# Summary of Internet of Things Technology and Its Application

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## Abstract

**The Internet of things involves many fields. firstly, this paper introduces the basic concept of the Internet of things and the development of the Internet of things. secondly, it briefly describes the system composition of the Internet of things. secondly, it summarizes the key technologies involved in the Internet of things, summarizes the application of the Internet of things, and finally writes about the challenges faced by the Internet of things.**

## Keywords

**Internet of Things Technology, Application.**

## 1. Introduction

The Internet of Things, as its name implies, connects all objects to the Internet. This includes not only simple things connected, but also people connected and people connected. The Internet of things (IOT) is an innovative technology generated by cross disciplinary technology. As an integration of automation and intelligence, the core of Internet of things is the Internet + sensor network. It is a bridge between the real world, the digital virtual world and the three real-time communication of human society. In 2020, FORREST_ER predicted the global "H2H" human information exchange and "T2T" ubiquitous data exchange business volume, and the ratio between them will reach 1:30. Therefore, the strong market prospects promote the continuous innovation of Internet of Things technology, thus driving the development of agriculture, animal husbandry, forestry, meteorology, environmental detection, logistics tracking, intelligent medical, intelligent building, intelligent cars and marine exploration and other fields.

## 2. Basic Concept and Development of Internet of Things

The concept of "Internet of Things" was formally established at the World Summit on the Information Society held in Tunis in 2005. Researchers in different fields have different definitions of the Internet of Things, so far there is no authoritative, complete and accurate definition.

According to the definition of ITU, the Internet of Things (IOT) is mainly composed of radio frequency identification tags, sensors, global positioning systems and geographic information systems (GIS) and other information sensing devices which are ubiquitous in objects. They are grouped through wireless sensor networks and then connected to the Internet as a whole. The main solution of the Ad Hoc Network is to collect data and exchange information and communicate with objects in the physical world. Data acquisition includes not only the acquisition of the real-time state of the object itself, but also the collection of the parameters of its surrounding environment. Information exchange and communication in ad hoc networks refer to the data flow between nodes. The Internet is a network for intelligent identification, geographic location, logistics tracking, environmental detection and efficient management of goods by analyzing and processing the collected data and supporting decision-making.

The development of the Internet of Things: The basic idea of the Internet of Things first appeared in the 1990s. In 1995, Bill Gates put forward the idea of "thing-to-thing connection" in "The Road to the Future", describing the future of our micro-phone/PC can be connected with daily necessities, automobiles, etc., so that we can "know the world without going out"; In 1999, MIT's AUTO-ID lab proposed it. In 2005, the International Telecommunication Union (ITU) officially published the

Internet Report 2005: Internet of Things at the World Conference, expatiating on the ideas and application prospects of the Internet of Things, attracting more countries and governments to participate in the research of the Internet of Things. IBM, a computer company, has put forward a project plan called "Smart Earth", which is considered by the U.S. government to be a huge impetus to the national economy. In August 2009, Wen Jiabao put forward "New Generation of Broadband Mobile Wireless Communication Network" in "National Medium and Long Term Science and Technology Development Plan (2006-2020)", which will become the main direction of the development of information technology in China, and will work with human's neural network. By analogy, the name of "Perception of China" comes from this. In November 2011, EU experts at the Global Internet of Things Conference in Beijing explained the EU Action Plan for the Internet of Things, which aims to promote the global development of the Internet of Things. In February 2014, John A. Stankovic, a lifelong academician of IEEE, published his first article on "Research Directions of the Internet of Things" in the new issue of the IEEE Journal of the Internet of Things. This paper introduces IoT's technology, network communication, management infrastructure, service and application development, and human-computer interaction. Statista, a website, accesses 17.6 billion Internet of Things devices in 2016. It is estimated that by 2020, the number of devices will grow to 30 billion + 100 million.

## 3. System Composition of Internet of Things

When describing the framework of the Internet of Things, researchers mostly use USN architecture as the basis, which can be divided into five layers: bottom-up sensor network (edge technology layer), access network, basic backbone network, network middleware and application platform. China Communications Standardization Association (CCSA) ubiquitous network working committee (TCl0) has given three layers of structure of the Internet of Things: the first layer is the perceptual extension system, the second layer is the heterogeneous convergent ubiquitous communication network, and the third layer is the application and service.

The underlying sensor network of the underlying sensor network, also known as the edge technology layer, is used to collect object information. It usually consists of sensor network, embedded system, RFID identification, reader or other different forms of soft sensors. Among them, the most widely used technologies are RFID (radio frequency identification technology), wireless sensor network technology (WSN), nanotechnology, intelligent embedding and so on. In addition, mobile phones, infrared sensors, cameras, GPS and other terminals that can sense all kinds of information needed may be connected to the network to help collect all kinds of information needed in the Internet of Things anytime and anywhere.

The object data collected by the access network sensor system needs to be processed. The access layer is responsible for routing, publishing and distributing information. If necessary, cross-platform communication is also needed, which is the first stage of data processing. The commonly used access networks are WWMI (Broadband Wireless Mobile Internet), WIFI, WIMAX, GSM, CDMA, WCDMA, etc. WWMI users can access the Internet through various wireless mobile terminals, such as Iphone, Gphone, PDA and other terminals.

Internet is the foundation and platform of the Internet of Things, and the Internet of Things is the extension and development of the Internet. In the Internet of Things, object information collected by various sensor devices must be collected on the Internet and processed and fed back. For example, in environmental monitoring, based on the perceived temperature, humidity, cleanliness and other data, through calculation, analysis and evaluation, the results can be used as a scientific basis for reasonable adjustment of the environment. The maturity of Internet development, wide application, security and robustness of the system are the foundation and premise to promote the rapid development of the Internet of Things.

## 4. Key Technologies of Internet of Things

The Internet of Things (IOT) is composed of low-cost, intensive coverage and randomly distributed nodes (passive nodes, active nodes, network nodes). Self-organization, high redundancy and strong fault tolerance make individual nodes invalid due to attacks or external environmental interference, then the whole system will not be paralysed. The Internet of Things (IOT) is the aggregate product of various technologies after the development of modern information technology to a certain stage. It is the integration and application of various sensing technology, data processing technology, artificial intelligence and automation technology. The main components of the Internet of Things system are perception layer, transmission layer and application layer. Around the main components of the system, the key technologies of the Internet of Things include the key technologies of the perception layer, the key technologies of the transport layer and the key technologies of the application layer.

As the lowest component of the Internet of Things system, the perception layer of key technologies in the perception layer has many data input points, which require the acquisition and short-term storage of the required parameter data for a specific target in the perception layer. The key technologies of perception layer are divided into signal acquisition technology and signal processing technology. In signal acquisition technology, it includes sensor technology, embedded system technology, operating system, various physical devices and core chips. Sensing technology is developing from a wireless sensor network which can only collect simple and low complex data at first to a wireless sensor network which can obtain complex data such as video, audio and image. The appearance of wireless sensor network makes the description of the physical world stop at static data scalar, but communicate with the physical world through various dynamic vectors. 。 Wireless sensor technology and nanotechnology are closely related. Through nanotechnology, the volume of infinite sensor changes to miniaturization and ultraminiaturization. Wireless sensor in the future will be as widespread as dust. ZigBee is a typical representative of sensing technology. ZigBee is widely used at this stage because of its simple, low cost, low power consumption, high efficiency and high sensitivity. Among them, RFID includes electronic tag and reader, EPC sensor, GPS, self-organizing network, short-distance wireless communication and other technologies are the core technologies of the perception layer.

Transport layer is the key technology of transport layer, which is based on telecommunication network and Internet. It is the transmission channel of data stream in Internet of Things system. Its core technology includes network access, data security and network protocol. The network is divided into access network and core network. GSM, TD-SCDMA, Inter_net, wireless network and heterogeneous network are all part of network access technology. Heterogeneous network is a kind of hardware and software manufactured by different manufacturers, which can run in different protocols to support different functions of overlapping convergence network; Through data security technology, data security protocol, key The establishment and distribution mechanism, the design of data encryption algorithm and authentication technology can ensure the security and reliability of signal transmission; the important components of network protocol are MAC protocol, networking technology, cross-layer network optimization technology, adaptive optimization communication protocol and lightweight high-energy protocol.

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## 5. Application of Internet of Things

The Internet of Things has great potential and can be deployed in many areas that affect the national economy and people's livelihood, but the deployed applications are very limited. In the future, there will be Smart Home, Smart Office, Smart Transportation, Smart Hospital, Smart Enterprise and Smart Factory. Here are some important applications.

Aerospace improves the safety of products and services by identifying forged products/components. The forged products/components are identified by introducing the electronic identity information of specific categories of Aeronautical components. In the life cycle of a product/component, electronic identity information records its source and security critical events. Electronic identity information can be stored in a distributed database and RFID tags, which can be securely connected to aircraft components and authenticated before they are installed on the aircraft. In this way, the safety and operational reliability of the aircraft will be significantly improved.

Intelligent transportation collects real-time vehicle information, driver information and road congestion information, and then makes comprehensive analysis and reasonable dispatch. The Internet of Things also provides solutions for the screening of toll collection system, passengers and goods in commercial transportation, and goods transported by international freight transportation systems supporting different government security policies to meet the growing global security needs. The use of Internet of Things technology in airport baggage management can realize the automation of tracking and sorting, increase the reading speed of each package and improve security.

Intelligent agriculture can adjust lighting, fertilization, watering, elimination of pests and diseases in real time according to the crop information collected by the Internet of Things, so as to ensure the suitable and efficient growth of crop environment; during the outbreak of infectious diseases, according to the animal movement information collected by the Internet of Things, real-time monitoring of animals can be carried out to control and prevent the spread of diseases; according to the number of animals in the herd, supplement can be issued. At the same time, according to the information collected by the Internet of Things, we can prevent the possible number of animals fraud.

Intelligent logistics shippers can select and ship goods, track, distribute and transfer objects in the transportation link, store, dispatch and sign and receive objects when they reach the receiving area, and both the shipper and the receiving party can inquire the status information of goods in real time.

Intelligent medical service uses mobile phone with RFID sensing capability as a platform to monitor medical parameters and drug delivery process, which can provide timely medical monitoring once an accident occurs. Portable and addressable wireless devices can be used to store health records and save patients'lives in emergencies, especially diabetes, cancer, coronary heart disease and stroke. Patients with obstructive pulmonary disease, cognitive impairment, epilepsy and Alzheimer's disease; edible biodegradable chips can be implanted into the human body for protection; in order to restore motor function, paraplegic patients can transmit muscle stimulation through an implanted agent-controlled electronic stimulation system.

## 6. Challenges of Internet of Things

Through the analysis of the enterprise environment, home, office and other intelligent spaces, the future work will be characterized by cross-organizational interaction, and need to deal with highly dynamic and temporary relationships. The technical challenges of the Internet of Things are as follows.

The limitations of Internet architecture in mobility, availability, manageability and scalability have hindered the development of IoT.

Security, Privacy and Trust

Security must ensure the security of Internet architecture in the design and operation stages; actively identify and protect the Internet of Things from arbitrary attacks (such as DOS and DDoS attacks) and abuse; actively identify and protect the Internet of Things from malware attacks [6].

Privacy controls personal information (data privacy) and personal physical location and location (location privacy); needs to improve privacy technology and related legal protection; standards, methods and tools for identity management of people and objects.

Trust-critical, protected, sensitive information needs to be exchanged easily and naturally. For example, agents will communicate with trusted services instead of people/organizations; trust must be part of the design of the Internet of Things and must be built-in.

Heterogeneous management of heterogeneous application services, environments and equipment also poses a major challenge.

Sensor data discovery mechanism is designed; Sensor data communication protocol is designed - sensing data query, publishing/distribution mechanism; Sensor data flow processing mechanism is developed; Sensor data mining - correlation, clustering and filtering technology design. In addition, there are other challenges: managing massive information, mining massive information to provide useful services; designing effective sensor network architecture and storage architecture; standardizing heterogeneous technologies, devices, application interfaces, etc.

## 7. Summary

Imagine that when you go out to work in the morning and the sensor at the door detects that you are going out, the information is transmitted to the computer. The computer will carry out a series of events through the Internet, sound broadcast the weather of the day, remind you of the things you should pay attention to today, and automatically broadcast the current road congestion, provide the best route; household appliances such as refrigerators will remind you of the refrigerator. When food is stored and expired, or even when wine is taken out, it can intelligently remind the response of "drinking more is harmful to health". When the bedroom door is pushed open at night, the sensor will automatically detect this action, turn on the lamp, turn off the lamp automatically after leaving, and so on. When the surrounding objects detect people's intentions through sensors, they will automatically and intelligently respond to certain changes in life and work. The development of the Internet of Things will be very expected. I believe that in the near future, with the continuous progress of Internet of Things technology, these ideas will gradually spread to daily life, and bring great convenience to travel, work and life.

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