WIRELESS SENSOR NETWORK

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ABSTRACT

If sensor networks are to attain their potential, security is one of the most important aspects to be taken care of. The need for security in military applications is obvious, but even more benign uses, such as home health monitoring, habitat monitoring and sub-surface exploration require confidentiality. WSNs are perfect for detecting environmental, biological, or chemical threats over large scale areas, but maliciously induced false alarms could completely negate value of the system. The widespread deployment of sensor networks is directly related to their security strength.Wireless sensor network technology has become one of technological basic needs of us. As wireless sensor technology improves; an increasing number of organizations are using it for a wide range of purposes. ZigBee technology is a new standard in wireless personal area after Bluetooth. After an introduction to this technology, a new wireless meter-reading system based on ZigBee protocol has evolved. This system, which is comprised of ZigBee network and database management system, has many important advantages such as low cost, low power consumption, and low date rate.

KEYWORD:Wireless Sensor Networks, Security Protocols, Network Threats, Applications, IEEE 802.15.4

I.   INTRODUCTION

With the development of network and communication technology, the inconvenience of wiring is solved with WSN into people's life; especially it has wide perspective and practicability in the area of remote sensing, industrial automation control, and domestic appliance and so on. WSNhas good functions

of data collection, transmission, and processing. It has many advantages compared to traditional wired network, for example, convenient organizin power dissipation, low cost, etc. At present, near field wireless communication technology has been used widely, especially Bluetooth, wireless local area network (WLAN), infrared, etc. But, they have a number of disadvantages, for example, complexity, large power dissipation, short distance,networking in small scale. In order to satisfy the demand of low power dissipation and low speed among wireless communication devices, a new type of wireless net technology-Zigbee emerges as the times require.

II.   ZIGBEE TECHNOLOGY

ZigBee is new wireless communication technology withshort distance, low complexity, low energy consumption, slow data rate and low cost, and it is based on IEEE 802. 15.4 Standard with the capacity of coordinating mutual communication among thousands of tiny sensorsThrough the radio waves, these sensors can transmit the data from one sensor to another with small energy cost and high efficiency. Compared with various existing wireless communication technology, ZigBee technology has the lowest energy consumption and cost. Because of the slow data rate and the small range of communication, ZigBee technology is extremely suitable for agricultural field which has small amount of data flows. The technical features of this technology also make it the best choice for wireless sensor networks. Therefore, it has the practical significance when applied in the crop environmental monitoring systemZigBee has the following features. ZigBee uses a variety of power-saving modes to guarantee that it could be used for at least six months to two years powered by two AA batteries. ZigBee uses the avoidance collision mechanism in CSMACA and pre-set a prior particular time slot for a fixed bandwidth communications service in order to avoid competition and conflict when sending data. MAC layer adopts a fully confirmed data transport mechanism, and each packet sent by the receiver must wait for confirmation. Zigbee has self-organizing features that one node can sense other ones without any human interventions, and connect with each other automatically to create a completed network. It also obtains self-recovery function that the network can repair itself when a node is added or deleted, the position of a node is changed, or a breakdown occurred. It also can adjust the

topology structure to ensure that the whole system can work normally without any human interventions.

a) Basic network structure

Zigbee supports multiple network structures, which mainly include star, tree, and mesh network. They are composed of the Coordinator, the router, and the end device. The Coordinator and the router need full function (FFD), but the end device could select either full function device (FFD) or reduced function device (RFD). RFD is only used to acquire data information and transmit the information to its parent node; it is not used to finish the work such as data transmission, route discovery, and route maintenance. The responsibility of RFD is used for building a new network, transmitting network beacon, managing nodes in the network, and storing network information, etc. Star network is composed of a Coordinator and an end device or multiple end devices, the end device could only communicate with Coordinator, it cannot communicate with end device, so star network is called single-hop network. The tree network and mesh network have routing function, so they are called multi-hop network.
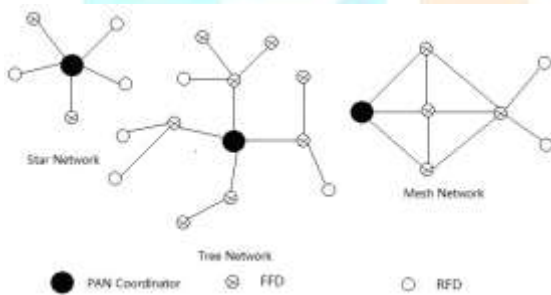

Fig:The architecture of Zigbee network

III. ZIGBEE PROTOCOL SUITE

ZigBee standard uses hierarchically structured. ZigBee does not exactly fit the OSI 7-layer networking model, but it does have some of thesame elements, including the PHY (physical), MAC (link layer), and NWK (network) layers. The Alliance focuses on the specification of the upper layers of the protocol stack (from network to the application layer), as the IEEE 802.15.4 protocol specifies the Medium Access Control (MAC) sub-layer and physical layer for LRWPAN.

IV. EXPLOSIVE PRODUCTION ENVIRONMENT REMOTE MONITORING SYSTEM ARCHITECTURE

System structure shows, the entire system by monitoring the host, GPRS module (or, a ZigBee

coordinator node, a number of ZigBee routers, ZigBee node and a number of nodes of terminal equipment. This is a cluster tree network structure is conducive to the number of network nodes and the physical expansion of the scope, complex, multi-node wireless network communication system is also an important reference value.The coordination of the network nodes, network management functions, the receiving terminal device node for the data upload, and transfer through the GPRS network to the monitoring center. Router nodes for routing of information, transmitted, allowing other nodes join the network. Node device to the network coordinator from time to time collect information to send and receive commands from the monitoring host. ZigBee module used for GPRS networks and Internet networks, the Internet (also available in other ways), the realization of ZigBee network data to monitor the upload and download the host commands. Host real-time monitoring of the collection, storage, monitoring and processing equipment from a remote terminal nodes of information. Its functions are divided into two major parts, Data Monitoring: to receive from the ZigBee network information collected, the corresponding data into the database; to receive instructions from the managers, and command frame format in accordance with the configuration commands, GPRS module through the command issued to the ZigBee network and do the action[3], [4]. Data Management: The database can be found, query data from the current ZigBee network information, such as: the production of the ambient temperature, pressure, overrun alarm, such as the peak period. ZigBee end-node using the occasional wake-up call from time to time work, time to wake up from hibernation to start data acquisition, ZigBee routing node to send a message, send completed and then enter hibernation. ZigBee routing nodes will collect the data sent to the ZigBee coordinator node, gateway GPRS module through the data uploaded to the remote monitoring center.
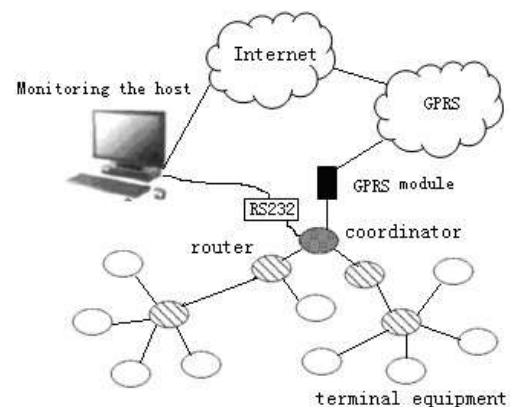
Fig: Structure of the framework of remote monitoring system.

V.   THE FUSION OF RFID AND ZIGBEE

RFID is a non-contact automatic identification technology that uses radio frequency signals automatic recognizes target and access to relevant data. The identification work does not require human interference and can work in variety of harsh environments. But if there is no network to transmit data, it will be difficult to play its advantage. Under the influence of environmental conditions, the traditional wired network may not be a better way to achieve. The feature of wireless sensor network is no center and self-organize, it is a powerful complement of RFID, and can solve the drawback of poor anti-interference, the effective transmission distance short. Based on the ZigBee technology and the RFID technology of information-fusion technology: the former used to monitor the target environment conditions, the latter used to identify target objects. Complementary and interdependent of the technology can effectively solve the problem of RFID data transmit in the mine and can also better perceive the safety hazard exists in coal mine **[4], [5].**
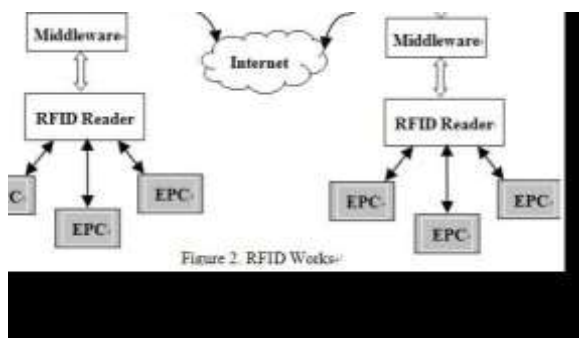

Fig: The fusion technology of wsn and RFID

The combination of ZigBee wireless sensor networks and RFID technology, make up for the drawback of short transmission distance of the RFID which can also solve some of the following problems.

1.RFID data transmission problem:GIS and RFID to achieve the separate wiring problem of personnel location under the traditional way; Because of geographical complexity of the mine, bad environment, wired connections will cause the data route in the mine complex and redundant and data lines will be influenced by poor environments to rotten skin, breaking leading to data transfer instability.; and effective data are collected precisely to ensure personnel safety of important security; relying on wireless sensor networks to transmit data, security, high reliability and eliminating the need for separate wiring problems, reducing input costs.

2. Personnel positioning problem: The combination of RFID technology and GIS, can solve based on ZigBee technology the personnel positioning inaccuracy of the problem; Under the ZigBee technology to realize personnel positioning mode, Personnel to wear the positioning of a ZigBee module which regularly sent the existed information, the sensor node which distributed in mine roadway to receive this signal, according to signal strength to determine its location ; When the mine tunnel barrier is greater, the existed signal attenuation occurs during transmission, detection accuracy of sensor nodes will be reduced or even fail. And when the network transmission links due to the malfunctioning of a node failure, the data will not reach the ground control center. Using RFID technology, Anti-pollution features of the electronic tag and the reader transmission and the diffraction function, to minimize the environmental impact of geography; with GIS analysis of the surrounding environment, truly accurate personnel positioning. And when the mine accidents occur, RFID tag will bring help to rescue; use of handheld devices that have targeted the location of facilities, staff side edge detection rescue, relief to improve greatly.

3. Under the mine the personal safety of staff problem: Implantation of clothes in the wireless data receiver can be realized well into the double protection of personnel; it apart from the ground control center received a warning message sent over in addition to the autonomy of the receiving sensor node detection data; when the data transmission is not stability or failure of data link control center to send the correct data can't be reached, it still can be achieved well into the safety of the personnel on alert.

VI.   APPLICATION OF WSNs

Zigbee wireless communication technology haswide perspective, Zigbee will be used in a couple of years in the area of industry control, industrialwireless location, home network, buildingautomation, medical equipment control, mine safety, etc, especially home automation andindustry control will be the main application fields. Zigbee wireless communication is appliedin families. With the development of people's life, the concept of smart home and home automation is well known, but it must relate to the transmission of information and signal if it comes true, so it is troublesome to wire cables. Zigbee is a new short-

range technology for wireless communication, it is specially designed for applications of wireless communication of low speed and low power dissipation, and it is ideally suited for establishing family wireless net. It is effortless to realize home temperature regulation, remote control of interior lighting systems, and automatic adjustment of curtain. Zigbee wireless communication technology is applied in meter reading system in the monitoring center just needs to analyze and calculate data acquired from users and obtain electricity consumption of users. After that, electric charge of the month is deducted from electricity account of users.The variety of possible applications of WSNs to the real world is practically unlimited, from environmental monitoring, health care, positioning and tracking, to logistic, localization, and so on. A possible classification for applications is provided in this section.

It is important to underline that the application strongly affects the choice of the wireless technology to be used. Once application requirements are set, in fact, the designer has to select the technology which allows to satisfy these requirements.

CONCLUSION

As a new wireless protocol in personal area, ZigBee has its unique characteristics including low cost, low data rate, and low power consumption which corresponds to a large market. This paper provides an application in the field of building automation. The fusion of two emerging technologies -- WSN and RFID that can give full play to the advantages of both technologies complement each other. It provides more reliable technique protection on the coal mine environmental monitoring and has great significance in China Mine safety. In this paper wireless sensor network technology is discussed along with application and it is clear that WSN proves to be emerging technology.

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