protocol is more energy-efficient than conventional LEACH.

Islam, M.J.; Islam, M.M.; Islam, M.N. performed a solar- aware, programmed clustered routing protocol A-sLEACH which is an extension to sLEACH for routing and MTE for radio model. Outcomes of applying this proposed scheme gives better performance compared to MTE and sLEACH .

V. CONCLUSION

Performance enhancement of sensor network using energy efficiency the point of view with the varying networking parameters. Wireless sensor networks can provide low cost solution to verity of real-world harms. Sensors are low cost tiny devices with limited storage, computational capacity and power. They can be deployed in large scale for performing both military and civilian tasks. Security is one of the main concerned when they will be deployed in large scale. As sensors have limited power and computational capability, any security mechanisms for sensor network must be energy efficient and should not be computational intensive.

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