Journal and Development of Wireless Sensor Networks

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Abstract

Because of the tremendous value, there is an increasing number of researchers pay attention to wireless sensor networks. This paper introduces the fundamental concepts, hardware part and representative research projects of wireless sensor networks. This paper also summarizes the results of proposed network protocol architecture, and briefly describes the latest developments of the major research directions. Detailed progress in some most significant areas for research is also discussed. Network layer routing protocol, data link layer protocol, power management, network simulation tool are included. This paper also talked about stack optimization and energy management of cross-layer designing, Sensor Sim project and so on.

1. Introduction

Wireless sensor networks are currently of concern in the international community, involving highly multidisciplinary cross the frontier of knowledge highly integrated hot research field. It combines sensor technology, embedded computing technology, modern network and wireless communication technology, distributed information processing technology, through all kinds of integrated micro-sensors collaborate in real-time monitoring, sensing, collecting information about the environment or the object This information is transmitted by wireless, and different network modes is transferred to the user terminal, in order to achieve the physical world, the world's computing connectivity and triple world human society, sensor network has a very broad application prospects in the military defense, industry, agriculture, urban management, bio-medical, environmental monitoring, disaster relief, counter-terrorism anti-terrorism, a number of important areas, such as remote control of the danger zone has potential practical value, which attracted the attention of many countries, academia and industry. It is considered to be one of the huge influences in technologies of the 21st century.

This article first introduces the basic concepts of wireless sensor networks, including system architecture, hardware platform, the base layer and a representative research project, and then briefly introduce the latest progress of the relevant research based network architecture framework proposed last for data link layer protocols, network layer routing protocol, the protocol stack optimization, energy management. As well as several of the most talked about hot points of network simulation technology, a

more detailed overview of the progress made.

2. System architecture of wireless sensor network, the underlying hardware platform, and typical applications research projects

A typical system configuration of the sensor network, including the distributed sensor nodes (cluster), receiver transmitter, the Internet and user interface. Wherein, the basic components comprising the sensor network nodes four basic units: a sensing unit (by the sensor and analog to digital conversion module), the processing unit (including a CPU, a memory, an embedded operating system, etc.), the communication unit (by radio communication module), and power, in addition, other functional units can be selected include: positioning systems which used The Global Positioning Satellite System (GPSS)[1], mobile systems, and power self-powered systems, sensor networks, nodes can be arranged by airplane or artificial Dispenser, etc., to be deployed in large numbers in perceive objects inside or near these nodes form a wireless network through self-organization, to collaborate in real time perception, acquisition and processing of network coverage area information and data via multi-hop network nodes via Sink (Receiver Transmitter) link The transmission of information throughout the region to the remote control and management center. Conversely, remote network management center can also be controlled and manipulated in real time nodes.

Sensor network node is a miniaturized embedded systems constitute the basic layer

support platform for wireless sensor networks, has appeared in a wide variety of network node design, they are on the realization of the principle is similar, but each uses a different micro processor or different communication protocols or methods, such as using a custom protocol, 802.11 protocol, ZigBee protocol, Bluetooth, UWB communications protocols and methods, typical node includes Berkeley Motes, Sensoria WINS, Berkeley Piconodes, MIT AMPs, SmartMesh Dust mote, Intel iMote, and Intel XScale nodes, ICTCAS / HKUST's BUDS, etc., sensor network has great potential applications in various construction node sensor network platform, a full range of application requirements for various types of sea and air research projects is endless The following list only a few items which represent typical applications, for example, such as for environmental monitoring, observation of meteorological phenomena Articles and weather data, microscopic observation of biological communities, flood warning, farm management, smart home, smart Traffic(For example, interactive street signs use GPS equipment on buses to estimate arrival times for passengers[2]), radiation monitoring which will assist with future measurement in this environment.[3], and for positioning Cricket and Ecllo, as well as projects for medical SSIM, I believe that with the deepening of research and development work, a variety of sensor networks will eventually throughout our living environment, in order to realize ‘computing is in everywhere’.

3. Wireless sensor network protocol architecture

Network architecture is a set of network protocols and network protocols are layered

on the network and its components should be completed to define and describe the function of wireless sensor networks, the network architecture is different from traditional computer networks and communication networks. And Network protocol stacks could be holistically considered and designed as distributed ways to lots of global optimization problems[4]. By summarizing the extensive literature research, combined with our own experience, we propose a network architecture framework, the network architecture consists of a layered network communication protocols, sensor network management and application support technology three parts. Network communication protocol layered structure similar to TCP / IP protocol architecture; sensor network management technology is mainly the management of sensor node itself, and user management for sensor networks; on the basis of layered protocols and network management technology, to support the sensor network application support technology, following the latest developments are described as each component functions and related research.

3.1 Layered network communication protocols

Layered network communication protocol used by the physical layer, data link layer, network layer which cannot be managed without management plane communications among geographically distributed network[5], devices and control agents, transport layer and application layer. Physical layer functions include channel selection, monitor, transmit and receive radio signals and other signals. Transmission medium used in the main sensor network with a radio, infrared, light and the like. The physical

layer is designed as little energy loss larger link capacity. The main physical layer comprises narrowband, and ultra-wideband spread spectrum technology. The main task of the data link layer is to strengthen the physical layer transmission bit primitive features that make the network appear as an error-free link. This layer can be subdivided into the Media Access Control (MAC) sublayer and the LLC sublayer. And the MAC header included a preamble, a start of frame delimiter, address fields, and a length or protocol type field[6]. MAC layer which defines how different users to share the channel resources available. MAC's design has some rules. Logical Link Control sublayer is responsible for the main function of the network to provide a unified service interface layer includes packet routing network, networking, and congestion control. Transport layer is responsible for transmission control data flow, providing reliable, cost reasonable data transmission services.

3.2 Sensor Network Management Technology

Energy management: In sensor networks, energy is the power of each node Sheng valuable resource. In order to make use of sensor networks as long as possible, must be reasonable and effective use of energy. Energy management part of the control node sensor network use of energy.

Topology Management: In sensor networks, in order to save energy, some nodes at some point will go to sleep, leading to ever-changing network topology, in order to enable the network to function properly, topology management control nodes the transition state, the network kept clear data can be effectively transmitted.

QoS support: It is agreed between the users communicate with each other on the network between the network and the user and on the quality of information transfer and sharing. In order to meet user requirements, sensor networks must be able to provide users with adequate resources, performance of work acceptable to the user.

Network management: network management equipment and transmission systems on the network for effective monitoring, control, diagnostic and testing techniques and methods used. Network management functions are mainly the fault management, accounting management, configuration management, performance management and security management.

Network security: Network security polices are essential elements in internet security devices that provide traffic filtering, integrity, confidentiality, and Authentication[7].Multi-sensor networks for military, commercial areas, security is an important research content, due to the random deployment of sensor nodes in the network, as well as the dynamic instability of the channel network topology, the traditional security mechanisms can not be applied. Hence the need to design new network security mechanisms. Can learn from the spread spectrum communication, access certification/authentication, data watermarking, data encryption and other technologies.

Mobile Control: Some applications, there is a service node can be moved. Mobile Control is responsible for detecting movement and control nodes, maintaining the focal point of the route, but also to the sensor nodes to track its neighbors.

Remote Management: For some applications, sensor networks are not easily

accessible in one place, in order to manage the sensor network using remote management is essential, remote management, the system can be corrected bug, system upgrades, closed subsystem changes in the control environment, so that the sensor network to work more efficiently.

3.3 Application Support Technology

Sensor network application support technology to provide users with a variety of specific applications support, including time synchronization, node localization, and collaborative applications to provide users with a service interface.

Time synchronization: communication protocols and sensor network applications require clock between nodes must be synchronized, multiple sensor nodes cooperate with each other to determine the sleep node also requires clock synchronization.

Node localization: node localization is to determine the relative position or absolute position of each sensor node. Node localization in military surveillance, environmental monitoring, emergency and other applications are particularly important. Node localization into centralized and distributed positioning positioning.

Distributed collaborative application service interface: sensor network applications are varied, in order to adapt to different environments, having been proposed for various applications layer righteousness.

The proposed protocol are: task scheduling and data distribution protocol TADAP (Task Assignment and Data Advertisement Protocol), sensor queries and data distribution protocol SQDDP (Sensor Query and Data Dissemination Protocol) .

Distributed network management interface: The main sensor management protocol SMP (Sensor Management Protocol). To transfer the data to the application layer.

In summary, research involving wireless sensor networks are being expanded in all aspects, because many problems have not yet been completely resolved, so the research space is great, following some progress hotspot will do a more detailed description.

4. Sensor network MAC protocol

One of the core sensor networks is power management, the analysis of existing systems shows that the RF module is the largest energy-consuming node member, the main objective is to optimize the direct control protocol .MAC RF module, the power consumption of the node have a major impact.

Invalid power sensor nodes mainly in the following four sources: a idle listening: node does not know when to send data to their neighbor nodes, RF modules must always be in the receiving state, consume large amounts of energy. This is the most important source of power invalid; b conflict: a plurality of data frames transmitted simultaneously to the same node, signal interference, the receiver can not accurately receive, retransmission cause energy waste; c crosstalk (overhearing):. Receiving and processing Data sent to the other nodes are invalid power; d control overhead: the control packet does not transmit valid data, the energy consumption of the user is invalid.

Currently, methods to reduce power consumption in the MAC protocol mainly used to

reduce the data traffic has increased RF modules sleep time and conflict avoidance. Among them, reduce the data traffic is the most fundamental solution, mainly against the network layer or add a data integration layer is not implemented on the data link layer, but at the MAC layer is capable of data integration and data fusion is how to study fewer areas, yet mature research results. In addition, when there is no data node hair, close RF module into dormancy state. This method can reduce the duty cycle, reducing crosstalk and energy waste caused by idle listening, the cost of increased latency and reduced throughput of the system. Current research focuses on work / sleep strategy development, adaptive, node synchronization mechanism such as a burst of data streams. Collision Avoidance mainly RTS / CTS / DATA / ACK handshake mechanism, which addresses the conflict caused by hidden nodes, but also to achieve a reliable transmission link layer, but also increases the control overhead. At present, the MAC protocol, most of the integrated use of these means, but the specific implementation in different ways.

Early proposed MAC protocol, such as PicoRadlo, SMACS etc., they use multi-channel. Multi-channel mode, the control channel and data channel separation, or the node has a plurality of RF modules RF module in different channels using different frequencies, can effectively reduce conflicts, but increases the node complexity, cost and power consumption. For the entire network cost considerations, the price must be reduced node, the node structure and function must be simple, commonly used nodes, such as the company's xbow Mica series, only one RF module, and only one frequency. Therefore, more recently proposed MAC protocol uses a

single channel. Here are a few more representative umbrella agreement. S-MAC and T-MAC protocol with collision detection uses when sending data Carrier sense multiple access, to avoid conflict. WiseMAC and B-MAC protocol uses when sending data Carrier sense multiple access (CSMA) WiseMAC to solve the hidden node problem by increasing the carrier sensing range, the cost of increased power consumption; in the B-MAC, RTS / CTS handshake control interface provided by the high level of the MAC protocol. BMA agreement draws LEACHl491 clustering idea. D-MAC based on the analysis of adaptive work / sleep schedule, the discovery of the data forwarding interruption problem, proposed a novel solution. IEEE802.15.4 standard American Institute of Electrical and Electronics Engineers (IEEE) developed, the sensor network is one of its main application areas, the market has been able to purchase the products meet the standards of the RF chip.

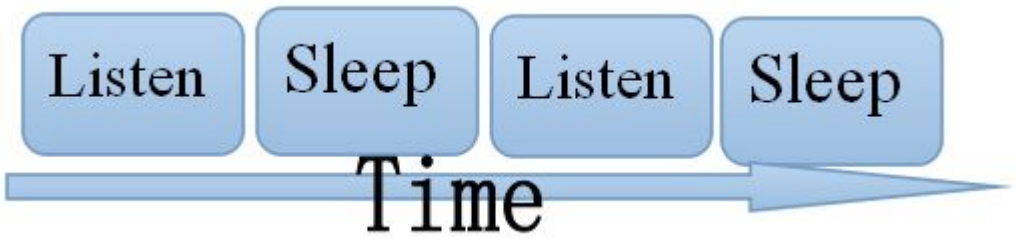

Figure 1:S-MAC Protocol

Sensor_MAC (S_MAC) S-MAC protocol sub-frame time, frame length is determined by the application. Frame is divided into phases and dormant stage work. As Figure 1 showed. In the 2002 version, the working phase duration is fixed. 2004 version in order to better support the data burst, the agreement will work to stage adjustable length. In the dormant stage, node shutdown RF modules, cache collected during this

period 'data, centralized sent session. In the beginning stages of the work, the node sends a synchronization message, after the adoption of RTS / CTS / DATA / ACK mechanism for transmitting data, to avoid energy waste caused by the conflict, through the synchronization message, the adjacent nodes can use the same work / sleep strategy, new node You can join in, this mechanism is called a virtual cluster in the agreement. S-MAC protocol uses the messaging technology, good support long message sent to the radio channel, transmission errors and packet length is proportional to the probability of successful transmission of short packet length is greater than the package, messaging technology based on this principle, the long Messages are divided into a number of short packets, using a RTS / CTS handshake, focus continuously send all short packets, can enhance the transmission success rate, but also effectively reduce the control overhead, an extension of the agreement is better, you can adapt the network topology change; drawback is the protocol implementation is very complicated, take a lot of storage space, which is particularly prominent in resource-constrained sensor nodes.

Timeout-MAC (T-MAC), T-MAC protocol with the 2004 version of the S-MAC protocol work much the same way, it will be time to divide the frame, the frame length is fixed, variable-length stage work, protocol defines five kinds of events and a timer TA, thus determining the end of time working phase. 5 kinds of events are a frame length timeout;.. B section win received data;. C data transmission conflict;. D node data transmission is complete or confirm;. E neighbor nodes exchange data. If the TA, the RF module is not listening to these five events any one considers the

channel enters an idle state. Node Down RF modules, go to sleep stage. Since the implementation mechanism T-MAC and version 2004 S-MAC is basically the same, their performance is very close to, the nodes periodically short interception channel, to determine the channel state, if the channel is idle, the node Sleep again, if the channel is busy node continues listening channel until the data has been received or is free again. Node when transmitting data, the previous frame is added wakeup preamble, so that the receiving node sends the data portion of the frame forward working condition to receive data. Add wakeup preamble, increases control overhead transmission and reception, but with a reduced power consumption idle listening.

WiseMAC will increase due to the leading wake control overhead, so it must be compressed to a minimum. WiseMAC agreement confirmed by the data packet carries the next node in a channel listener time to get all the neighbor nodes of node channel listener time, when sending data can be compressed to a minimum wake leader, taking into account node clock drift, Wake preamble length. Wherein the mouth is the node clock drift velocity, L is the acknowledgment packet times or more to the present time, L is the all nodes interception channel interval. WiseMAC can adapt well to changes in network traffic, it is ultra low power SOC chip and WiseNET combined design. However, due to the need to store the neighbor node node channel listener time, will take up valuable storage space, increased protocol complexity, especially in the high-density network node problem is particularly prominent.

backoff algorithm, confirmed by the link layer to ensure transmission reliability, the use of low-power technology to reduce idle listening listens to achieve low-power

communications, channel assessment by the received signal RSSI strength using an exponentially weighted moving average algorithm calculated the average channel noise, and then a short minimum RSSI value and average noise of time, to determine the state of the channel, including the initial backoff backoff algorithm and congestion backoff two, by application settings . The main contribution of this protocol is that it provides a series of the upper layer protocol to a bidirectional interface, e.g. setPreambleLength the like, by setting the interface, MAC protocol can be applied to many different types of network traffic.

BMA agreement is divided into two phases, the cluster set-up phase and the steady-state phase. Establishment phase in the cluster, the cluster head node election based on the number of residual energy. All elected cluster head by way of non-persistent CSMA, elected announcements broadcast to other nodes. According to cut the throat of the remaining nodes received signal strength, which decided to join the cluster. After the system enters the steady state phase. Steady-state phase consists of a number of fixed-length sessions, each session consists of a contention period, the data transfer cycle and idle periods. In contention cycle, all nodes open RF modules contention data transmission cycle. In contention period after the establishment of the cluster head node within the cluster to broadcast data transmission scheduling strategy, each node needs to send data to obtain a certain transmission time. Nodes only open in their transmission time of the RF module, send data to the cluster head, the rest of the time going to sleep. If no node transmits data within a session, then the data transfer cycle length is 0. After receiving the data within a cluster head node cluster,

data fusion, and sends to node Sink.

Data-gathering MAC (D_MAC) analyzed the work of adaptive S-MAC and T-MAC protocol / sleep strategy to find the data forwarding interruption and made swing wake strategy (staggered wake up schedule) to solve this problem. Data from the sensor nodes form a tree to Sink node tree collection, data transmission tree is unidirectional, from child to parent. Nodes of work / sleep state transitions, which send and receive work state is divided into two parts, swinging wake cycle policy adjustments in each node of the tree, so that the transmission time of the child with the parent node reception time coincides, in the ideal case, the data will always be forwarded, without any delay.

IEEE802.15.4 provides an apparatus for cheap low complexity, cost and power consumption, low data rate wireless connectivity standard, sensor network is one of its major applications. Standard defines a protocol stack MAC layer and physical layer. MAC layer using CSMA / CA access, there are three kinds of physical layer Frequency Selection: 868 MHz, 915 MHz and 2.4 GHz. To reduce power consumption, the standard uses a caching mechanism, the specific process is as follows: Node regular listener channel, receiving beacon frames into hibernation in the absence of data transmission and reception. After the network coordinator (coordinator) Sui send data to keep dormant nodes periodically send beacon frames, which carry the destination node address these data, the network coordinator node discovery cache destined for its own data frames to send poll indicates they can receive data, the network coordinator after receiving the poll frame, it first sends an

ACK frame to the node, and then send the cached data, after receiving the data, the node sends an ACK frame to the network coordinator.

5. Routing Protocol

Mandate routing protocol is to establish a route between the sensor node and the Sink node, and reliable transmission of data.[7] Since the sensor is severely limited network resources, the design principle to follow include routing protocol can not be executed too complicated calculations, not too much can not exchange routing information between nodes save much state information, node and so on. In order to effectively accomplish the above tasks, have been proposed a variety of routing protocols for wireless sensor networks mostly use the following special Point. A sensor node according to the data attribute addressing instead of IP addressing; b monitored data sensor nodes are often sent to Sink node; c raw monitoring data in a large number of redundant information, routing protocols can merge data , reduced redundancy, thereby reducing bandwidth consumption and emission power;. d meter grate speed, storage space sensor node, transmitting power, energy supply is limited, you need to conserve these resources. And he low cost of sensor nodes provides a mean to deploy large sensor arrays in a variety of applications, such as civilian and environmental monitoring[8].

Sensor network routing protocols can be categorized into the following categories:

Data-centric routing protocol: This routing protocol is based on data tracking, monitoring data in accordance with the attribute name, data fusion on the same

property in the transmission process, thereby reducing the transmission of redundant data, such agreements also integrates network layer and application layer routing tasks of data management tasks. A typical representative of such routing protocols include Flocding and Gossiping, SPIN protocol, directed diffusion.

Cluster-based routing protocols: In this type of routing protocol, will be divided into a sensor node clusters, cluster monitoring data transmitted first leader, the leader can cluster sampling data fusion, and then forwarded to the Sink node to reduce network traffic . A typical representative of such routing protocols include LEACH and TEEN.

Location-based routing protocols: These routing protocols by using the position information of the data to the target area, thereby eliminating the need to find the target node to the entire network broadcast data, in many cases, using the position information to measure the distance between a pair of nodes, in order to select a more energy-saving transmission path for data packets.

Routing protocol is based on the data flow model and the quality of service requirements: These routing protocols in a bid to provide data routing Yun meet the communication quality of service requirements. Some of the energy agreement by calculating the residual energy of each node sends packets need to carefully select Send route for data flow, in order to prolong the life of the whole network. QoS measures similar to borrow some agreement with the Internet in order to select the data stream to ensure that the transmission delay path.

In addition to the previous class of classic routing protocol design method, in recent years there have been many new routing protocols and design methods for sensor

networks, routing protocols are increasingly in-depth study and practical, for example, the use of graph theory, traffic optimization methods for sampling data News routing. There is also the MAC layer and routing layer protocols bundle design, cross-layer optimization techniques to further reduce power consumption. Routing can also have random deployment of sensor networks adjust the network topology and make redundant nodes are often in a sleep state.

6. Stack optimization and energy management of cross-layer design

Under the guarantee system communication performance (such as transmission rate, delay, packet loss rate, etc.) of the premise, optimized protocol stack designed to directly support the optimization of network energy management decide whether the network has a practical value, optimizing system design requires a global outlook Cross-layer, it is worth emphasizing that the design of wireless sensor network protocol stack must first consider the application of the characteristics of the network, and the specific requirements of complex fault-tolerance, anti-interference, energy-saving targets and other key indicators to be carried out. By drawing on research methods and modern network worm's leading wireless communications, information processing, the current sensor networks have some initial research. However, there are a lot of sensor network research project, due to the inherent characteristics of diversity and lack of knowledge of network applications, trying to design a common sensor network communication protocols and distributed data

processing algorithms. The design and execution in order to take into account the versatility of inefficiency, waste of resources, can easily become empty talk, lack of practicality and feasibility. Therefore, the need for sensor networks are classified by application, and to design and optimize the network implementation mechanism for the different categories of features. Sort include: dynamic, sensor nodes, Sink gateways, as well as the observed object changes if the relative position between the three and how to change the frequency, based on dynamic network design, you can use a more reasonable network routing update frequency, while ensuring the route At the same time reduce the routing protocol to maintain the normal function of the cost, lower power consumption and a more rational allocation and coordination between the different nodes observation missions.

Data transfer mode, based on the transmission network needs to consider what types of data streams, and in what way to spread. Environmental parameters such as sample data stream sent to Sink node can be divided in accordance with the timing of sending continuous, event-driven, inquiry-driven and mixed several data dissemination also broadcast, multicast, unicast, points, etc. . Real-time, different applications for real-time monitoring data requirements are clearly different. Node Dispenser way. Using artificial means in accordance with a predetermined rule may seem to arrange the positional relationship between the nodes, the system design of the network topology can make some reasonable assumptions; if a random fashion, the node density and node spacing is difficult to predict, which requires the system designed to adapt to a variety of network topologies; such as the need to support new nodes join at

any time, it is required to have a mechanism to ensure that the system does not interrupt the normal operation. Similarly, energy management and low power sensor network design must also be combined with the actual cross-layer, where in addition to emphasizing optimal design support protocol stack, but also must consider the node-level low-power technology. In order to reduce the power consumption of the sensor nodes in order to prolong the life of the purpose of the entire network, you need to design and achieve ultra-low power sensors, microprocessors, particularly the ultra-low-power chip RF communication. SOC is the inevitable direction of development, but also hardware and software SOC chips and MAC protocol collaborative design.

In short, there is practical value of sensor network implementation and its energy management program, must meet the requirements of specific applications. Many existing studies are in communication performance and energy consumption of the design process for a specific type of application to find a suitable compromise in order to achieve overall optimization.

7. Simulation platform for wireless sensor networks

For the average computer network, we usually adopt the applicability of simulation and actual physical measurements to measure a combination of new protocols and methods. But for wireless sensor networks, due to its own characteristics, physical measurements in many environments is not feasible, then the computer simulation becomes an important means of evaluating the performance of sensor networks,

efficient and accurate simulation tools to promote networking technology development play a great role. For example, NS2 network simulation tool uses a series of object-oriented design methods, through a large number of simulation module that provides a wide range of network protocols used for simulation analysis, and made a very intuitive system performance analysis, as well as similar as well OPNErc GlotrioSirri other specialized simulation for mobile communications, the emergence of wireless sensor networks has opened up many new application areas, but also made a lot of new, previously wired and wireless networks have not encountered problems. In a wired network simulation, NS-2 and OPNET widely used in the performance analysis of wireless sensor networks are not very suitable, so now there have been some characteristics of wireless sensor networks and development of new parallel simulation languages and simulation tools, the following will introduction.

Wireless sensor networks are highly application-oriented network type, which is significantly different from the simulation analysis simulation characteristics of existing wired and wireless networks in the following aspects. Simulation scale: the traditional wired networks, with limited representative node topology can simulate the performance of the entire network to a large extent, but for wireless sensor networks, because of its large redundancy, high density node topology structure type, therefore can not be used to analyze a limited number of nodes in its overall performance, and therefore must be considered in the simulation scale parallel computing a large number of nodes. Simulation Target: traditional wired and wireless networks are the

main simulation analysis network throughput, QoS indicators-end delay and packet loss rate, and most of these in the application of wireless sensor networks is not the main objective analysis. In contrast, in the past, the network model is not so unnoticed node life analysis, energy analysis node is become a very important objective analysis. Business Features: In traditional networks, the actual type of environment simulation analysis of relatively fixed, such as real-time multimedia communications major is to consider the amount of information in the case of a constant bit-stream performance of the network; datagram network is mainly considered random packets of the Poisson distribution generation and transmission, but for wireless sensor networks, which is based on a random event-driven type of business, and its use is highly for different applications, so there is not a fixed business model. Also generate random events, and even within the event would not have happened Chi network presence throughout the life cycle, and therefore can not be applied to any kind of existing network business model to model. Node Features: Wireless sensor networks are highly interactive with the system of the physical world, and therefore affected by a very serious incident. This is not only reflected in itself subject to noise, interference and sabotage and other factors considered, but also reflects the instability of nodes. Due to the limited capacity of the node itself with its prone to failure (for example node energy depletion caused), which are exacerbated by the uncertainty of the network, and these cases are rarely seen in the previous system. Other features of wireless sensor networks: In addition to the above aspects, wireless sensor networks in many other directions have introduced their own uniqueness, such as a network node operating system itself

should be very streamlined, this is different from the traditional router nodes and nodes personal computer operating systems. In addition, the previous network simulation system is generally a combination of a fixed level modules together, such as MAC layer protocol family make 802, the transport layer using the TCP / UDP protocol, but in wireless sensor networks, due to its high for the characteristics of different applications, simply do not have a unified fixed combination agreement, and therefore how to build more accurate models and protocols abstract nodes in the simulation is a question worth exploring.

Despite the presence of various sophisticated network simulation platform, such as NS-2, OMNeT ++, OPNET, GloMoSim phase QualNet, but due to a very special nature of wireless sensor networks, which have some of the limitations of the simulation platform used, many scholars put a lot of effort applied to specialized sensor network simulation tools, there are more representative of the results of the following items. SENSE project is to address the deficiencies of traditional network simulation tools used in the field of wireless sensor networks and the development of a simulation program. SENSE after making necessary changes for the NS-2 comes from. SENSE using the system structure for the module, the use of the inter-module reusability principle, as long as the interface between the modules to meet the requirements, the module can be reused either be replaced, even fully developed on the basis of the new application SENSE simulation program , differs from other simulation software is used SENSE parallel simulation and optional serial emulation mode, the system defaults to serial emulation. This is taking into account the parallel

simulation software simulation, in many cases resulting in low efficiency, thus giving the opportunity for users according to their needs appropriately selected.

TOSSIM project is based on a simulation tool TinyOS system, which is characterized by the establishment of a TinyOS bottom part of the hardware abstraction software and adds the necessary event simulation models and external communication mechanisms. TOSSIM been used in TinyOS node performance analysis and simulation run TinyOS found to solve some flaws within the system. TOSSIM foot height for TinyOS system simulation tool can be bit-level simulation, and this is

Most simulation tools currently not available. The direction of current efforts TOSSIM project is to expand the simulation model, functional modules provide some preliminary version does not have, such as battery performance analysis module, CPU runtime module.

SensorSim NS-2 simulation tool is developed on the basis of, the idea is to build a model to adapt to the wireless sensor network library on the NS-2. SensorSim were using functional model and energy model to simulate the node software (various protocol stacks, applications related programs) and hardware components (CPU, power supply, RF receiver circuitry and sensors). The hardware simulation main idea is to build a power supply to a single physical hardware multi-mapping hardware by using the power of the analysis to summarize the characteristics of the overall power consumption of the node. SensorSim mainly completed the power supply and RF receiver circuit model, other aspects of the model is being perfected. Endeavors SensorSim project is mold intermittent characteristics of the battery to further refine

the proposed battery model, while also continuing to complete the construction of the model library include various sensors hardware features software simulation work. EYES project Stefan Dulman, Paul Havinga etc. OMNeT ++ simulation platform based on the development work carried out for the characteristics of wireless sensor networks, and implement some existing protocol validation. The project is an important European EYES project content.

8. Conclusions

In this paper, the impact sensor network design and implementation of several key hotspot issues are summarized. You can see that the wireless sensor networks in the process of development to the practical, and there are many theoretical and engineering problems to be solved, so all levels as well as cross-layer design has a significant research and development space. I believe that with resolve many issues related to wireless sensor networks will eventually enter into our lives and play a important role in social progress.

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