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The Internet of things and Smart Grid

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Abstract. The Internet of things and smart grid are the frontier of information and Industry. The combination of Internet of things and smart grid will greatly enhance the ability of smart grid information and communication support. The key technologies of the Internet of things will be applied to the smart grid, and the grid operation and management information perception service centre will be built to support the commanding heights of the world's smart grid.

1. The Internet of things

Internet of things is an important part of a new generation in the field of information technology. There are two meanings: Firstly, it's the core and foundation of things that is still the extension and expansion of the Internet. Secondly, its client extends and expanses to any object and between objects to exchange information and communicate. The Internet of things is defined as any objects is connected to the Internet by RFID, infrared sensors, GPS, laser scanners and other information sensing device to realize intelligent identification, location, tracking, monitoring and management of objects.

1.1. Radio Frequency Identification

By radio signals identify a particular target and support for reading and writing data, radio frequency identification technology is a technique to establish specific optical or mechanical contact in the specific target.

Generally speaking, the structure of the RFID system that include an electronic tag and a reader is not very complicated. The electronic reader can identify the corresponding electronic data In the electronic tag by identifying items specific marker information. When in practical use electronic tags that can be used to recognize the goods are bundled to Items to be identified. For example, we often see the electronic mark in the shopping mall. Between the electronic reader and electronic tag reading and writing data is realized by the special communication protocol. In general, the electronic reader sends the corresponding instruction to the electronic tag. After receiving the corresponding instruction, the electronic tag can return the designated symbolic data in memory to the reader. This widely used method of communication can be achieved does not require contact but the use of electromagnetic changes.

Reading distance, the normal work between the electronic reader and electronic tag distance, that is one of the most important indicators for RFID system. In practical applications, the radio frequency identification system is bid difference in the reading distances. In general, RFID systems' reading meters are in the range of meters to hundreds of meters. In the low frequency part its' range of



action is in meters, otherwise, can reach meter to meter. According to the study, an active tag to make the maximum effective distance reach meters usually is used.

1.2. Infrared Sensor Technology

Infrared Transducer (ITR) can measure temperature sensitive physical properties by the infrared ray. Infrared light, also known as infrared light, has the physical properties of reflection, refraction, scattering, interference, and absorption. Anything, as long as it has a certain temperature that above absolute zero, will be provided with radiation infrared. The infrared sensor measurement can be done without direct contact with the measured object directly, so there is no friction and has the advantages of high sensitivity, fast response and other advantages.

The infrared sensor is composed of optical sensing system, detection element and a switching circuit. According to different structures, the optical induction system can be divided into Transmission type induction system and reflective induction system. The sensitive element is widely used in thermal resistance. Thermal resistance will be heated by infrared radiation and then the resistance will be changed. After that, the transformation of electrical signal changes response to change-over circuit.

1.3. Global Position System

GPS is composed of a space satellite, a ground signal connecting point and a user signal receiving device. It can provide users with high precision position, speed and temporal information in all-weather continuous real time. Compared with the positioning function, it's more important and widespread for GPS to apply in power system. The monitoring and protection system in electric power system such as microcomputer protection and security automatic equipment monitoring system, dispatching automation system, wave recorder automation equipment fault accident, all need accurate time standard to achieve accurate synchronization purposes. With the development and expansion of power system, especially the scale of power grid, it's also required higher standards of accuracy and convenience.

1.4. Machine to Machine

Current trends in the development of communication technologies is gradually moving toward integration from the development mode of independent parallel. As known, such as the integration of mobile communication network and computer IP network, signal network, TV network, computer network, satellite communication network, power network all towards integration. M2M can transform information from the terminal to another terminal, which can be described as a dialogue between the machine and the machine (Machine to Machine). In general, M can represent the machine (Machine), person can represent the Man and mobile device can represent Mobile. As a result, M2M becomes the connection and communication between people, machines, and mobile devices. M2M covers almost all the technologies and means to build connections between people, machines, and systems, and is often considered a representative of the Internet of things. M2M technology provides a unified network platform for different devices, enabling digital city, digital power system, intelligent grid, information resources and data resources by the unified network platform.

The integration of RFID, a sensor network (based on sensor technology), M2M, industrialization and industrialization is called four major supporting technologies of internet of things. Two integration is mainly used in industrial information, especially in the automation and manufacturing industry. RFID, M2M and sensor network play a key role in the smart grid plays especially. The relationship between the four is shown in Figure 1.

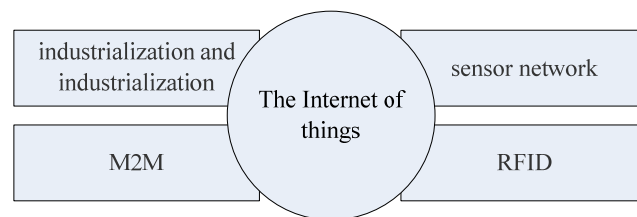


Figure 1 Four major supporting technologies of internet of things

1.5. The security problem of networking technology

Security of the Internet of things system is in accord with general computer system and IT system security. Its' security reflect in 8 scales, such as Read controllability, data confidentiality, user authentication, privacy protection, non-repudiation, communication security, data integrity and availability. The first four relates to three layer architecture of DCM networking application layer and The latter four are mainly related to the transport layer and the perception layer of the Internet of things. Among them, the most popular two safety problems is that "privacy protection" and "credibility guarantee" (that is data integrity and confidentiality). Especially networking technology in the primary and intermediate stage of development, you can find that the current security system can basically meet the needs of networking applications by analyzing the hierarchical architecture of the IOT technology.

Compared to Internet technology and computer technology, the Internet of things technology has its own unique security problems. Special attention is needed to cause:

①Skimming: The information may be read In the terminal equipment or operator cardholders unknowingly.

②Eavesdropping: Intermediate information may be intercepted in a communication channel.

③Spoofing: the data by forging or copying equipment the Data entry system falsely.

④Cloning: cloning of terminal equipment and impostor

⑤Killing: The terminal device may be damaged or stolen

⑥Jamming: The system can't use fake data and cause the blocking of equipment

⑦Shielding: using mechanical means can shield the electrical signals which may lead to the end can't be connected.

But based on the main issues mentioned above, Things will face the following five specific (it does not exist in general IT security issues in information security) in the stage of Middle and advanced stage of Internet of things development.

(1)4 categories (a total of 4 kinds of networks, such as length of wire communication, short distance wireless communication and the long and short distance,) are mutually connected to heterogeneous, multichip, multilevel distributed network problems, will lead to a unified security system that is difficult to achieve effective "bridge" and "transition".

(2)The difference of Read device type, big and small and handling capacity will lead to security information transmission and processing in unified difficult.

(3)When the equipment may be out unattended, lost and in a motion state networking communication connection may be intermittent or poor credibility. A variety of these factors will increase the complexity of the design and implementation of information security systems.

(4)There may be difficult to ensure a smart object be distinguished and accepted and keep the transmission of information safe and hard.

(5)Tenants may use a single server model, which presents almost stringent requirements for the design of the security framework.

2. Smart-grid Technology

2.1. The definition of smart grid

Different countries have different definitions of smart grid, and there is no uniform definition. A more consistent view is that make the development of electric power energy conversion (power), transmission, distribution and sale of electricity supply realize centralized management by means of informatization, the whole system of electric grid in the aspects of intelligent communication, realize the precise power supply, complementary power supply, improve energy efficiency, reduce network losses, power supply safety, save the cost of electric power network, it is called a smart grid. According to the US Energy Agency's report on the modern grid, the smart grid has 7 major features. ①Self-repair ability (self-healing); ②it can arouse the user's initiative to participate in the operation of the power grid (incentive); ③ Effectively defend attacks (Security); ④it can provide reliable high quality power (high quality); ⑤it is able to accommodate various types of power generation and storage (new energy participation); ⑥it can Build a thriving electricity market; ⑦ it can optimize the power equipment and Reduce the loss of power grid operation and operation cost.

The national Power Grid Corp define the development direction of smart grid in China as "strong smart grid." It regards UHV power network as the backbone network and is based on the coordinated development of power at all levels, Support with information and communication platform. With information technology, automation, interactive features, including a power system of each link, covering all the voltage level, which realize the integration of modern power grid with "power flow, information flow, business flow" business.

2.2. *Strong smart grid technology system*

(1) Smart sensing technologies. if you want to control A complex Strong smart grid, you need to be able to observe effectively. Sensors and network support, represented by fiber sensors, smart sensors, wireless sensors, become the necessary technology for smart grid.

(2) Wide area measurement technology. PMU has been widely used in power systems, which uses high-precision pulses provided by global positioning system. Voltage at each site of the power system and Current signal synchronization accuracy reach microsecond level to Provide synchronous time scales for synchronous pharos measurement

(3) Power electronic technology. High power electronic technology includes HVDC transmission, flexible AC transmission, custom power, flexible DC power transmission and other aspects. it has a large number of applications in In SVC, TCSC, FCL, CSR, UPQC as the representative of the new transmission, reactive power compensation, power quality control.

(4) Simulation analysis and control decision technology. From the aspects of digitalization, visualization, decision control to carry out unified planning of smart grid, inspection and management we can analyze, control and ensure the condition of smart grid.

(5)Information and communication technology. Information and communication technology can provide the "plug and play" technical support for smart grid. Information technology includes spatial information technology (including GIS, remote sensing, GPS), streaming media technology, information intelligent processing technology and so on. Communication technology including optical fiber communication technology, wireless communication technology, power line carrier communication technology. Many of these technologies have already been applied in the current power grid, but their applications are still relatively narrow and need to be further extended.

(6) Intelligent equipment and intelligent device. Intelligent equipment and intelligent device covers all aspects of the smart grid, covering power system, transmission, distribution, and use of the various links. Each element can be a smart device or intelligent equipment control, an organic part of the smart grid.

3. **Combined with network technology and smart grid**

Smart grid is one of the most important applications of Internet technology and vice versa. Technology used in smart grid networking can achieve perceive and accessing advanced and reliable communication information and realize transmitting, controlling and calculating distributed intelligent information. Through smart sensors holding various equipment and installation together can form a

unified information service bus to analysis information, cut the cost and make the power grid operation and management reach the optimum.

The three layers of reference system of internet of things are perception layer, network layer and application layer. In the smart grid change into a smart grid sensing layer, network layer, and application layer of smart grid. The frame of the three floor is shown in Figure 2.

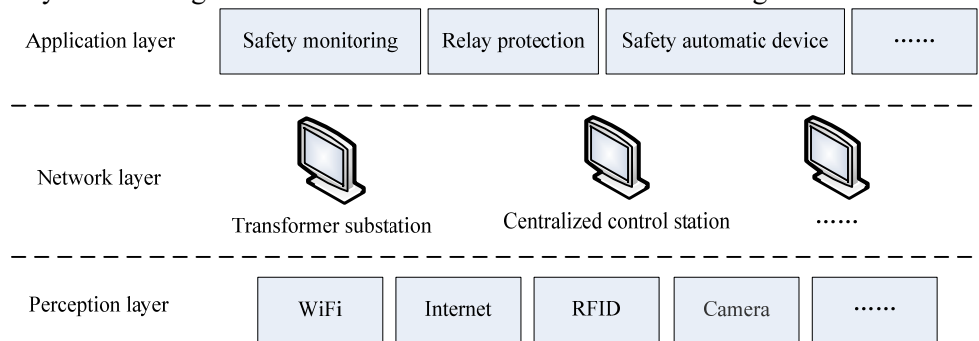


Figure 2 The frame of three floor in smart grid

In the smart grid, the Internet of things consists of WSN that constitute the perception layer. Internet of things includes two-dimensional code tag, reader, RFID tag, camera, various sensors and the necessary network components and the main role is to identify and detect, collect and capture information required.

The smart grid network layer is mainly composed of cable, optical transceiver. By using hierarchical control, network transfer, transfer, diversion, or substation centralized control station can call and get the information they need and handle Different information. Therefore, the network layer not only has the function of network also has the ability of information processing. At the same time, the network layer select, compute process and save the massive information form Internet of things to enhance the insight and performance of smart grid.

According to the actual needs of the smart grid, the use of networking technology can realize the intelligent power grid in application layer. In the application layer it can eventually realize the complete integration of information technology and smart grid technology to make the development trend of smart grid have a corresponding effect. In order to realize the aim at supplying electricity accurately and using an electric. The key lies in the use of the application layer can through information technology to meet the various needs of smart grid. It truly protects the safe use of electricity and improves energy efficiency.

In summary, the main function of the perception layers is to realize the intelligent perception of the entire Internet of things in the three levels of the internet of things. Through the use of radio frequency technology, sensor technology, self-organizing networks and short-range wireless communication technology, it can achieve information acquisition, capture and object recognition. The main function of the network layer is to realize the transmission and communication of information, which can be based on the inherent telecom network or the internet. The main function of the application layer is to realize all kinds of specific applications, including intelligent control, monitoring and so on. In the power generation section, through the Internet of things technology, it can improve the detection level of the state of the unit, and improve the stability and flexible operation of the unit. In the transmission link, through the Internet of things technology, it can effectively improve the transmission efficiency and reliability of transmission, realize automatic diagnosis and ensure the safe operation of transmission lines. In the substation link, through the Internet of things technology, it can effectively improve the status of substation equipment maintenance, improve the service life of equipment. In the distribution sector, it can check and warn early the Distribution network state Through the Internet of things technology, which can ensure the production and daily use of electricity, achieve management optimization, improve reliability of supply, cut down on wastage and improve the quality of service.

4. Conclusion

This paper introduces the technology of Internet of things and the technology of smart grid, including radio frequency identification, infrared induction and so on. These technologies are combined with smart grid technology and exist in all aspects of smart grid. The Internet of things in smart grid is also made up of perception layer, network layer and application layer. The network layer is responsible for the processing of information. The network layer is responsible for the processing of information. The application layer is responsible for determining the processing method in accordance with the needs of the grid.

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