

Research on Smart Home System Construction based on the Internet of Things (IOT) and Big Data

Xinxin Xie^{1,a}, Wenzhun Huang^{1,b*}

¹Department of Electronic Information Engineering, Xijing University, Xi'an, 710123, China

^aemail: 346148500@qq.com, ^bemail: huangwenzhun@xijing.edu.cn

Keywords: Smart Home, System Construction, Big Data, Internet of Things, Systematic Design.

Abstract. In this paper, we conduct research on the smart home system construction based on Internet of things and the big data. As cloud computing and big data are widely used in smart home, intelligent household from wired to wireless, makes the operation of the user can add simple convenient. User home smart home can be the data stored in cloud computing platform, and can at any time and at any place through the cloud plate a smart home control the corresponding operation. Digital home is the information and digital technology comprehensive application in life that is based on the computer technology and network technology, the use of digital technology, the personal computer is combined with traditional household appliances, centered on high performance computer. We enhance the basic smart home system with the integration of data analysis that is novel.

Introduction

Into the era of Internet of things, the intersection of science and technology to promote the rapid development of the embedded hardware software, the basic technology of smart home are getting better, such as household equipment cable PLC local area network technology, wireless WIFI, smart grid, after the intervention of general Internet access technology, and constantly expand the central management functions of smart phones and the intelligent, smart meters, smart switch socket industry support, etc. to make smart home began to appear strong service and system building skills.

Compared with ordinary household, smart home not only has the traditional residential function, provide safe, high grade and the pleasant family life comfortable space as also from the passive static structure into a dynamic intelligent tool, to provide a full range of information interaction function, to help families keep smooth communication with external, optimize people's life style, help people to arrange time effectively while enhance the security of home life, and even provide various energy cost saving plan. Household intelligent web services SOA framework by the resource layer, adapter layer and intellisense application layer three parts. (1) Resource layer is the abstraction of perception and operation interface, not only support intelligent household system of data acquisition devices access gateway, also can transfer data adaptation layer information. Considering the resource layer based on family gateway, designed as a collection of standard operation interface, and according to the dynamic adjustment of the device interface household. (2) Intellisense application layer by sensing the user's preferences, habits and state feedback information, intelligent household services through inference dynamically that realize intelligent household service mode of personalized and intelligent. (3) Web services based on SOAP protocol which can realize the seamless interaction between basic different platforms, using web service mode, in extensible markup language as a data representation format to complete parsing and general adaptation of heterogeneous data, implement and intellisense seamless interaction between the application layer. The introduction of the adaptation layer can make the other two layer structure problem without considering heterogeneous data, so as to improve the response speed of system while improve the user experience [1-3].

All the appliances in the future, residential facilities are connected to the Internet, large and small home appliances are real information home appliances. Artificial intelligence will be widely used, and the application of the control network of neurons will make smart home organization more effective, more convenient management. Intelligent environment through embedded in a physical

space, voice recognition, computer vision and metope projection and other modal interaction ability, hidden from sight of the computer can determine people's intentions and to make appropriate feedback or action, to help people work more effectively or to improve the quality of people's lives. Accordingly, in Figure 1, we demonstrate the overview of the smart home system.

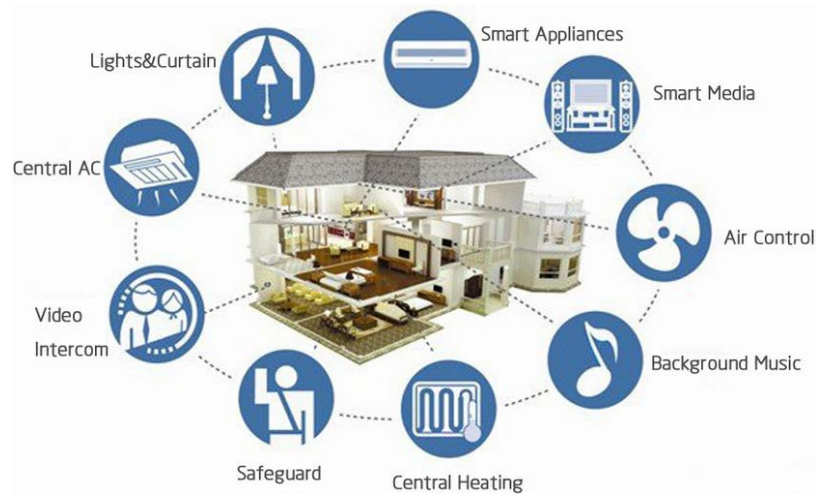


Figure 1. The Overview of the Smart Home System

In this paper, we conduct research on the smart home system construction based on the Internet of things and the big data. In the information highly developed today, all kinds of communication and the Internet technology to promote the great progress of human civilization. How to make life more efficient and comfortable as the pursuit of many people as the concept of smart home came into being. In the following sections, we will propose our perspectives in detail.

The Proposed Methodology

The Internet of Things. Over time, the related research and application of Internet of things is more and more attention, the Internet of things is regarded as important areas to keep basic national core competitiveness in the new century, is the big opportunity to realize leap-forward development in our country. Predictably, along with the development of the Internet of things will bring vast innovation space: from a technical point of view, the Internet of things will directly promote the development of the computer industry, communication network, sensor industry technical innovation and automatic control or related industry, from the perspective of industrial design is concerned, the Internet of the things under the background of product design, the innovation space more broad [4-5].

According to the survey, the primary techniques of the IOT could be summarized as the follows. (1) Smart technology. Smart technology to effectively achieve the purpose of a forecast while using the knowledge of all sorts of ways and means through the intelligent system in the object that can make objects have a certain intelligent, to the realization of active or the passive communication with customers, is also one of the key technology of Internet of things. (2) Sensor network. In recent years, a large number of scientific research in wireless sensor network literature, and points out the several problems of each layer protocol stack and the main purpose of the solution concentration in energy saving, scalability, reliability and robustness. (3) Radio frequency identification technology. When an object with RFID tags is through special reader, tag reader will be activated, and tag information will be transmitted by radio waves to the reader and the information processing system, thus complete the information collection work which is responsible for the control and information processing system according to the specific requirements to process information appropriately.

As a new networked computing system, the concept of Internet architecture and the architecture of networked computing system as given above, therefore, in the design and implementation of Internet of things need to set up the Internet of things first before system structure, in order to make the final set up of the performance of the Internet of things system consistent with the expected demand. The Internet of things is the new network architecture that can achieve global tracking and sharing of the

information of the item. At present, the sensor network for the Internet of things technology research includes the following aspects.

- Because of the sensor network is the bottom of the Internet and the information source, the network performance parameters, such as own integrity, integrity and efficiency is critical.
- Integrated sensor technology, with embedded computer technology, distributed information processing technology, such as collaboration to real-time monitor, sense and collect all kinds of environmental or monitoring object information and carries on the processing and delivery.
- Network topology in the node failure occurs and is likely to change that should consider the self-organizing network, automatic configuration ability and extensible ability [6].
- Sensor network in addition to the general wireless network of basic information disclosure, tampering, replay attack, denial of service, and other threats, also face sensor nodes are easily manipulated by the attacker physics, and obtain all information, stored in the sensor node is to control the threat of the part of the network.

The IOT Assisted Smart Home. Household appliances on radio frequency tag, central controller location and running state of the object that can be detected at any time, to reduce the communication between the equipment designs reducing power consumption. Food on radio frequency tag, on the refrigerator, food in refrigerator, speaking, reading and writing device read information, automatically adjust the suitable temperature and humidity of food.

Management information system that can be seen in every field of work and life, but smart home information management system is not only just need the collection and storage of information, but need to use the method of artificial intelligence, the laws between the mining data, coordinate with electrical equipment operation that reduce the core power consumption. Intelligence lives in a unified information platform on the basis of the general common information management system need to add intelligence analysis and control module, to achieve the intelligent electric control. In addition, the unified information platform needs to provide standard communication interface to communicate with various types of electrical equipment, information collection equipment operation.

With the improvement of the increasing household appliances and electrical appliances intelligent, smart appliances need to closely communicate with the central control information system. But at the moment of household electrical appliances in the world of communication interface and no unified standard communication protocol, and lead to general intelligent electrical equipment or inability to communicate with each other on the market, or the central control information system is difficult to communicate easily with intelligent electric appliance, so formulate unified household appliances communication interface and communication protocol is important aspect in the development of the basic future intelligent electrical appliances and general scenarios [7].

The Big Data and Smart Home. Because of the smart home system data are stored in the cloud computing platform, the user is through the cloud computing platform to realize the control of the smart home devices, so also in the existing cloud computing and basic big data security protection technology to strengthen the protection of cloud computing platform to store data mainly from the following two aspects. (1) Data segmentation technology, based on the traditional data encryption, data segmentation, then even illegal users access to the data information and deciphering the success, but not completes content. (2) Cloud computing platform operators to ensure the integrity and security of user data, is bound to the user's data backup, when a user with carriers after the termination of the cooperation, not delete the backup of data, can also cause the user's data information leakage, so at this time must be taken to data disposal technology to ensure that the user's data information security.



Figure 2. The Big Data Inner Connection Pattern

Data transmission direction was divided into general ascending and descending, uplink is mainly perceived status data, the direction of the data transfer from the terminal nodes to the gateway, the downstream data mainly control data the direction of the data transmission is mainly composed of gateway nodes to the terminal. Because the program is based on the cloud implementation of smart home system, the standardization of data process should not only consider the number and type of the sensor information, consider the information status of space and time, which will provide the basis for the top of the cloud data application.

Node data preprocessing, its main function will be collected all kinds of detector of strange data filtering, removing illegal and invalid data, the failure data recovery, will be effective and valid data format according to the standard, and encapsulation. Node control machine will be collected all kinds of detector of traffic flow information is used to control the node of the traffic, and the processor preprocessing, on the one hand, using the LCD liquid crystal display that make each owner is very convenient to know their various fees; On the other hand, the use of communication interface, through TCP/IP protocol, ensure safety, reliability, validity of data collected transmitted to the control center, used for coordinated control and management of the whole system.

The Future of the Smart Home System. The system of standardization and the standardization of the market and the intelligent household industry have not uniform industry standard, does not have compatibility between the products of the company. Although under the support of the ministry of the information industry, formulated and issued two standards related to the smart home, but the market is still lack of unified standards to specification.

The development of the Internet of things is introduced a new concept and development space for the smart home, the intelligent household can be seen as the Internet of things of a kind of important application. Based on Internet of things of intelligent household, characterized by the use of core information sensing devices will household life related to the various subsystems organically unifies in together, and connect with the Internet, monitoring, management, information exchange and basic communication, to realize intelligent household [8].

IOT of smart home system integration is based on the openness of the system the system adopted by the agreement must have a wide range of product support, and continuously strengthen the pace of the unified standard of Internet of things intelligent household. To realize the large-scale development in the future, need to involve the whole business chain of smart home business operators, provide the solution of the whole business chain, business integration and equipment maintenance, etc., so as to make the business chain benign development, to further promote the family insurance, services, with finance and other industries and the development of the three nets fusion. For the Internet of things intelligent terminal, it not only should have awareness of the sensitive, that also should have more powerful computing ability, to have all kinds of information collection and the ability to control.

When the Internet of this concept is introduced into the basic intelligent household, the collision between them is so intense. Smart home is not in the traditional sense of simple control of the inside of the family household electrical appliances, such as TV sets, refrigerators, air conditioners, water

heaters, lighting, etc. It is a greater range of control, which can be roughly summed up as the following aspects. (1) Family data center: a large amount of data in the data, such as movies, music, games, etc., can through the Internet, mass storage to the network data server, convenient to check at any time. (2) Family security center: family security equipment, such as general cameras, infrared detectors, smoke detectors, once connected to the Internet of things, the master can at any time any place to understand dynamic home safety can also give residential property or equipment hosting specialized agencies is responsible for custody. (3) Home entertainment center: the commonly used household information, such as weather forecast, consulting information through family terminal device connected to the net to know in time. (4) Family business center, business center can complete a series of, such as the payment, payment, shopping task, let host can never leave home to complete various trivial daily life.

Conclusion and Summary

In this paper, we conduct research on the smart home system construction based on the Internet of things and the big data. In the modern city, the physical space of household is more and more limited. At the same time, the people to be resided to the home to enjoy higher and higher expectations. In the face of this situation, only in the present condition of the premise of physical space, the use of the avant-garde concept and the advanced technology to expand the mental space of household is a way to develop green and harmonious home. We combine the Internet of things and the big data to design and implement the corresponding system that will be innovative. In the further research, we will then integrate more techniques for the better optimization.

Acknowledgements

This research was financially supported by the 2015 Research Project of Higher Education Reform in Shaanxi (15BY126) and the 2015 Teaching Reform Research Planning Project of Xijing University (JGGH1511).

References

- [1] Portet, François, et al. "Design and evaluation of a smart home voice interface for the elderly: acceptability and objection aspects." *Personal and Ubiquitous Computing* 17.1 (2013): 127-144.
- [2] Hu, Qinran, and Fangxing Li. "Hardware design of smart home energy management system with dynamic price response." *Smart Grid, IEEE Transactions on* 4.4 (2013): 1878-1887.
- [3] Tsai, Pohsiang, and Bojun Pan. "Intelligent electricity bill saving system for smart home." *Fuzzy Theory and Its Applications (iFUZZY)*, 2015 International Conference on. IEEE, 2015.
- [4] Jacobsson, Andreas, Martin Boldt, and Bengt Carlsson. "On the risk exposure of smart home automation systems." *Future Internet of Things and Cloud (FiCloud)*, 2014 International Conference on. IEEE, 2014.
- [5] Bu, Honggang, and K. Nygard. "Adaptive scheduling of smart home appliances using fuzzy goal programming." *The Sixth International Conference on Adaptive and Self-Adaptive Systems and Applications, ADAPTIVE*. 2014.
- [6] Meliones, Apostolos, and Dimitrios Giannakis. "Visual programming of an interactive smart home application using LabVIEW." *Industrial Informatics (INDIN)*, 2013 11th IEEE International Conference on. IEEE, 2013.
- [7] Sun, Chao, Fengchun Sun, and Scott J. Moura. "Data enabled predictive energy management of a PV-battery smart home nanogrid." *American Control Conference (ACC)*, 2015. IEEE, 2015.

[8] Panna, R., R. Thesrumluk, and C. Chantrapornchai. "Development of the Energy Saving Smart Home Prototype." *International Journal of Smart Home* (2013).