

# Summary of embedded technology development

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## Abstract

**As one of the electronic computer operating system, embedded system has been gradually applied to various industries, in order to analyze the development trend of the embedded software technology in the future and the development direction, based on the specific concept of embedded technology, the present stage in the process of application development situation and future development trend are analyzed in detail.**

## Keywords

**Embedded technology; development tendency; integrated circuit.**

## 1. Introduction

Embedded system is defined as: ease of use as the center, based on information technology, software and hardware can be tailored to adapt to specific equipment system. Special information system with strict requirements for use, stability, cost, size and energy consumption. Embedded human system mainly consists of embedded microprocessor, peripheral hardware devices, embedded human operating system and user applications [1]. It is a combination of hardware and software that can work independently. Different external instruments and internal application software can be set up according to the needs of customers. In essence, embedded system is embedded software with the help of certain special technology embedded into the system or some software and hardware. From the perspective of the industrialization development direction of embedded technology, we should first design and develop related chips and then apply the research and development software to related equipment when the hardware conditions are mature, and gradually realize mass production. Embedded system generally includes microprocessor, microcontroller, memory, etc. Under the condition of guaranteed applicability, it can work together through the mutual coordination between modules. Compared with ordinary computer software embedded software has a strong practicability, it can realize the reuse of users' needs embedded software is dependent on the existence of the computer, in other words, the main purpose of embedded software is still to serve the computer system.

The main characteristics of embedded technology are shown in the following aspects: First, embedded technology has a certain practical significance, embedded technology and function of user needs, embedded technology is embedded in the computer system to obtain, but also to serve the computer system.

## 2. Fundamental

### 2.1. Historical development of embedded systems

The real evolution of embedded computers came after the advent of microprocessors. In November 1971, the arithmetic operator and controller circuit were successfully integrated to introduce the first microprocessor, followed by 8-bit and 16-bit microprocessors. The systems formed with these microprocessors as the core are widely used in instrumentation, medical

equipment, robots, household appliances and other fields. The wide application of microprocessors has formed a broad embedded application market, computer manufacturers began to provide OEM products to users in a large number of plug-in ways, and then users choose a suitable set of CPU boards, memory boards and various I/O plug-in boards according to their own needs, so as to constitute a dedicated embedded computer system and embed it in their own system equipment.

In the 1980s, with the improvement of the level of microelectronics processes, integrated circuit manufacturers began to integrate the microprocessors, I/O interfaces, A/D converters, D/A converters, serial interfaces, and RAM, ROM and other components required in embedded computer applications into a VLSI, thereby manufacturing microcontrollers for I/O design, commonly known as microcontrollers. Microcontrollers have become a rookie in embedded computers. In the 1990s, embedded systems further developed rapidly, driven by the huge demand for distributed control, flexible manufacturing, digital communications, and information appliances. DSP products for real-time signal processing algorithms are developing in the direction of high speed, high precision, and low power consumption. The 21st century is an era of network prevalence, and the application of embedded systems to various types of networks is an important direction for its development.

The development of embedded systems has gone through the following three stages:

Phase 1: The early stages of embedding technology. The embedded system exists in the form of a programmable controller with a simple function of a dedicated computer or a single-chip microcomputer as the core, with functions such as monitoring, servo, and equipment indication. Most of this system is used in various types of industrial control and weapons and equipment such as aircraft and missiles.

Phase 2: Marked by high-end embedded CPUs and embedded operating systems. The main feature of this stage of the system is the emergence of highly reliable, low-power embedded CPUs on computer hardware, such as ARM, PowerPC, etc., and support operating systems to support the development and operation of complex applications. [3]

The third stage: marked by chip technology and Internet technology. Microelectronics technology is evolving rapidly, and SOCs (systems on chip) are making embedded systems smaller and more powerful. At present, most embedded systems are still isolated from the Internet, but with the development of the Internet and the increasingly close combination of Internet technology with information appliances and industrial control technology, embedded technology is entering a period of rapid development and wide application.

## 2.2. Embedded system composition

From the external characteristics, an embedded system is usually a fully functional software and hardware integrated system that can operate independently without relying on other external devices. If such a system is dissected, it can be found that it may include several levels:

The core level of the embedded system is the central processing unit part, which contains the operator and controller module, and further equipped with the memory module, power module, reset module, etc. on the basis of the CPU constitute the smallest system commonly referred to. Due to advances in technology, integrated circuit manufacturers usually make many peripherals into the same integrated circuit, which is more convenient to use, such a chip is often called a microcontroller. On the basis of the microcontroller, the power supply sensing and sensing, actuator modules, and supporting software are further expanded to form a complete unit with specific functions, which is called an embedded system or embedded application.

Hardware structure:

Although the functions, appearance interfaces, operations, etc. of various specific embedded systems are different, and even very different, the basic hardware structure is similar, and it has a high degree of similarity with the hardware system of the general purpose computer. The hardware part of the embedded system looks no different from the general-purpose computer system, and also consists of a processor, memory, external devices, I/O interfaces, graphics controllers, and other parts. However, the characteristics of embedded system applications make the embedded system different from the general computer system in the composition and implementation of software and hardware. In order to meet the speed, volume and power consumption requirements of embedded systems, operating systems, application software, special data and other data that need to be stored for a long time usually do not use large-capacity and slow storage media such as disks, but mostly use EPROM, E2PROM or flash memory (Flash Memory). In embedded systems, A/D or D/A modules are mainly used for measurement and control, which is rarely used in general-purpose computers. Depending on the actual application and scale, some embedded systems use a foreign bus. With the rapid expansion of the application field of embedded systems, embedded systems are becoming more and more personalized, and more and more types of buses are used according to their own characteristics. In addition, in order to test the internal circuitry of the embedded processor, the processor chip generally uses boundary scan test technology (JTAG).

Software architecture:

The software system of the embedded system is designed for the specific hardware system and user requirements of the embedded system, is an important part of the embedded system, and is the key to realizing the functions of the embedded system. The embedded system software system is similar to the general computer software system, which is divided into four layers: the driver layer, the operating system layer, the middleware layer and the application layer, each with its own characteristics.

Drive layer:

The driver layer is the layer that deals directly with hardware, providing hardware drivers or underlying core support for operating systems and applications. In embedded systems, drivers are sometimes referred to as board-level support packages (BSPs). BSP has the function of initializing the basic hardware environment of the system after the embedded system is powered up, including microprocessors, memory, interrupt controllers, DMA, timers, etc. Driver layer - There can be three types of programs, namely board-level initializers, standard drivers, and application drivers.

Operating system layer:

The operating system in the embedded system has the core functions of the general operating system, which is responsible for the allocation of all software and hardware resources of the embedded system, scheduling work control, and coordinating concurrent activities. It still has embedded features and belongs to the Embedded Operating System (EOS). Mainstream embedded operating systems include Windows CE, Palm:OS, Linux, VxWorks. pSOS. QNX. LynxOS, etc. With an embedded operating system, writing applications is faster, more efficient, and more stable.

### **2.3. Recent development of embedded technology**

From the aspect of hardware, the microprocessor chips of major companies gradually develop from single core to multi-core, with the speed gradually becoming faster, the performance gradually becoming stronger, and the power consumption gradually decreasing. There are more than 1000 kinds of embedded microprocessors in the world, and there are more than 30 series of system structures. The mainstream systems include ARM, MIPS, PowerPC, X86 and SH, among which ARM's Cortex series processor is the best seller and has a variety of related development packages. At present, the underlying layer and platform have been relatively

perfect after many years of development, realizing a variety of applications of chips, and the huge market has brought a lot of capital and technology[2].

From a software perspective, there is also a wealth of mature systems. At present, there are WindowsCE, Vxwork, etc., and Hopen embedded real-time operating system of cass group of Chinese Academy of Sciences. The application software involves embedded human Web browser, embedded human database, embedded human GUI system.

In fact, embedded human system has a very wide application space, in life and all walks of life can be involved in embedded human system. From the perspective of China's embedded technology industry, Java, Web, WAP and other aspects have a relatively deep application, while also playing a certain role in language communication, multimedia and other aspects. In the process of accumulating in the development of embedded type system in our country has made some breakthrough, from the industry talent demand embedded type system need professional talent is still relatively lack, with 4 g, 5 g mobile communications business as an example, the specialized talents and only ten thousand people concentrated in datang telecom, companies such as huawei, zte, According to the market environment and relevant expert analysis, this field needs at least 150,000 talents, and the lack of talents is also one of the factors restricting the further development of embedded technology[3].

#### **2.4. The development trend of embedded technology**

At the initial moment, the roll angle and pitch angle can be obtained by using the acceleration value: The 21st century is an era of informatization, digitization and networking, so IT provides an opportunity for the development of embedded systems. The rapid development momentum of IT and chip industry will inevitably drive the development of embedded systems, and the development of embedded systems will naturally promote IT and chip industry. From the perspective of the application prospect of embedded technology, embedded system mainly includes the following development directions.

(1) Interconnection technology. At present, the world has entered the era of high-speed information and all of these roots in the application of Internet technology, so the integration of embedded technology and network interconnection technology will be one of the development trends of embedded technology. The new embedded software can meet a variety of network interfaces, which has a great advantage over the single chip microcomputer. In addition to the basic TCP/IP protocol embedded system CAN also support USB, CAN and other interfaces. Network applications can be realized with the support of network protocols and drivers[4].

(2) Artificial intelligence. Embedding technology has brought strong technical support for the realization of artificial intelligence. Combining artificial intelligence with embedded technology can greatly improve the intelligence level of related equipment. For example, in human-computer interaction, the use of embedded human software can greatly improve the authenticity and accuracy of human-computer interaction; In the intelligent instrument, human embedded human parts can realize intelligent monitoring and achieve the purpose of automatic electricity control, automatic water control, automatic temperature control; In medical technology, embedded system or embedded software is used to achieve intelligent surgery, so as to reduce the harm of patients in the treatment process.

(3) Wireless network. Compared with the traditional wired network, wireless network undoubtedly has a greater space for development, and its coverage and application are more extensive than wired network. Expanding the use of embedded technology in wireless networks will also be a trend. At present, the embedded human technology in the information transmission of WIFI and Bluetooth has been relatively mature, but its application to 3G and the emerging 4G network needs to be extended, especially in the protocol stack needs to be optimized and improved[5].

### 3. Summary

The diversity of embedded system with its function and running stability of accepted by all fields and to get rapid development. In the future, the application of embedded technology development prospects will be more extensive, embedded technology has will become a very important part of our daily lives, and we live closer integration, at the same time, the wide application of embedded technology, It also helps to further improve the quality of our life and make our life more convenient and comfortable. At the same time, it will bring more and more economic benefits.

### References

- [1] Xin W , Zhong W , Wei H , et al. Summary of Embedded Systems Development[C]// International Conference on Frontiers of Manufacturing Science & Measuring Technology. 2017.
- [2] Paliwal Mrinal et al. An analysis of embedded system design aspects[J]. ACADEMICIA: An International Multidisciplinary Research Journal, 2021, 11(10) : 837-844.
- [3] Niu Y S , Wang S , Yang G . The Summary of General Embedded 32-bit RISC CPU Design[J]. Microprocessors, 2012.
- [4] Xiaohu Liu. Research and Design of Serial Server Remote Monitoring Based on Embedded System[C]//.Proceedings of 2019 International Conference on Computer Information Analytics and Intelligent Systems(CIAIS 2019).Francis Academic Press,2019:188-192.
- [5] Zijian Zhou. Research on Embedded Operating System Manage Function to Improve Memory Consumption Issues[C]//.Proceedings of 2019 International Conference on Wireless Communication, Network and Multimedia Engineering(WCNME 2019).,2019:141-143.