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# Research and application on the smart home based on component technologies and Internet of Things

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**Abstract**

This paper presents the design of a smart home system based on Internet of Things (IOT) and service component technologies. The current situation of IOT has been analyzed in detail. An approach based on SOA and component technology has been proposed and applied, which can help to realize every-changing dynamic semantic integration of the web services. Furthermore, the software architecture and main modules are explained as well. Finally, this paper discussed the heterogeneous information fusion in the Internet of Things.

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## 1. Introduction

The Internet of Things (IOT) technology establishes a connection between all things and the Internet via sensing devices and implements intelligent the identification and management. The information sensing devices include RFID (Radio Frequency Identification Devices), infrared sensors, GPS and laser scanner devices. They are all connected to the Internet to implement remote perception and control. IOT is widely applied in intelligent transportation, environment protection, government work, public security,

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smart home, intelligent fire control, industrial monitoring, elderly care, personal health, etc. The network in the diagram refers to a certain network which can achieve recognition, positioning, tracking, surveillance and management intelligently.

With the development of economy and the advent of information-based society, people's requirements for living condition are continuously increasing. Building smart home and intelligent residential district based on the application of information technology gradually is becoming more and more imperative.

It is important to process and use the enormous and decentralized information. The service computing based on component and SOA become the key point of IOT and then to adapt to the every-changing requirements.

## 2. Research on the current situation of IOT

Mainly involves the current situation about implementation technology of IOT, the new sea computing model of IOT, etc.

### *2.1. IOT technologies*

In the system structure of IOT, it mainly have EPCGlobal system framework [1] with the support of the Europe and America and Japan's Ubiquitous ID [2] (UID) content networking system. EPCGlobal mainly includes EPC coding system, radio frequency identification system and information network system three parts. UID has the recognizing code, the communication devices, and information system server and ucode analytical server four parts. China also actively participates in the above content networking system structure and standard research, and is actively working to the standards to adapt to China's development of the situation.

The key technology of IOT including radio frequency identification (RFID), the sensor technology, nanotechnology, intelligence embedded technology. Among them, the RFID is the foundation and networking core of the construction of IOT. This subject will use RFID as passive data collection mechanism to realize the information infrastructure data collection.

At present, outside of China, the development and application of networking mainly concentrated in the United States, Europe, Japan, Korea and a few countries, the initial research direction is mainly bar code, such as RFID technology in commercial retail, logistics field application, in recent years applications start expanded to the environmental monitoring, biological and medical treatment, intelligent infrastructure, etc. Typical of the United States "wisdom the Earth" Smart strategic [3], Japan's u-Japan, south Korea's u-Korea strategy, the European IOT action plan, all the purpose is to support a new generation of IT technology make full use of in all walks of life. China currently support at full blast the development of IOT whether national science and technology plan and the industrial standard of things for networking, and has started a great deal of research and application work.

### *2.2. The new Sea Computing application schema of IOT*

Through the computing and communications equipment and intelligent algorithm objects Embodiment objects in the physical world, let the interconnect between objects, in advance of the unpredictable judgment to realize in the interaction between things in the scene, and that it is essential to information equipment can contact in the real world of physical at everywhere, will expand to the physical world information. The concept about sea computing was firstly put forward by the Chinese academy of sciences on April 12, 2010 in Beijing at the Chinese academy of sciences high technology planning strategy seminar. The Cloud Computing is the service-side calculation mode, but the Sea Computing is on

behalf of terminal of the entire world computing of all things, the Sea Computing is physical world between the object of the computing mode [4]. From the point of view of the computing model the application model of IOT can be divided into two parts, the perception mode and the sea computing model. Now the researches about the application of IOT are mostly applied in networking perception mode, and the level of intelligence to higher things networking new computing model based on the Sea Computing model of the application is less at home and abroad. And perception mode to compare, the Sea Computing model that more emphasis on distributed computing network (Decentralized) structure, easier to eliminate a single control points, a single bottleneck and a single point of failure expand more flexible. Wisdom of Crows come from the Sea Computing can make IOT more robust, more adapt to the users' needs and the change of environment.

## 3. Research on the service computing and component technologies

Service computing or service science as a new research field has gained more and more attention. It has passed through two development stages [5]:

At first stage, Garter Group proposed the concept of SOA (Service Oriented Architecture) in 1996, to make service computing development rapidly. The first high tide of service computing appeared. At this stage, SOA is an attention technology. Service oriented programming paradigm' decoupling, based on open standards interoperability, large particle reuse, supporting dynamic expanding technologies have begun enjoys popular support. More and more projects have begun to use SOA methodology in EAI (Enterprise Application Integration) and other application fields such as End-to-End resource planning to seek the software reuse, flexibility, low cost and rapid development.

At second stage of service computing, IOT (the Internet of Things), Social Information Network and Cloud Computing have gradually become the most concern focus. SOA, SaaS (Software as a Service) and SOC (Service Oriented Computing) represent the general trend of the future. The development of service computing is entering into the second high tide.

It mainly reflected in two aspects:

One is software and resources are put in the cloud and as the infrastructure, and then the consumers need not setup or deploy them on their local computers in many cases. Another is the software using and operating mode about XaaS (Anything as a Service) will support users to use rather than owning, to consume and use information and communication technology resources with pay-on-demand mode. Service is not only the link or adhesive among the infrastructure and the user experiences but also the kernel carrier of the various kinds of the exposed intelligence in new network environments with dynamic, open, indeterminacy and assembly characters.

The service components are assembly and binding according to the business process though ESB (Enterprise Service Bus). Of course, they should stand by the SCA (Service component Architecture)/SDO (Service Data Object) standards so that to be reused in the ever-changed environments.

## 4. A sample about smart home to use IOT and component technologies

Smart home is the core component of Intelligent Residential District. When the concept of IOT technology is introduced to the implementation of smart home, traditional smart home is out of fashion [6]. It will cover a much wider range of control. For example, smart home involves family security, family medical treatment, family data processing, family entertainment and family business. The architecture of smart home application based on IOT and component technologies shows as Fig. 1.

### *4.1. Family Security Service*

The host can keep in touch with the latest security dynamics of the whole family anytime and anywhere if family security devices, such as camera, infrared detector, smoke detector, etc, can be access to the network of IOT. Another strategy is to grant sanction of the devices to property management office or specialized agency.

### *4.2. Family Medical Service*

If there are old people or children in the family, we can place some cameras in the right position in order to timely understand the current situation. Household medical devices like sphygmomanometer are access to the network of IOT and community hospital. So doctors can keep in touch with the patients' health condition conveniently and make timely treatment.

### *4.3. Family Data Service*

Large amounts of data in the family, such as films, music, games, etc, can be stored in the network data servers through Internet of Things and can be checked conveniently.

### *4.4. Family Entertainment Service*

The common information, such as weather forecast, consultation information, etc, can be informed well through family terminal devices which are access to Internet of Things.

### *4.5. Family Business Service*

Family business center can finish a series of tasks, such as payment, shopping, etc. So people can stay indoors to deal with their trivial daily life.

## 5. Heterogeneous information fusion technology of IOT

Heterogeneous data fusion aims to deal with many data source data and get higher quality data information. Based on the content of network data fusion technology is essentially using the computer technology to get the time sequence of equipment parameters and running status information visualization and statistical analysis, according to demand, automatic collection, integration, analysis and comprehensive as a representation to complete need evaluation and decision task of information process.

Heterogeneous information fusion based on system structure, mainly based on the data of abstract levels and functions of the system, and based on three kinds of data fusion method. The fusion of data processing based on the system structure according to centralized, distributed, and P2P and mixed way for acquisition obtained data were distributed or centralized fusion processing. The data fusion based on hierarchy model is processing main data fusion, characteristic class level fusion and decision-making level fusion. Data fusion level refers to the direct use of original data processing. Character class fusion refers to the original information, and then the feature extraction feature information analysis and processing. Decision-making level fusion of target or the environment by types, characteristics and attributes and, thereby, to judge command, control and provides the basis for the decision-making behavior. The data fusion based on the function model mainly includes data association, target state

estimation, attribute, function module, behavior pattern detection, identity estimate, behavior prediction, logical reasoning, situation assessment, etc.

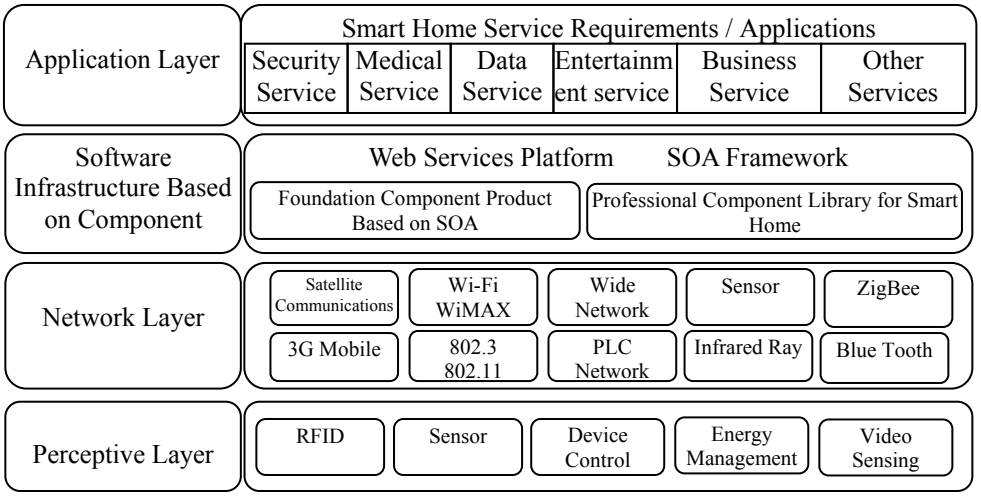


Fig.1.The architecture of smart home application based on IOT and component technologies

## Conclusions

IOT brings a new age for IT technologies and can change our life and job to a more intelligent and modern stage. The research and application of component technologies and the new application mode of IOT such as sea computing can facilitate the IOT to a more widely fields. Smart home, Intelligent Residential District and more other applications will appear in future.

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