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A study of Wireless Sensor Network Data Acquisition

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Abstract **- Wireless sensor network (WSN) data acquisition has the unparalleled advantage of other networks due to its self-organizing network structure. However, its limited resources many key problems have not been solved well. This paper summarizes the key technologies and the main challenges in WSN data acquisition, WSN network protocol and its main performance indicators, and several current technologies and the combination of WSN were analyzed and discussed, and finally, the wireless transmission future research on key technologies of sensor network data acquisition has prospected.**

Keywords: Wireless Sensor Networks; Overview; Data Acquisition; MIMO

1. INTRODUCTION

With the rapid development of technologies such as wireless communications, integrated circuits, sensors and MEMS, the large number of low-cost, low-power, small-size and multi-functional miniature sensorsproduction is possible. The reason that the micro-sensor, because the sensor is as small as dust floating in the air, so it is also known as smart dust (Smart Dust) [1] . Sensor nodes with built-in micro-sensor, you can sense the environment of the heat, infrared, sonar, radar and seismic signals, etc., but also can capture the temperaturedegree of physical activity, humidity, light intensity, pressure, soil composition, moving object size, speed and direction, etc. People interested in wireless sensor networks (Wireless Sensor Network, referred to as WSN) is a networked information system integrating distributed information collection, information transmission and information processing technology.2 Sensor nodes are often randomly distributedplaced in many human inaccessible occasions, self-organized way to form a fast, effective and reliable wireless network.Nodel nodes are often isomorphic, andBecause of its low power consumption (even without changing the battery) features, it is suitable for a variety of applications in unattended IEEE1451.5 wireless standards provide a variety of WSN.Wireless application standards based on protocols and requirements [3] .WSN in the process of information collection, transmission and processing, its fundamental purpose is to the sensor node to collect the datausing single-hop or multi-hop transmission to the sink or base station (BS) by wireless transmission, and the processing of the data may be intranet or extranet[4] , that is to say, the data can be processed or compressed by the intranet before single or multi-hop transmission to save more energy and further improve the multi-hop processdata fusion, in the most possible way to reduce data redundancy. In addition, the data can also be transferred to the BS for further processing, such as the restoration of the originalthe shape, size, or color of the original image.With the current common wireless communication networks such as mobile communication networks, wireless LANs, Bluetooth networks, Ad hoc networks, etc., the use of WSN for data acquisition the main features of [2, 4] : (1) The sensor nodes are large in number and densely distributed, and the network is very large (2) In the process of data acquisition, node processing data capacity is very limited due to the price, size and power constraints, sensor nodes. (3) Energy saving is crucial.

1 .WSN data acquisition of key technologies

WSN data acquisition involves many disciplines; the key technology can be divided into four parts, namely network communication protocol, the core support technology, self-organization Management, development and application.

2. WSN data acquisition is facing the main challenge

Wireless sensor networks are data-centric networks, and their applications are often inseparable from data collection. Therefore, designing an effective network data collection mechanism is crucial an important issue. Compared with traditional networks, sensor networks mainly face the following challenges in data collection

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due to their self-organized structure and limited resources
(1) Energy-saving problem
(2) Energy Consumption Problem
(3) Relevance of collected data Due to the intensive deployment of nodes in WSN
(4) Ad hoc routing problem
(5) Interactive data collection issues
(6) The robustness and adaptability of the network

3. WSN data acquisition network protocol performance indicators and analysis methods

In the study of WSN data acquisition process, the design of network protocols directly affects the effectiveness and reliability of data acquisition, and the performance evaluation of various network protocols. The standard mainly includes the following six aspects:

(1) Energy efficiency. The energy efficiency of WSN is the primary consideration in protocol design. In general, the network life cycle (or round) is used to measure the network important parameters of life expectancy.

Price life cycle performance is good or bad the main form:

Number of rounds of data collection at the death of the first node; {

}1% nodes before the death of the data collection rounds; {

} 50%

Nodes before the death of the data collection rounds; {

} 100% nodes before the death of the data collection round. Here the wheel is collected data through the network data compression processing after the single-hop or multi-hop transmission to the BS in the process. In order to get more life cycle, we must consider the issue of energy balance. There are two main energy balance problems ways to control: dynamic clustering method to make each node dynamically become cluster heads, thereby reducing the cluster head spends more energy-consuming leading to the possibility of early death; using especially in multi-hop WSN systems, heterogeneous strategies can effectively prevent energy holes and improve the life cycle of WSN. For example, Heinzelman proposed the Low Energy Adaptive Clustering Hierarchy (LEACH) protocol [7-8] .The first node died before the number of life cycles comparison, we can see that, compared with the Direct Protocol LEACH agreement, the system can improve the number of rounds can be increased .However, since each node in the LEACH protocol decides whether to be elected as a cluster head according to the randomly generated random number compared with the threshold value, each round the resulting cluster heads have no fixed number and location, and inconsistent size of each cluster can result in unequal energy consumption. In addition, since all cluster heads communicate directly with the BS, the energy consumption of the cluster head far away from the BS will be greatly increased, leading to further unbalanced energy consumption [8] . In this regard, Lindsey et al. Proposed a power sampling of the sensing information system Efficient Gathering in Sensor Information Systems, PEGASIS) protocol [9-10] , which uses the greedy algorithm (Greedy Algorithm) form a chain with the shortest distance between adjacent nodes, and randomly select 1 cluster head in the chain to transmit the merged data to BS. Saves more energy than the LEACH protocol and has a life cycle that is two times that of LEACH. The PEGASIS algorithm assumes that a node passes a positioning device or sends. However, when the number of nodes is large, the link will become very long and the data transmission delay will be significantly increased. Later improved algorithm using TEEN (Threshold Sensitive Energy Efficient Sensor Network Protocol) [11] with APT EEN (Adaptive Periodic Threshold sensitive Energy Efficient sensor Network protocol) [12]there is the use of cluster-chain algorithm combined with Adaptive Power Control (Cluster Chain Routing Protocol, CCRP) [13] and Cluster Chachin Channel Adaptive Routing Protocol) [14] , and the use of Priority Covering Flooding (PCF) [15] on the basis of flooding algorithms, etc. These algorithms are based on energy efficiency and energy consumption. There are some improvements in the balance, but many new problems have arisen.

(2) The effectiveness of data transmission. The effectiveness of data transmission analysis includes network transmission rate and network throughput. The network transmission rate is mainly related to the bandwidth, as a result, new technologies such as the use

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of OFDM technology and the dynamic allocation of wireless bandwidth resources for cognitive radio are introduced into WSN data acquisition.16-17 In addition, in the case of a certain bandwidth, using different modulation techniques will get different network transmission rate. Because in WSN, users often get interested in the letter from the BS therefore, WSN throughput is usually defined as the throughput of the BS. Throughput is an important performance indicator of WSN data acquisition, which directly reflects the WSN work Operation efficiency and is closely related to the wireless channel competition mechanism of the network M AC protocol. The main data flow in the existing WSN is sent by the sensor node Because of the large number and dense distribution of WSN nodes, the data traffic of each node in the network is different, and some sensor node traffic flows close to Sink it is easy to cause congestion problem. The reason why these nodes have a large amount of traffic is that a plurality of routes pass through a certain node and different traffic control mechanisms can be obtained Different throughput performance index. In addition, the throughput enhancement is often considered together with the delay performance. For example, TMAC protocol proposed in the SMAC protocol an adaptive duty cycle, which is a protocol that takes energy loss, latency, and throughput into account, divides a frame into variable-length T a and T s Some data is sent during a variable period of T a and maintains the balance of the network load by dynamically changing the duration of T a . Even though the node is active after T a time, if there is still no data to send, the node will immediately go to sleep [1].

(3) Reliability of data: The reliability of data mainly depends on the receiving channel bit error rate, which in turn depends on the bit error rate required in a particular application

(4) Network transmission delay: The delay in WSN mainly includes delay of data transmission, delay of establishing route, delay of data fusion and delay of establishing cluster architecture, etc. Refers to the transmission of information from the source node to the BS all the time spent. Because the data of interest on the network delay requirements, in the specific design, you can test the effects of delay can sometimes be ignored.

(5) Sensing Coverage: WSN coverage control refers to the WSN node energy, network bandwidth and node computing resources such as limited resources, through WSN node deployment and routing and other means, so that all kinds of WSN resources are optimally distributed, the perception, monitoring, sensing, communications and other quality of service has been changed Good process.

(6) Scalability and robustness of the network: Scalability of the network, also known as scalability, means that the network is required to be as large as possible in the topology and network protocols of the network has the nature of infinite extension because it is conducive to WSN data acquisition adapt to a variety of monitoring scenarios change. The robustness of the network refers to the self-healing network good robustness allows the network to adapt to changes in the harsh environment, can also continue to complete the task of data collection in the event of some node death, but also easy to network to add new nodes, and then easily complete the network maintenance.

4 WSN data acquisition in a variety of new technologies combined

In recent years, with the development of M IM O technology, OFDM technology, game theory and cognitive radio technology, these new technologies should gradually come to WSN data acquisition In the past, many new directions of academic research have been formed.

4.1 Collaborative MIMO based WSN data acquisition

Minimizing energy consumption in WSN design is a very important performance metric that relates to the lifetime of the entire network.MIMO technology can be effective Use the multipath effect to suppress the fading and improve the capacity and spectrum utilization of the communication system.When the system capacity is constant, relative to the SI SO system, Technology to reduce the transmit power of the WSN node.However, due to the small size of the Wireless Sensing Interface

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Module (WT IM), physical days are to be formed separately on low power nodes line array is unrealistic. So the single antenna-based virtual IMO scheme is proposed. Among them, [21] has proved that in its multi-hop WSN model, the cooperative MI Compared with SISO, MO can save energy when long transmission distance reaches a certain value, and put forward an effective transmission control strategy. This result shows that virtual IMO Collaborative communication in WSN is not suitable for short-range communication, but suitable for large-scale scene data acquisition. In the WSN to use the virtual IMO communication, while ensuring energy conservation, but also pay attention to maintaining the balance of energy consumption. [21] has proved in the WSN the use of collaborative M IM O technology can save energy, where the saving energy refers to the total energy of the system, including transmission energy loss and circuit energy loss. [22] proposed a collaborative MIMO scheme. The article makes a switch between MIMO, MISO, SIMO and SISO and chooses the most energy-efficient transmission to reach to extend the life of the network.

4.2 OFDM-based WSN high-speed data acquisition

However, with the development of wireless WSNs, it has to adapt to various high-speed transmission scenarios, such as wireless media Sensing Network, many people think of the application of OFDM technology in WSN when the bandwidth is increased. [16] Proposed a cooperative OFDM Case, where the collaboration node will be converted to the source node to send out the carrier frequency, according to the OFDM transmission to the data sent to the destination node.

4.3 WSN data collection based on game theory

Game theory as a new discipline and mathematical analysis can help us solve many problems in communications. Especially in the optimal choice, you can use the game source distribution and management to improve the performance of the network.

4.4 Wireless Sensor Based WSN Data Acquisition

In the case of limited network resources, especially in the case of limited spectrum resources, a perceptual approach may be used to obtain a wider bandwidth for the WSN, especially in the absence of It is even more important to get more bandwidth in a line multimedia sensor network, so in the last two years there has been a perceived use of perceptual radios in WSNs

Considering the design of larger bandwidth, literature [27] considered the problem of spectrum resource allocation for a resource-limited WSN. The following problems were considered in the allocation process: Spectrum The issue of fairness of allocation, the problem of maximizing the use of spectrum resources, the priority of sensing data and the chances of channel alternation.

5 CONCLUSIONS

In WSN data acquisition process, the key design is the network communication protocol energy saving and equalization, and network self-organization and dynamic routing problems and so on are all inseparable from the design of network communication protocol. In fact, most of the current research on WSN data acquisition problems are all around the communication protocol In the future research work, its main direction is to apply all kinds of new technologies to WSN data acquisition, and to design a simple and comprehensive network communication protocol, so as to further optimize energy efficiency, delay, throughput and sensor coverage, etc. The author summarizes the key technologies contained in WSN data acquisition and the main challenges are faced with the key performance indicators and the corresponding analysis methods in the current WSN data acquisition are summarized, and then introduced various new technologies in WSN related applications.The article has a more important reference meaning in the research direction and method of WSN data acquisition.

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