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A STUDY ON INTERNET OF THINGS ARCHITECTURE FOR UBIQUITOUS POWER

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Abstract:

The ubiquitous power Internet of Things is the link between power system equipments and the monitoring devices and the engineers who control them. In fact, the data obtained by the system is using sensor technologies first. The data is then transmitted via communication technology to the server. Finally data are interpreted and stored by massive data, cloud storage, man-made technology and others. The customer and power supply provider will then collect the related data of each power grid connection and make the data visible and shared. The power plant is a broad system of many similar appliances. Therefore a broad framework is required to cover all facets of the omnipresent force of the Internet of Things to satisfy the applicable requirements. This paper suggests an infrastructure for the Internet of Things for power, including the aggregation of underlying data, security and sharing of information and data storage.The collection, transfer, retrieval and storing of data is very simple with this architecture.

Key Words: Internet of Things, Ubiquitous Power, Device, Architecture

Introduction:

In 1999 Professor Ashton, at the MIT Auto-ID Centre suggested the Internet of Things (IoT), anemerging technology that was first explored by RFID. IoT is an important push to promote the composition of networks for diverse applications. It helps objects around us to interact with each other through the web [1]. IoT consists of three components, a layer of perception, an implementation and a network layer. The IoT from the awareness layer is connected to actuators, sensors, RFID tags and other smart terminals. The contact between the things and human beings is responsible for the network layer. The application layer [2] provides the link to various applications where the IoT system will be used. Over the years, technology connected to the Internet of Things has been very advanced, setting the strong groundwork for the building of the all-encompassing power of the internet of things. The alluring strong Internet of things links energy consumers, grid companies, power generation companies, manufacturers and the equipments to produce shared data as well as people and things. It represents consumers, grid, energy generation, producers and the public. It takes the grid as the middle, plays a forum and shares the role, generates more resources and provides value services for the growth of the whole sector and more business entities [3]. The machine is enormous and features various facilities, including electricity generation, substation, transmission, distribution and power. Therefore a pervasive Internet of Things requires various infrastructures. A selection of sensors and a range of MCUs were used for the perception layer. A variety of networking technologies and so on is used in the network layer. Applying embedded infrastructure for gathering data perception layers, application layer protocol formula,data encryption algorithm, use of different communications tools and centralized memory store is recommended to harmonize standards as far as possible.

Related Architectureand Standards of Perception Layer:

In order to reach the pervasive power Internet of Things, we suggest a new architecture for "things." This newdesign facilitates data collection, storage, processing and transmission features for every forms of applications and devices in the all-round energy Internet of Things. It is possible to implement the architecture directly or by incorporating other components. This architecture will also be used for concurrent tracking, data collection of physical parameters and equipment management in various areas of the pervasive power Internet in items environment. We used IEEE1451.2 as a guide to many actuators, sensors and transducers in this design. This Standard defines a range of requirements for the acquisition of data from the description of the sensor interface [4], [5]. There are a number of MCU data storage and processing connections including single-chip processors, DSP, FPGA, and so forth. They have different costs and different situations. Single chip machine DSP and FPGA cost even more. Their benefits are service and in real time, whereas single chip computer peripherals are more versatile. In most cases, the single-chip computer is more advanced and still beats the single-chip computer in the Internet of Things for power systems. The architecture contains different MCU-linked sensors through different MCU peripherals. The MCU is connected to the memory module and the contact module. The whole machine is primarily battery-powered. The application layer protocol then organizes the data. The data are encrypted and finally managed by the MCU for the safe transfer of the data. Data are transmitted to the server via the contact module.

The majority of implementations of the omnipresent power Internet of Things are powered by dry batteries, and the device thus requires a high degree of low power consumption. In the past, MCU systems always waited for events in an infinite number; the CPU always performed. Furthermore, almost all changes have been made to multiple examples. This could be modified by using event-driven programming techniques from the hierarchical state machine (HSM). A loop, event processor (EP), un-preemptive kernel or preemptive kernel is present in the code below. It also contains the application monitoring device monitoring framework. This programming technology is used for the architecture. The specific state machine and active objects are created; the applications and related software programs are written and explicitly transplanted within the programming technologies as long as the application scenarios and related specifications are specifically analyzed.It can then be seen right away. This helps you not to build spaghetti of cookies or IFs but instead to generate effective and maintainable applications with well-understood behavior. Incomparably more versatile and resilient to change than conventional an event-driven program

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focused on state machines [6]. It also stops a vast volume of applications for multiple design scenarios from being typically rewritten. And every time a poll shows that there have been no activities that extend the battery life, the framework enters a low-power mode. By comparison, the standard solution provides little space for a transition to low-power sleep mode and is thus much less convenient for incorporating low-power designs.

There are several forms of powerful internet data including temperature, moisture, current, etc. We have therefore established a single application layer protocol to unify the specification and promote management. The protocol consists of the start character, company number, department number, department form number, system number, product type, packet type, data, final character and testing CRC16. The value of the data contains an integer part and a fraction part, for example, the value of the temperature is a whole of one byte and a fraction of one byte. There is no set data length. The records of the Power System must be backed up to protect the data. The AES128 encryption algorithm is used universally to simplify administration. The algorithm has been developed specifically for encrypting 16 bytes of data. The length of the data of the above protocol is thus not set such that the data is supplemented with 0 for the fixed portion and the data obtained to a multiple of 16 for the whole Protocol length. The key also consists of 16 bytes of information. To complicate the key, the encryption algorithm AES128 will first be used to encrypt the key and then use the encrypted key to encrypt the protocol details. And all 16 bytes of protocol data are separated and encrypted and transmitted. Data on the server side was decrypted and merged to guarantee data protection. Another protocol can be used for the scene in which the image is acquired, unifying a video format and compression algorithm. The infrastructure listed includes the data acquisition architecture, the embedded computing platform, application-level standard protocols, and encryption algorithm standards. The perception layer's related aspects are structured and make the collection of data in the omnipresent Internet of Things very simple.

Related Communication Technology:

For the omnipresent force of the Internet of Things there are multiple networking technologies. The two broad types of networking infrastructure can be classified: 1) wired and 2) wireless. Both have their pros and cons. Wired contact has the benefits of secure transmission, protection, speed and good applications anti-interference. Furthermore, wired connectivity in the operating environment is poor and can be used in a number of settings. At the same time, the wired communications rely on the physical media in order to disseminate such that the total radiation emitted is small and the effect on the human body is limited. Wireless networking is easy to install and does not necessitate cumbersome cables. At the same time prices are smaller and the spatial landscape can be deployed flexibly and less damaged [7].The commonly used wired networking technologies for power systems are: optical fiber and energy transmission (PLC). Wireless connectivity covers ZigBee, WLAN, and the newest NB-IoT, LoRa and the current 5G developments.

The pervasive power Internet of Things has different connectivity infrastructure specifications in various settings, including speed, delay, energy usage and coverage. The use of any communications technology must be systematic for centralized management. The media and interfaces of a particular wired networking technology should be standardized by using wired communication and the communication protocol should be incorporated.The benefits of wireless NBIoT technology include low power consumption, wide link, high coverage and low costs. It can be immediately upgraded and is comfortable to use based on existing stations. But the rate of transmission is lower and the delay is longer. NB-IoT technology, which can achieve low cost and low power consumption, can also be used universally in the pervasive power Internet of Things with a low latency and speed specifications such as metering or temperature control. And in more distant areas there are still stronger signals. The commonly used CoAP protocol is to be used reliably with NB-IoT technology. Real-time control can be accomplished using commercially available 5G technologies for scenarios of high speeds and latency requirements.

Data Storage and Processing:

The pervasive power of the Internet of Things is to communicate and engage with knowledge in the power system anywhere, wherever, anyway. This eventually produces a vast volume of data at all times and after submitting this data to the server, the data cannot be lost. In the internet and Big Data age, data are resource and richness, so for more processing and query, these information must be processed. Thus clearly, the standard database would not comply, and the time series database could well meet the needs of the Internet of Things era for a vast volume of data storage.

Time series data is a time-based series. These data points are related to a line in the time-coordinated coordinates. Many latitude reports can in the past be used to display patterns, regularity and abnormality; large-scale data mining, machine learning, simulation and early warning can in future, be carried out. Only the present value of the data is documented in contrast with the standard database while the time series database preserves all the historical information. At the same time, it still takes time to query time series data as a philtre condition [9]. The data will be consulted in the future at some point after the data have been preserved in the time series archive. And data can be analyzed using different smart algorithms to benefit from Big Data. For example, current data of irregular lines can be strictly categorized and neural network algorithms can be used for training.Therefore it is possible to benefit immediately from a significant amount of training in the subsequent results, which are current information on short circuits, open circuit current and regular information. This simplifies the judgment and treatment of the mistake by staff.

An Example of NB-IOT Uploading Temperature and Humidity Data:

Applications of NBIoT technologies are listed below. In this case, the above design is used to read the temperature and moisture data by the MCU with the sensor SHT20 in a certain time. The data was submitted to the server after processing. In power system settings where latency and speed are not important, it can be used to track equipment. It may be used for example, in cable trenches to track cable trench temperature and humidity. The cable trenches are critical temperature and humidity, which control the cable's operation. Because of the location of the cable trench, it is impossible to get signals in the cable trench from the previous wireless networking technologies. Enhanced by 20dB NB-IoT technology coverage is 100 times the coverage update. In subway cable tunnels and distant substations, the signal is excellent.To facilitate terminal entry, NB-IoT can accommodate 50,000 connections under one cell. Because corresponding NB limitations have been implemented by the telecom operators, data transmitted must go to the network first. Through filling in a private server address on the operators' website, data can be sent to the power company's own server. When the data enters the private archive, it is easy to decode and merge the original data. For the purposes of getting the necessary data, the initial data is parsed by the protocol, and the intellegent algorithm is then used to interpret data for the regular functionality of the cable. In a time series database the data are stored.

Conclusion:

We are suggesting an architecture ideal for all-around Internet of Things. This design encompasses the hardware design for data collection in the perception layer, the MCU software platform, the application protocol and our enhanced encryption algorithm for network layer communication technologies classification and standardization as well as data bases for application layer unification. For the bulk of the situations in the ubiquitous internet of things, the norm and guide is given. First the built framework protocols can be strengthened and categorized so that it can be extended to multiple situations more effectively. We are now in the process of evaluating the use of the omnipresent power Internet of Things to further develop the architecture suggested. We hope that the omnipresent power Internet of Things will soon be completed.

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