

# Research on Data Communication Security and Its Optimization Technology Based on Sensor Network

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**Abstract:** as the Constant Improvement of the Economic Level of China, the Communication Technology of China Has Also Been Greatly Developed, Especially the Wireless Sensor Network Technology Has Been Effectively Improved and Perfected. At Present, the Application Direction of the Sensor Mainly Includes the Monitoring of Environmental Conditions, the Monitoring of Physical Health, the Measurement of Atmospheric Parameters, the Control of Temperature, and So on. Compared with the Traditional Sensor Equipment, Wireless Sensor Has Significant Advantages in Portability, Power Consumption and Cost, and is an Important Carrier to Complete the Task of Data Transmission among the Network Nodes. However, in the Process of Wide Application of Wireless Sensors, the Security Problem of It is Also a Very Important Issue. Therefore, This Paper First Introduces and Analyzes the Structures of Commonly Used Wireless Sensor, and Then Discusses the Method of How to Realize Secure Data Transmission in Wireless Sensor Network.

## 1. Introduction

As the constant development of communication industry China, the communication technology of China has been constantly optimized and improved, and the related technology of sensor network has been gradually advanced. Especially in recent years, wireless sensors, are widely used in many aspects, have the advantages of high portability, low manufacturing cost and low power consumption. Therefore, compared with the traditional sensors, it has a more extensive application prospect and has a very wide range of applications in environmental protection, industrial production, medical health, military affairs, and so on.

The development and promotion of sensor network is also the inevitable demand of the development of Internet of things technology. This is because in the process of the development and application of Internet of things technology, a large number of terminal devices need to be used, which must be effectively connected with the corresponding sensors and form the corresponding network nodes. The function of these network nodes is to complete the data acquisition, calculation and transmission, etc. At the same time, in order to meet the needs of data transmission, each network node must have a certain bandwidth. The volume of the sensor is small, in order to meet the needs of normal operation, most of them rely on their own power supply to work.

The security of data transmission in sensor networks is a very important issue, especially in wireless sensor network. Because these network nodes are often placed in areas where no one or fewer people are located, once maliciously damaged, it will have a direct impact on the security of data transmission. In addition, there still isn't a scientific and effective security protection mechanism for data transmission of the wireless sensor network, which makes it difficult to effectively guarantee the security in the process of data transmission of the wireless sensor network. Therefore, combined with the current development and application status of sensor network, it is very important to formulate a reasonable and effective data communication security strategy for the development of the communication industry of China in the future.

## 2. Application and Structure of Wireless Sensor Network Technology

At present, wireless sensors are widely used because of their low cost and low energy consumption, so they are especially suitable for monitoring and data acquisition in special areas. In

the process of practical application, in order to ensure that each network node can realize efficient data transmission, the distance between each node can be adjusted according to the transmission performance of each node. In addition, the sensor network node also has a very strong self-organization ability, if a new node is added to the sensor network, the network will automatically identify it. The common wireless sensor network structure is shown in fig.1:

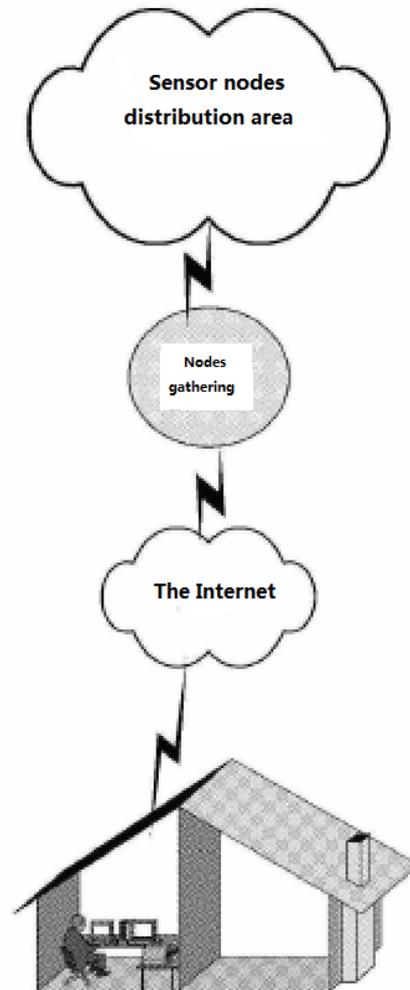


Fig.1. Structure of wireless sensor network

From the network structure chart of wireless sensor, it can be found that the wireless sensor network is mainly composed of four main parts: the first is the monitoring area formed by the gathering of wireless sensor devices, in order to ensure the comprehensiveness of monitoring, the node equipment must be arranged in combination with the corresponding standards and specifications; the second is the gathering nodes of data transmission, the function of this area is to process the data of the observation area; the third is the transmission network area, the transmission network usually refers to the Internet, as the name implies, the function of this area is mainly to transmit the data; the last is the management platform, by which managers can read the observation data on the management platform.

As mentioned above, wireless sensor network is widely used in the field of environmental monitoring at present. It can not only detect the physical and chemical properties of soil, but also fulfill the tasks of atmospheric monitoring, surface humidity monitoring and the monitoring of plant diseases and insect pests. The key reason why wireless sensor networks can achieve such a variety of monitoring functions lies in the particularity of its sensor node structure.

As a whole, the internal structure of the sensor node is mainly divided into five parts, namely, power supply, storage module, sensing module, calculation module and communication module. Among them, the power supply is directly related to the working lifespan of the sensor, because the sensor volume is small and can not use the external power supply, so when the internal power

supply is fail, the sensor node can not continue to work; the storage module is mainly responsible for temporarily storing the transmitted data; the sensor module detects the indexes of the external environment by the use of various detection components; the calculation module, as the name implies, calculates all kinds of data according to the established calculation rules; the communication module, its function is to transmit the data and communicate with the outside.

Generally speaking, each network node can realize the basic communication function only if it has the corresponding communication protocol. The common node communication protocols are shown in fig. 2.

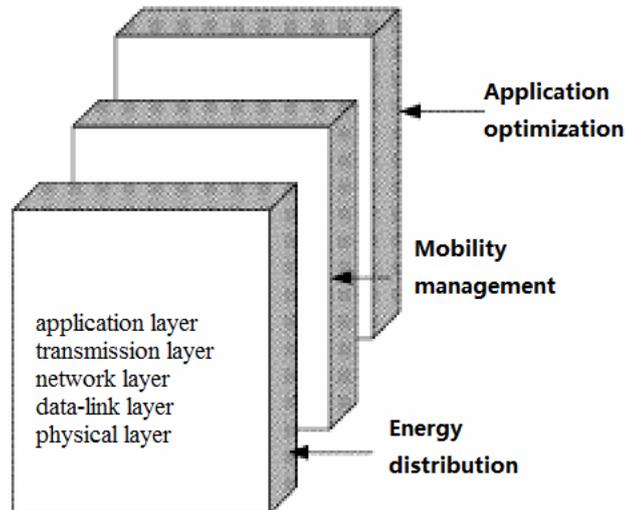


Fig.2. Node communication protocols

It can be found from the chart above that the communication protocols of network nodes are generally divided into five levels: application layer, transmission layer, network layer, data-link layer and physical layer. If divided according to the function, they can also be divided into energy distribution, mobile management and application optimization.

### 3. Security Analysis of Data Transmission in Sensor Network

The security of data transmission is a very important problem in the process of the application of sensor network. In the course of future development, the key to improve the development and application level of the sensor network is how to improve the security of data transmission. At present, in the course of designing the sensor network, in order to guarantee the rationality of the sensor network design, it is necessary to take into account the various factors such as the node size, the length of working hours of the sensor network and the security requirements of the data transmission. The practice shows that by improving the rationality of the data processing algorithm, the design level of the sensor network can be improved. In general, the sensor network nodes applied at the present stage mainly have the characteristics of small volume, less components in its structure, and the internal power supply. So, the sensor network nodes have a very high requirement for the performance of the internal power supply. At the same time, because the number of its components is small, the computing power of the data is relatively insufficient, and it is difficult to compare with the computing capability of the computer. Since the components in the node are few, the node's calculation and data processing capability are relatively small and cannot be compared with the function of the notebook computer. In addition, the size of the node is in direct proportion to the communication capability, and most of the sensor nodes currently in use have weak communication capabilities, typically only about ten meters of communication range, and it is difficult to guarantee the quality of the data transmission once more than ten meters.

Except for the characteristics of small in size, distributed structure and self-organizing ability are also the main characteristics of sensor network. Most of the sensor networks used at present use the distributed principle to arrange each node. The advantage of this distributed structure is that each

node in sensor network is in a equal level, and there is no distinction between high level and low level. Therefore, compared with other network structures, it is easier to upgrade the sensor network structure. After adding new nodes, the new nodes can be quickly identified by other nodes and then form a new network structure. When the damaged node appears in the sensor network, the network itself will automatically delete the node and update the network structure.

From the node of sensor network, as shown in figure 3, the sensor network node often carries at least one sensor nowadays; and in many cases, it carries more than two sensors, which is an inevitable choice to improve the working efficiency of the sensor node. Moreover, most of the nodes with more than two sensors that carry different types of sensors, which can fully tap the working potential of the sensor nodes and achieve higher detection efficiency.

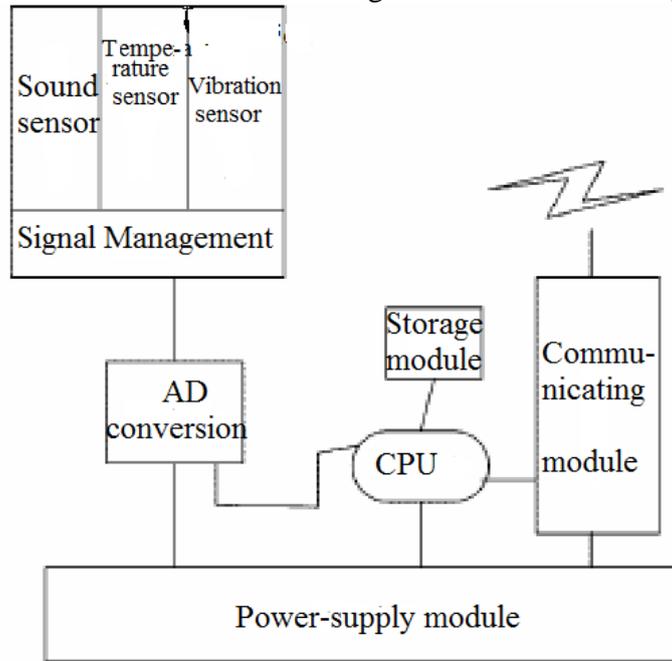


Fig.3. Internal hardware structure of sensor node

It is evident from the above chart that the inside of the sensor node is equipped with a central processing unit, a digital conversion module, a power supply module, and a data storage device, etc.

In the process of laying out the sensor network, in order to improve the working efficiency of the sensor network, the distance between each node should be set according to the performance of each node. In general, you need to set it to a lattice layout with the same distance, as shown in fig. 4.

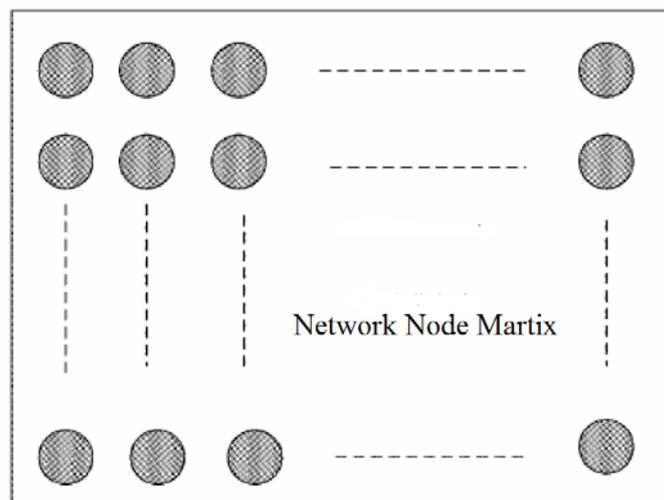


Fig.4. Sensor network lattice layout

For wireless sensor network, the security of data transmission is more important. This is because

wireless sensor network is usually used in areas where no one or fewer people are available, and these area managers are often inaccessible and unable to inspect and repair frequently. Therefore, once the wireless sensors in these areas are destroyed, the nodes can not work properly, which will have a negative impact on the whole sensor network.

Different from other network structures, in wireless sensor network, once one or several nodes are attacked, the network can not work properly, and can even be used by the lawbreakers, so that the whole sensor network would lost its defense function. A sensor node that is subjected to malicious attacks and that is broken are often referred to as malicious node. When a malicious node is present in the sensor network, the number of malicious nodes will increase continuously, the efficiency of the corresponding data packet will be decreased and the efficiency of data transmission is extremely low, which highly influences the transmission performance of the sensor network.

#### **4. Conclusion**

Generally speaking, because of the advantages of simple in structure and small in size, wireless sensor network is very suitable for dangerous and remote environmental monitoring, such as nuclear power stations, barren areas and areas with poor environment and climate. In the process of practical application of wireless sensor network, we should pay attention to two key problems: on the one hand, the problem of power supply. Because of the small size of wireless sensor node, it is difficult to use external power supply, so internal battery is needed to supply power. The performance of the battery directly affects the working lifespan of the sensor node. Once the battery is exhausted, the sensor node will stop working. Therefore, in the process of designing sensor network node, we must choose the battery with excellent quality. On the other hand, it is the security problem of data transmission of wireless sensor network, if the high efficiency and the security of data transmission can not be guaranteed, then the arrangement of sensor network will lose its significance. And different from other network structures, once there are malicious nodes in wireless sensor networks, the number of malicious nodes will continue to increase, resulting in a continuous decrease in the efficiency of the data transmission. Therefore, in the process of the development and application of sensor network in the future, we must fully realize the importance of data transmission security, combine with the actual practical situation and requirements, reasonably set up the internal structure and layout of the sensor node, ensure the security and efficiency of data transmission, and lay a solid foundation for the realization of sustainable development of sensor network in the future.

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