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Design of AI Algorithm Using IOT By Embedded System Technology

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Abstract - The expansion of artificial intelligence has a substantial beneficial influence on the lives of people, and the development of embedded technology has a direct impact on the expansion of the Internet of Things. Both of these developments are having an impact on the growth of the Internet of Things. Research is being done to determine how an artificial intelligence algorithm may be included into an embedded device using this information. The embedded system hardware configuration and the embedded system software running algorithm are both improved in order to boost the research of embedded technology and raise investments in people and material resources in the study of embedded systems. Gaining knowledge of western sophisticated technology, as well as the embedded technology that is employed in the Internet of Things, may help increase the performance of embedded systems. The results of the experiment show that the artificial intelligence algorithm is able to effectively improve the performance of the embedded system.

Keywords: Artificial intelligence, Embedded system, Hardware structure, Embedded technology

1. INTRODUCTION

As a result of the rapid expansion of communication networks and the development of integrated circuit design, the study of embedded systems has become one of the most active areas of research within the information technology industry. Information technology has developed into a new industrial system in China as part of an effort to speed up the country's process of industrialization. An embedded system is a kind of computer system that integrates hardware and software and is capable of doing certain specialized tasks all by itself. Embedded systems may also communicate with one another. It is a comprehensive system that incorporates cutting-edge computer technology, semiconductor technology, electrical technology, and the specialized applications of a variety of different industries. This innovation in knowledge and technology is continual, and the system relies heavily on both. This article takes a look at the status quo of embedded systems, provides a concise summary of their component parts, and makes some predictions on their potential future development. An embedded system is a special form of computer system that is constructed using software as well as physical computer components. It is possible to modify software and hardware in order to fulfill the specific needs of an application system with regard to its functions, dependability, cost, volume, and power consumption. The combination of

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computer hardware and computer software that constitutes an embedded system. In most cases, an embedded operating system and application software make up a device's software, while the embedded central processing unit (CPU) and external peripherals make up the device's hardware. The performance of the embedded system might be improved by incorporating some of the fundamentals of artificial intelligence into the optimization process.

2. EMBEDDED SYSTEM BASED ON ARTIFICIAL INTELLIGENCE ALGORITHM

- **hardware configuration of embedded system based on artificial intelligence algorithm**

The continued growth of embedded systems correlates with the fast development of embedded technologies. Embedded systems are becoming more and more common. Embedded technology is becoming more vital as its usage spreads across more and more applications. As technology has advanced and the requirements for system performance have continued to rise, embedded systems have shifted their focus from hardware design to software implementation in order to achieve more effective software and hardware co-design. This change was necessary in order to achieve more effective software and hardware co-design. As a result of both the progression of technology and the growing importance placed on system performance, an increasing number of embedded systems are making use of specific hardware optimization and acceleration methods. This article combines a specific hardware environment with an integrated platform in order to improve the embedded environment, boost the performance of the artificial intelligence algorithm for recognition, and optimize the performance of the embedded environment overall. The bulk of embedded devices are composed of embedded computer systems and the hardware that is connected with them. A software layer, a hardware layer, a layer of system software, and an intermediate layer make up the majority of the embedded computer, which serves as the core of the system. Other layers include an intermediate layer. The majority of the time, when people talk about the software layer, they are referring to the layer of software that is used while developing embedded systems. The hardware layer is comprised of a variety of components, including the memory, embedded CPU, universal device interface, and others. It serves as the principal module for the embedded system. The RTOS, the graphics system, the file system, and the network protocol are the most important parts of the software layer. The intermediate layer, which is also referred to as the driver layer software at times, sits between the system software and the underlying hardware. This separation is what allows the system device driver to function independently of the hardware. As a direct consequence of this, the hardware configuration of the embedded system has been improved. The essential structure of the embedded system is shown

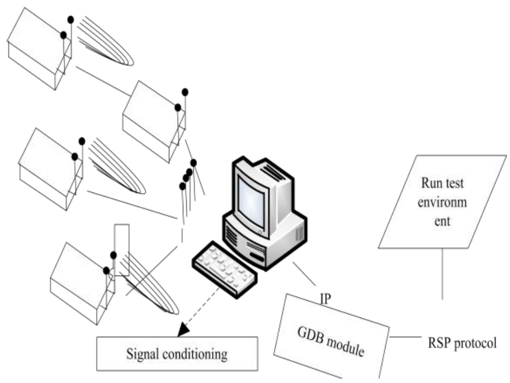

Fig.1 Basic structure of embedded system

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in Figure 1.

For embedded hardware systems, in addition to the basic control components, it is possible to take into account the storage, communication, debugging, and display functions, as well as any other auxiliary functions related to the embedded system. Memory, communication devices, and displays are the three categories that may be used to classify the widely used embedded peripherals. Memory is the most common kind of embedded peripheral. The multi-channel batch operating system, the time-sharing operating system, and the real-time operating system are currently the three types of operating systems that have the greatest number of users. Linux is a group of operating systems that are based on UNIX and are used in these systems. The task switching technology of the system enables the system to function as a multiuser environment that is also capable of genuine multitasking. one of the numerous advantages offered by the embedded operating system. The current generation of embedded microprocessors is characterized by the following

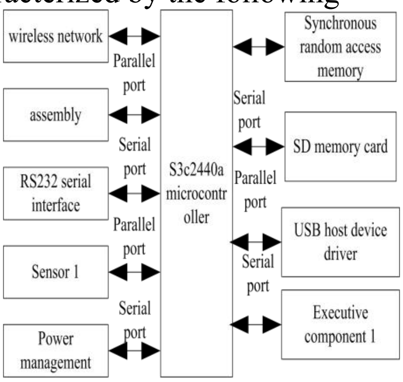

Fig. 2 Main control structure of embedded system

characteristics: small size, low power consumption, low cost, high performance, online control, support for the thumb (16 bit) and arm (32 bit) dual instruction set, large capacity flash memory, low cost, storage of a large number of intelligent programs, quick execution speed, flexible addressing, high execution efficiency, fixed instruction length, and established hardware conditions for embedded intelligent systems. Currently, technologies such as fuzzy logic, neural networks, artificial intelligence, and a variety of others are being successfully applied in a broad range of sectors, and the generally accepted theories are quite correct. The four most important components of the intelligent control module are the knowledge base, the inference engine, the knowledge acquisition program, the vast database, and the embedded MCU that stores the data. It is not at all out of the question to develop the necessary hardware, software, and other elements for an embedded intelligent sensor. In light of this, the master control structure of the embedded system has been given some optimization. Figure 2 depicts the structure after it has been optimized.

Both the low-end embedded DSP processor and the high-end embedded DSP processor are put to use in the field of computer communication. One of these two types of processors is based on an embedded microprocessor, while the other is based on a highly integrated embedded chip system. The embedded microprocessor with the intelligent control module (fuzzy, neural, or artificial intelligence technology) is comparable to the intelligent control module, which stands for the intelligent control module. It is an intelligent control module that integrates sensors into its system. It is able to duplicate the manner in which human professionals solve problems and has considerable expert knowledge in the relevant disciplines. It is able to apply sound reasoning and is skilled in some information collection techniques, but in general, its talents are far more advanced than those of specialists. In addition to being adaptive, transparent, and interactive, it has a certain degree of intricacy as well as a level of difficulty.

- **Embedded system software operation algorithm design based on artificial intelligence algorithm**

Because of the continual development of embedded systems, embedded technology is now widely employed across a wide variety of sectors and is essential to all aspects of production as well as day-to-day life. Embedded technology has become more important in recent years. The word "embedded system" may apply to a wide range of software programs that are connected to computers. For specialized computer systems that have high requirements for performance, reliability, cost, volume, and power consumption, it is desirable to use hardware and software that can be customized. The embedded system is very relevant and is inextricably bound up with a number of different applications. It is possible to alter and personalize it to satisfy the specific needs of each application and to concentrate key efforts on those applications that have the potential to advance the development of embedded systems more effectively. The faultlessness of the function may be directly attributed to the incorporation of an MCU and software that is embedded. The intelligence of embedded devices is unaffected by the absence of standard software for embedded systems. It's also possible that it was written in a language that's quite popular, like VC++. Application software, which serves as the basis of embedded systems, is characterized by stringent criteria pertaining to reliability, quality, and storage capacity. The implementation of multifunctional real-time presents challenges with more stringent criteria for real-time. This serves as the cornerstone upon which the multitask real-time processing platform of the embedded system is constructed. As illustrated in Fig. 3,

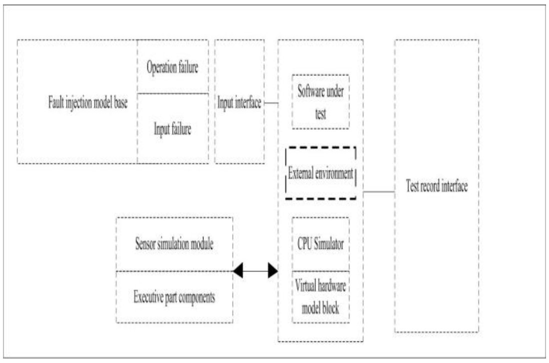

Fig. 3 Multitask real-time processing platform of embedded system

The embedded system is used most often in applications involving artificial intelligence. The artificial intelligence data for the core module of the whole system is received by the embedded system, where it is analyzed and processed before being sent on to be processed further in line with the rules that have been defined. Before sending the digital signals to the core module for processing, the digital module in this system converts the data from the artificial intelligence into a signal format that the embedded system is able to process. The optical module is the initial component that finishes off the collecting of data for artificial intelligence. After being retrieved from the system positioning module by means of an artificial intelligence processing algorithm, the necessary artificial intelligence characteristics are then subjected to processing and analysis before being output and regulated in accordance with a specified target value. When the acquisition time is set to A, the information collection may be accurately defined by the solutions of linear equations; this is possible because of the linearity of the equations.

$$B = \frac{(B_2 - B_1)}{(A_2 - A_1)X} + \frac{(B_1 A_2 - B_2 A_1)}{(A_2 - A_1)} \quad (1)$$

In the formula, the start time of the information collection is represented by the letters A1 and A2, while the start time values are represented by the letters B1 and B2. When describing the current state of information collection, the software architecture of the mobile network information intelligent acquisition system based on Embedded MCU is characterized by the data obtained from a linear equation. This is performed by utilizing the data. The output of the model for making predictions, denoted by ym(k), is composed of two parts. The answer that was given as input was 0, and one of the parts was the free response to Yi (k). The ability to govern the moment before this one has absolutely nothing to do with this one, and neither does the ability to control the moment after this one or the moment after that one. The second kind of answer is called the forced response, and it is the model response that is introduced to the system after the control function has been played. The forced response is represented by yf(k), which is the same as the zero state response. The newly added control function in predictive functional control may be represented as a linear combination of a number of existing functions (fn) in certain implementations of the technique. As a direct result of this, the predictive functional control approach is enhanced in the way that will be detailed further below.Embedded application software is not the same as traditional application software. It does this by allocating certain hardware resources in line with the user's expectations and by selecting a particular hardware platform in accordance with the unique application circumstances. When developing embedded application software, we often make use of a trustworthy embedded operating system in order to cut down on the amount of resources that are used by a variety of distinct systems. This operating system ensures both the consistency of the running time as well as the performance in real time of any sort of task that may be required.

- **Optimization of embedded system operation process based on artificial intelligence algorithm**

The use of intelligent sensor technology and the usage of embedded technology are inextricably linked and cannot be separated. Embedded technology provides the capacity for a standard sensor to do calculations, connect with other devices, and make choices based on the collected data. The embedded software is able to interact with one another and can even establish a connection to the Internet. Intelligent sensors equipped with intelligent algorithms and intelligent algorithms

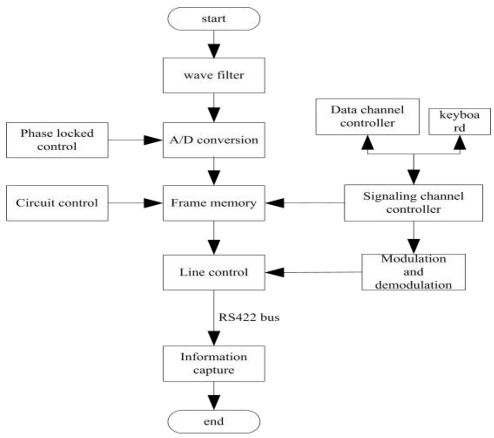

Fig.4 Information collection flow of embedded system

integrated into embedded systems will be a part of the Internet of Things. As a direct consequence of this, embedded technology is an essential component of the Internet of Things. The goal of software and hardware collaborative synthesis is to maximize the potential of a target by using the model's function application and constraint conditions as inputs. After that, it decides the system calculation, communication resources and job allocation, map drawing, processing, voltage adjustment, and so on, and ultimately arrives at the software and hardware structure of the system that is optimal. It is essential to do research on the approach for a variety of computer architectures, such as single processor, dual processor, multi-core, and multi-core systems. The number of applications that make use of embedded systems is now developing at a rapid rate, and concurrently, there is an increasing need for the creation of new embedded systems. The vast majority of today's embedded devices are not up to the task of meeting the needs of actual applications.

The embedded platform provides the basis for embedded artificial intelligence systems. This platform is comprised of graphic gathering equipment, artificial intelligence processing equipment, artificial intelligence display equipment, and artificial intelligence processing equipment. To ensure that embedded systems perform their functions as efficiently as possible, the method of information collection used by these systems has been enhanced by using the concepts of artificial intelligence. Because the system level synthesis of embedded systems needs the co-design of both software and hardware, this research refers to it as hardware/Software. The concepts of co-synthesis and system integration are synonymous with one another. In the beginning, the function, capabilities, and constraints of the embedded system are discussed. Following that, the system is specified via the use of task diagrams, formal language, and natural language. The process of selecting or allocating the architecture of the system is concurrent with the selection or allocation of the system's computing and communication resources. You have the option of selecting these resources from the permanent platforms that are already in place, or you may include them into the design of the system, which is comprised of a number of components such as a processor, memory, communication unit, and specialized hardware accelerator. This is the typical design that the optimization of the operating process for an embedded system looks like.

In order to successfully execute the automated design of embedded systems, a powerful optimization algorithm has to be created in line with the specific stages of system synthesis and the upper limit of design parameters. Assignment and mapping are two types of subproblems that are notoriously difficult to solve when they occur together. If jobs are considered to be independent constants, then the intervals at which they occur and the life cycles that they follow will compete with one another. The approach that is used to calculate task priority is as follows. When designing automated embedded systems, certain synthesis techniques and design parameter limits need to be taken into consideration. Additionally, an efficient approach for optimization has to be developed. In general, combinatorial optimization issues are instances of subproblems that have a large range of potential solutions and numerous problems to solve. Some examples of these problems are assignment, mapping, and processing. Many different approaches to optimization have been investigated and put into practice. The cycle value for the job is a, the number of tasks that need to be completed is n, and the priority of the work is r. The task is then processed via a mix of processing management tools and artificial intelligence based on this information. If tasks are independent constants, then they will not interact with

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one another over the whole of their respective lifecycles and time periods. After some time, the task prioritization algorithm was eventually solved.

Using the approach described before, the idle time di(t) of task margin is then subjected to further normalization. If Ei (t) indicates the amount of time the CPU was used to complete the work and I represents the amount of time left before the task is due to the system, then the technique for sorting tasks based on time point may be achieved as follows.

The idea of artificial intelligence is used to standardize the operational parameters of embedded systems. This is done in order to establish whether or not the system's given responsibilities can be managed centrally. It is required to make certain that the scheduling limit of tasks is proportional to the rate of resource usage in order to accomplish the monotonous processing of the system operating ratio. This is necessary in order to ensure that the artificial intelligence dynamic task priority change algorithm is followed. According to the research that came before this one, one of the advantages of using artificial intelligence algorithms is that they allow for a high system operation utilization rate, which in turn permits the implementation of a monotonous work processing ratio. The operational consequences of the step system

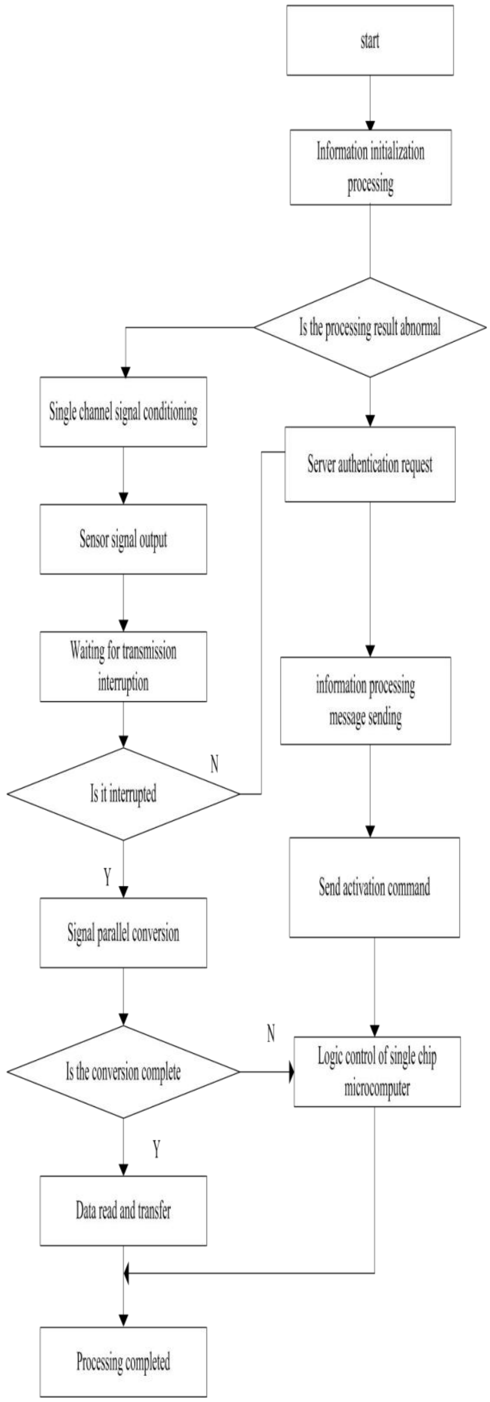

Fig. 5 Optimization of embedded system operation process

3. ANALYSIS OF EXPERIMENTAL RESULTS

The following conditions constitute the test environment's parameters: The

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processing delay performance was measured after the real-time operating system terminal PC had the virtual machine ar ware and the kuntu2.0 operating platform added to it. The processing delay performance was determined by setting 30 processing tasks at random. The processing algorithm determines the delay allocation function by using the embedded notion as a starting point. The next step is to install a web-core 2.6 CPU operating at 1.6 GHz together with 21 GB of system memory. The Windows 8 development platform and Windows Server 2007 are the two options that users will choose. The hardware of the sensor is kept simple by using a single-chip microcontroller with six bits of memory and 256 bits of programmable memory. The use of 10 KB of RAM in conjunction with a 12 bit digital signal converter results in an increase in the rate at which information is sent over mobile networks. When the mcs1210 is utilized as the principal chip for the embedded MCU, the number of external receiving components that can be employed to construct a multi-node sensing network is restricted to a very small number. The figure demonstrates the correctness of the embedded system in contrast to both the traditional system and the system by showing the results of regression testing.

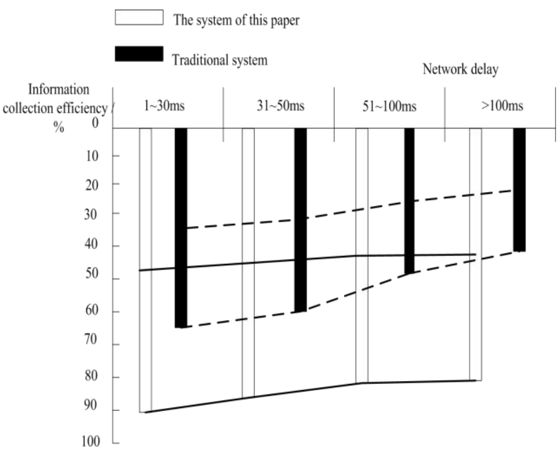

Fig. 6 comparison test results

It can be seen from the figure that the system can simulate the running environment of embedded application software and realize dynamic identification of software and hardware by combining with fault injection technology. It has better performance and has more advantages than traditional test behavior and function. This design can simulate the running environment of embedded system and promote the operation of embedded application software. Compared with the traditional test behavior and function, this design has higher software test performance and better guarantees the running effect of the system.

4. CONCLUSION

This picture demonstrates how, when paired with fault injection technology, the system has the potential to perform dynamic identification of software and hardware by simulating the operational environment of embedded application software. It performs better than the conventional test behavior and function, and it gives a greater number of advantages. This architecture may be able to simulate the operating environment of the embedded system and provide support for the capabilities of embedded application software. In comparison to more traditional approaches to testing behavior and function, the running impact guarantees and overall software test performance offered by this architecture are much better.

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