Design of Clinical Medical Data Monitoring System Based on Artificial Intelligence and Big Data

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Abstract. With the development of medical information technology, the scale of clinical medical data increases exponentially, which brings great difficulties to the management and monitoring of clinical medical data. The hardware unit of clinical medical data monitoring system consists of hardware frame unit, ARM processor selection unit, RAM memory selection unit and its gateway and remote client device selection unit. Through the design of hardware unit and software module, the operation of clinical medical data monitoring system is realized. Compared with the existing system, the design system has shorter response time and higher monitoring efficiency, which fully proves that the design system has better application performance and provides an effective means for hospital administrators and public health management departments.

Keywords: Artificial intelligence · Big data · Clinical medicine · Medical data · Monitoring

1 Introduction

Big data has opened a major era of transformation. Its concept in recent years has become more and more recognized, and has applied to all walks of life in scientific research production. It is no longer far away in people's lives. Engineers at Google used years of search-log data to predict the spread of winter flu in the weeks before the H1N1 outbreak, and to predict specific regions and states; Farecast used flight records and airfare data to predict fares for domestic flights with 75% accuracy; and Xoom successfully spotted criminal gangs trying to defraud each transaction by analyzing data from cross-border remittance companies. Big data is changing the world, from technology to business, economics, humanities, education, health care and other aspects. Big data holds great value, the application of Big data makes us face great opportunities which will bring great change to the whole era.

In the medical and health industry, but also because of its industry characteristics, clinical medical data has been more and more mentioned in recent years, become the object of study. But how to make "Big Data of Clinical Medical Treatment" from the

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“cloud” to be a real and effective information product or service is still something worth studying. The clinical medical industry has met the challenge of massive data and unstructured data for a long time. Because of the limitations of technology and finance, it has not been applied well. In recent years, many countries are actively promoting the development of medical informationization, as well as artificial intelligence technology, which means many medical institutions have the funds and direction to do big data analysis. With the rise of electronic health records systems, imaging systems, electronic prescription software, medical claims, public health reports, and related applications and mobile medical devices, the medical services industry has emerged as the primary beneficiary of big data with the greatest analytical potential. Huge amounts of data from medicine, pharmacy practices, health care professionals, patients, medical records, and even institutions are waiting for big data analysis. The analysis of these data, which is used as a reference for the treatment of clinical patients, has begun to serve as an entry point for the analysis and application of medical big data, with a growing number of institutions and scholars conducting research [1]. On the other hand, how to use this medical data in the supervision of medical behavior and medical quality from the perspective of public management of clinical health care is seldom discussed.

With the development of hospital management and the improvement of hospital supervision, it is imperative to strengthen hospital supervision by using modern information. But at present, the information construction of domestic hospitals mainly focuses on business process management and charge management, and seldom involves the monitoring of clinical medical data quality. For example, reference [2] rethinks the issue of patient consent in the era of artificial intelligence and big data. However, there is not much mature experience for reference in monitoring the quality of clinical medical data through the information system, including whether the doctor’s diagnosis and treatment is in line with clinical norms, excessive or lack of medical treatment, whether the medication is safe, and whether the diagnosis and treatment of patients with medical insurance is in line with the provisions of medical insurance policy.

Based on the analysis of medical big data and artificial intelligence technology, this paper collected, calculated and analyzed clinical medical data, and found these irrational and irregular phenomena. According to the above ideas, a set of clinical medical data monitoring system is designed and implemented in medical institutions and public health management departments, which provides effective means for hospital managers and public health management departments.

2 Hardware Unit Design of Clinical Medical Data Monitoring System

The hardware unit is the basis for designing the stable operation of the system. In order to solve the problems existing in the existing system, the hardware unit of the system is designed, including hardware frame building unit, ARM processor selection unit, RAM memory selection unit and its gateway and remote client device selection unit. The specific design process is as follows:

2.1 Hardware Framework Building Unit

The system adopts modular design method, adopts ARM system V5 architecture S3C2440A as the main control unit chip, and the hardware design is divided into the functional module design of the terminal main control board and the interface board, mainly including RAM memory circuit, Nand Flash memory circuit, power supply module circuit, ECG rate collection module circuit, body temperature parameter collection module circuit, pulse oxygen saturation collection module, etc., and adds the LED lamp to display the system status [3]. The system functional structure diagram is shown in Fig. 1.

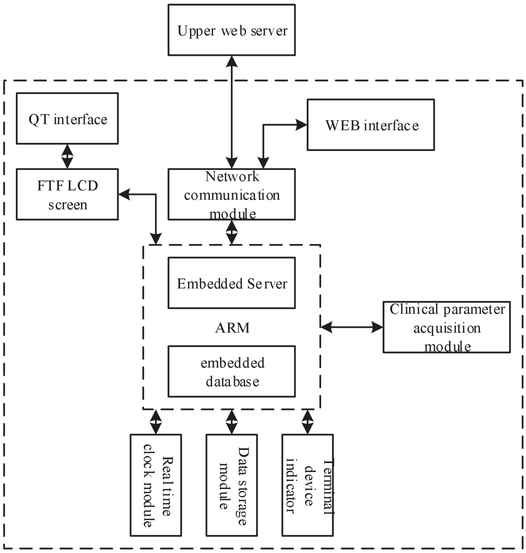

Fig. 1. Design system hardware framework diagram

Based on the design system hardware framework mentioned above, the system hardware is selected. Due to the limitation of space, this study only scientifically selects ARM processor, RAM memory, its gateway and remote client devices, and other devices continue to use existing system hardware devices [4].

2.2 ARM Processor Selection Unit

The S3C2440A is a microprocessor based on the ARM920T core. It is a high integrated, low power processor introduced by Samsung. It is developed with 0.13 um CMOS standard cell and memory compiler. It adopts a new bus architecture known as the Advanced Microcontroller Bus architecture. The core of the S3C2440A has an advanced RISC machine designed with a 32-bit ARM920T RISC processor. Its low-power, simple, and all-static design is particularly suited to cost-and power-sensitive applications [5].

The chip integrates the following components: 16kB instruction cache, 16kB data cache, external storage controller, LCD-specific DMA LCD controller, 4-way DMA controller for external request pins, 2-way SPI, 3-way URAT, 2-way USB host control/1-way USB interval control, 4-way PWM timer/1-way internal watchdog timer/watchdog timer, 8-way IIC bus, 8-way 10-bit ADC and touchscreen interface.

The control circuit needs to realize the function is similar to the host computer in the PC. The control circuit design includes microprocessor, SDRAM, Flash and various other device interfaces, including LCD interface, touch screen interface, USB interface and DART interface etc. [6].

2.3 RAM Memory Selection Unit

The S3C2440A microprocessor itself has only 16-kilobyte instruction Cache and 16-kilobyte data Cache, without internal RAM or ROM. In order to make the main control system work normally, it is necessary to configure external RAM memory in the control circuit.

Although the S3C2440A does not have physical RAM memory, the S3C2440A is configured with an external storage control unit that includes the SDRAM controller and slicing logic. The storage controller of the S3C2440A provides the required memory control signals for access to external storage channels [7].

The S3C2440A's storage controller has the following characteristics:

First, support the mode of large and small terminals (software selection);

Second, there are a total of eight memory banks, and Bank0 can be used as a boot ROM, with the exception of bank0, other banks have programmable access sizes.

Third, the address space: bank0- bank5 fixed 128 MB;

Fourth, 7 fixed start address banks, for each bank programmable loop access;

Fifthly, the starting address of bank7 is adjustable, and the capacity of bank6 and bank7 is programmable.

Sixth, support SDRAM automatic refresh mode and power-down mode.

In a S3C2440A reset memory image, the SROM represents ROM or SRAM -type memory, and the SFR represents a special functional register. OM0, OM1 are the two external pins of the S3C2440A, when OM [0: 1] = 0 the processor can boot from Nand Flash, and when OM [0: 1] - 0 the processor can boot from *j* at 0x00 _ 0000 instruction unit.

In theory, the entire 32-bit CPU storage size is 4 GB, which is from address 0x000 _ 0000 to 0xFFFF _ FF. For S3C2440A, from 0x0000 _ 0000 to 0x4000 _ 0000 is the actual address space available. Space is reserved for 0x6000 _ 0000 to 0xFFFF _ FFFF. The first 1 GB of S3C2440A is divided into 8 groups of memory blocks, which correspond to the 8 enabling pins of nGCS [0: 7] chip respectively.

Blocks 0–5 are ROM/SRAM blocks, blocks 6 and 7 are SROM/DROM/SDRAM blocks, and when the system is accessed at the corresponding storage location, the corresponding nGCS [0: 7] pins are enabled. From 0x4800 _ 0000 to 0x6000 _ 0000 are special function registers for S3C2440A, that is, registers for other function units on the S3C2440A control chip. Because ARM has fixed registers, but different companies produce ARM -based microprocessors will vary, usually there is a specific block of memory to store these control registers storage location.

Because SDRAM is controlled by a storage controller, not every SDRAM chip is supported by the CPU of the ARM. The sixth and seventh chunks of the S3C2440A support 2 MB, 4 MB, 8 MB, 16 MB, 32 MB, 64 MB, and 128 MB SDRAM. The SDRAM storage mapping space address configuration is shown in Table 1.

Table 1. SDRAM storage mapping space address configuration table

Block size	Bus width	Memory architecture
32 MB	×16	(8M × 4 × 2 banks) × 4 ea
	×16	(4M × 4 × 2 banks) × 4 ea
	×32	(4M × 5 × 2 banks) × 4 ea
	×32	(2M × 8 × 4 banks) × 4 ea
	×16	(4M × 8 × 4 banks) × 2 ea
	×32	(2M × 16 × 4 banks) × 1 ea
	×8	(8M × 8 × 4 banks) × 1 ea
	×16	(4M × 16 × 4 banks) × 4 ea
64 MB	×32	(4M × 8 × 4 banks) × 4 ea
	×16	(8M × 8 × 4 banks) × 2 ea
	×32	(4M × 16 × 4 banks) × 2 ea
	×8	(16M × 8 × 4 banks) × 1 ea

As shown in Table 1, block size refers to the size of the SDRAM as viewed from the ARM CPU, depending on the maximum access range of the CPU. The maximum 128 MB SDRAM for S3C2440A was described earlier, but the address configurations for SDRAM with 32 MB and 64 MB block sizes are listed here due to space limitations. Bus width is the unit of one-time access by the CPU. Memory architecture refers to the specification of the SDRAM provided by the main control chip memory controller. The architecture of SDRAM includes BA pins, and the target chip uses different address lines for block address selection.

ARM -based microprocessor memory can be divided into two types according to the different access methods. One is asynchronous memory, such as ROM, EPROM, etc. The biggest feature of this type of memory is that the number of address buses can only determine the number of units of memory, suitable for small-capacity system design, which is usually used to place the system's bootstrap program. The other is synchronous memory, such as SDRAM. This type of memory must have a set of synchronized clocks. It runs faster than asynchrony, and its address bus does not correspond to the size of the memory. The SDRAM address bus can represent both a row address bus and a column address bus, and the row and column address buses can be grouped differently depending on the SDRAM [8]. There are also so-called block address choices, and the number of blocks varies depending on the SDRAM, usually divided into 2 or 4 blocks.

In order to improve the system running speed and facilitate future system upgrades, 64MB SDRAM is pre-configured in the control circuit design. As you can see in Table 1, there are two options for configuring a 64 MB SDRAM with a 32-bit bus width. One option is to select an SDRAM chip with a base unit of 128 Megabytes and a memory architecture of 4 M84banks and 4 EA. The second option is to select an SDRAM chip with a base unit of 256 Mb and a memory architecture of 2 EA (4 M164banks). Since both solutions require four banks, two address lines, A24 and A25, are required to implement block selection.

2.4 Gateway and Remote Client Device Selection Unit

The hardware platform used in the gateway is OK6410 development board, which is shown in Fig. 2.

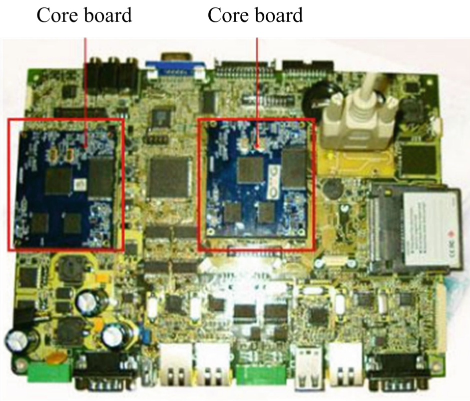

Fig. 2. OK6410 development board physical schematic

The resources on the development board are as to

Processor: Samsung S3C6410, ARM11 core;

Main frequency: 553 MHz/667 MHz;

Memory: 256 MB;

NAND Flash: 1 Gbytes;

Network Card: 1 100M network port, using DM9000AE, with the connection;

Serial port: 4 serial ports, including a RS232 serial port and 3 T;

USB: A USB HOST and a USB Slave interface;

LCD: 4.3 in. TFT LCD screen.

The hardware platform adopted by the remote client is TQ2440 development board, the physical development board is shown in Fig. 3.

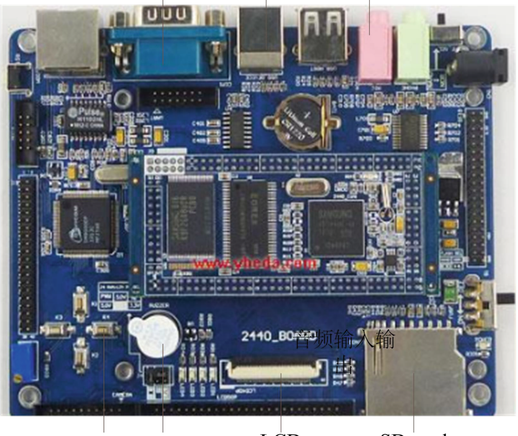

Fig. 3. TQ2440 development board physical schematic

The resources on the development board are as follows:

Processor: Samsung S3C2440, ARM9 core;

Main frequency: 400M, can double frequency to 533M;

Memory: 64M;

NAND Flash: 256 M;

Network Card: 1 100M network port, using DM9000AE, with the connection and transmission indicator l;

Serial port: an RS232 serial port and 3 expanded interfaces;

USB: A USB HOST and a USB Slave interface;

LCD: 4.3 inch TFT LCD screen.

The above process completes the design and selection of system hardware, but still can not achieve the monitoring of clinical medical data, so based on this, design system software module.

3 Software Module Design of Clinical Medical Data Monitoring System

The software module of the design system includes data acquisition and transmission module, data mining module and data stability control module. The software module design process is as follows:

3.1 Data Acquisition and Transmission Module

The clinical medical data mainly include temperature, ECG rate, pulse oxygen saturation, etc., and the above data collection and transmission schemes are selected as follows:

(1) Temperature measurement scheme
There are two methods to collect body temperature data: traditional contact method and popular electronic instrument method.
Mercury thermometer: This is the most common clinical contact method of measuring body temperature. A glass tube is filled with mercury in its storage sac. Using the principle of mercury expansion by heat, the body temperature is displayed. This method has the advantages of convenience and practicality. But because this kind of thermometer is easy to volatilize after breaking, pollutes the environment, this kind of measurement method has been eliminated in some areas.
Electronic thermometers: Common electronic thermometers are thermistor and thermocouple thermometers [9, 10]. The principle of thermistor thermometer is that the value of thermistor in thermistor varies with heat expansion and cold contraction, and the principle of thermocouple thermometer is that the current varies with temperature in the circuit composed of two different kinds of metals. Because of the rapid development of science and technology, the cost of manufacturing thermometers is gradually declining, electronic thermometer measurement has been quite mature. In the existing technology, electronic thermometer can not only achieve discontinuous measurement, but also can achieve continuous measurement, which provides help for continuous monitoring of body temperature.
At present, there are two methods of human body temperature measurement: contact method and non-contact method. Infrared thermometry is a common non-contact method of temperature measurement based on the principle of thermal radiation. The advantage is that the measurement technology is mature and convenient, and it is a development direction of measurement technology.
The MLX90615 is a contactless electronic chip. Using infrared measurement. The measured data have the advantages of high accuracy and stability. So this system uses non-contact 1VB, X90615 chip for temperature measurement.

(2) ECG rate measurement programme
The commonly used ECG acquisition modules are very complex, including input conditioning circuit, preamplifier circuit, shielding driving circuit, high-pass filter circuit, low-pass filter circuit, etc. In the acquisition process, the ECG signal collected by the input electrode is amplified through the amplification circuit, then the low-frequency signal contained in the ECG signal is filtered through the high-pass filter circuit, and the power frequency signal and the high-frequency signal are interfered with and filtered. Finally, the signal is amplified and converted into a digital signal that is easy to identify through an analog-to-digital converter, and the data is provided to the processor for processing.

Nowadays, more and more electronic technology is used in medical treatment. Many companies have introduced small integrated circuit chips, in which filter circuits, amplifiers and AD converters are concentrated. There is a digital signal processing module inside the chip for digital filtering algorithm. So choose a small BMD 101 ECG acquisition chip, not only can reduce the layout of the circuit, but also can make the design more concise, form a modular design.

(3) Pulse blood oxygen saturation measurement scheme
Common electrochemical methods and optical methods are widely used in the measurement of blood oxygen concentration. Traditional electrochemical methods first need to take blood from the human body, and then electrochemical analysis by an analyzer to get the partial pressure of arterial oxygen, so as to calculate the oxygen saturation of arterial blood. Compared with electrochemical methods, optical methods not only do not need to collect blood, will not cause injury to the human body, but also can be real-time continuous monitoring. The main principle of the photochemical method is to calculate the oxygen saturation of blood by using the different absorption of light by blood at different wavelengths. Although the accuracy of the photochemical method is lower than the electrochemical method, it is simple to use. Its clinical effects have been widely recognized. YS2000A module using photochemical measurement method, high measurement accuracy, good real-time. Therefore, this monitoring system uses YS2000A module with digital blood oxygen probe to collect pulse and blood oxygen saturation.

Human physiological parameters include ECG, heart rate, pulse, oxygen saturation, body temperature and so on. According to the design characteristics of telemedicine data acquisition system, this paper adopts the following design schemes. The ECG module uses BMD101 chip, the oxygen module uses YS2000A module designed by Shanghai Berry Electronics Company and digital oxygen probe to collect pulse and oxygen saturation information, and the body temperature measurement uses MLX9061 chip, so the body temperature measurement can be completed without building other circuits. This modular design facilitates system maintenance, but also reduces the cost of research and development.

The existing data transmission methods are mainly as follows:

WiFi technology: WiFi technology is based on the IEEE 802.11 protocol IEEE 802.11 protocol, the Chinese name for wireless fidelity technology. WiFi technology has been rapidly applied due to its unique technical advantages since it came out. It has the advantages of long transmission distance, high transmission speed and no need for wiring. At the same time, WiFi technology allows many users to access, easy to expand the system, has become a rapid development direction of the infinite local area network.

Bluetooth technology: Bluetooth technology is widely used in people's daily life, such as Bluetooth headset, Bluetooth speaker and mobile phone data transmission. The Bluetooth Technology Alliance is mainly responsible for the management and certification of Bluetooth projects, the maintenance of Bluetooth certified trademark rights and the effective supervision of Bluetooth protocol development. To enter the consumer market as a Bluetooth device, the electronic device manufactured by the manufacturer must comply with the Bluetooth device specification standards introduced by

SIG. Its characteristics are short transmission distance, slow data transmission rate, suitable for short distance and small capacity transmission. Because of its common frequency band, it is easy to be disturbed by the outside.

Ethernet transmission: The most common standard of communication protocol used between communication devices. Ethernet networks use CSMA/CD technology, and Ethernet transmits packets between interconnected devices at a rate of 10 to 100 Mbps. Ethernet is similar to the IEEE 802.3 standard. It has the characteristics of fast data transmission speed, good confidentiality, can use a variety of transmission media. Suitable for large capacity transmission without distortion.

According to the special requirements of clinical medical data monitoring system, the system chooses Ethernet which has better confidentiality to transmit medical data.

3.2 Data Mining Module

Data mining is the application of big data analysis method, which can mine clinical medical data deeply and lay a solid foundation for its monitoring.

Data mining is an interdisciplinary field, which combines database system, statistics, machine learning and other technologies into one. Data mining can be described from the business point of view as: according to the established business objectives of enterprises, exploring and analyzing a large number of enterprise data, revealing hidden, unknown or verifying the known regularity, and further modeling its data processing methods. In the field of medical big data, many data mining techniques have been successfully applied to clinical medicine and scientific research. Based on the basic concepts of data mining, this chapter focuses on some algorithms of data mining, including the most common association rules algorithm and clustering classification algorithm, and applies them to the clinical data of patients, and tries to discover some unknown rules in the clinical data of patients by using the algorithm rules, so as to provide a scientific basis for medical prediction and optimization of medical plan.

The technologies and methods used in data mining mainly come from interdisciplinary and related technical fields, which can be summarized as the following seven points:

1) Statistical methods: certain statistical processes are involved in data mining, such as mathematical sampling and modeling, hypothetical judgment, etc. Nowadays, under the background of big data, distributed storage and computing capacity are becoming stronger and stronger, and the sampling calculation method can even be directly evolved into total calculation.
2) Decision tree: Decision tree is mainly used for data classification and prediction, and has many implementation algorithms, including ID3 learning algorithm, SLIQ algorithm, etc. In the clinical medical forecast project of a hospital, the decision tree classification method of data mining is applied to the test report data of patients, and the decision tree graph of the test report data of patients is obtained.
3) Artificial neural network: This technology mainly imitates biological neural network, and improves the learning ability of the machine through data training, so as to achieve the effect of autonomous prediction. Often used for clustering, feature mining and other operations.

The above mentioned technologies have different advantages and disadvantages, so there is no universal data mining method. In the specific work, the appropriate algorithm is selected according to the data type and data set size.

However, in the process of data mining, an attribute is first determined to be included in the class attribute, and the number of determined attributes must be controlled, which is the concept of "multi-dimensional mining". Because including too many attributes will reduce the performance of the system, then the system's predictive responsiveness will be affected; If the included attributes are incomplete, then the accuracy of data mining will be reduced. Usually for a certain industry more familiar with the practitioners often through industry experience to filter out the relevant attributes. As the number of attributes in a dataset rises to a certain level, such as thousands of clinical indicators of diabetes, the difficulty factor for practitioners in making empirical judgments increases, resulting in misjudgments [11–13].

The indexes of clinical medical data mining model are shown in Table 2.

Table 2. Clinical medical data mining model indicators table

	First level indicators	Secondary indicators
Indicators of clinical medical data mining model	Basic attributes of patients	Age
		Sex
		Region
		Occupation
		Income
		Constellation
		Other indicators
	Medical services	Visit number
		Frequency of visits
		Consumption of medical treatment
		Other indicators
	Index business	Number of indicators
		Indication of abnormal indicators
		Index test value
		Index test frequency

Association rule algorithm is a frequent item set algorithm for mining association rules. Apriori algorithm and FP-Tree algorithm have been widely used in many fields such as sales, insurance and so on. The basic idea of the algorithm is to find out all item sets, the probability of occurrence of these item sets must not be less than the minimum support degree set by the system, and then generate strong association rules from item sets, which must not be less than the minimum support degree and the minimum confidence degree. Then, according to the rules generated by the initial itemset, all rules containing only the items of the set are generated, in which there is only one item on the right of each rule, and only those rules that are greater than the minimum confidence level given by the system are left. The algorithm can generate all frequent item sets using a recursive approach.

In order to better explain the principle of association rule algorithm, this section starts with a simple medical data example, briefly describes the operation process of association rule algorithm. The sample data is shown in Table 3.

Table 3. Data sample table

Report sheet number	Medication status
1	A.B
2	C
3	D
4	A.B.C
5	A.C

Support: in the above sample, the support of sub item set $\{A, B, C\}$ is 1/5, because only the record with order number 4 contains all three sub items a, B and C. The support of $\{A, B\}$ is 2/5.

Confidence: this indicator will tell you how often a patient report contains a, then the possibility of item b. For example, the confidence level for $\{A, B\}$ would be 2/3, because three reports included a, and only two reports contained a sub item combination $\{A, B\}$. So the confidence is defined as:

$$Conf(X, Y) = \frac{Supp(X \cup Y)}{Supp(X)} \tag{1}$$

Promotion degree: in general, if the two have high support and high confidence, it means that there is a strong correlation between the two. However, in some cases, this may be incorrect, because even if A and B are independent of each other, items A and B may still have high support. A better criterion to judge the strength of association rules is called promotion degree. The calculation formula of lifting degree is as follows:

$$Lift(X, Y) = \frac{Supp(X \cup Y)}{Supp(X) * Supp(Y)} \tag{2}$$

The degree of promotion is greater than 1.0, which indicates that X, Y has strong correlation. The higher the degree of promotion, the stronger the correlation strength. In the previous example, the lift of $\{A, B\}$ is calculated as follows:

$$Lift(A, B) = \frac{Supp(A \cup B)}{Supp(A) * Supp(B)} = 1.667 \tag{3}$$

3.3 Data Stability Control Module

This module uses the artificial intelligence control technology to carry on the accurate control to the clinical medical data stability, enhances the data monitoring the effect.

In the monitoring system of clinical medical data, there is a high demand for real-time data. This requires mobile platform -side applications to access the backend database at regular intervals, downloading the latest data in a timely manner. However, during the downloading of data, there are likely to be data loss, response timeouts, data redundancy, and so on. In the whole process of system, the system should specify the method of data time stability. In this paper, the use of frame drop management mechanism to complete. The frame drop mentioned here includes two cases: active frame drop and passive frame drop.

Because of the complexity of the network, the video packets transmitted in the network may be lost or damaged. If the received data is not checked by the receiver, then the decoder will be unable to decode normally. Network packets will contain a check code for the data they carry, in case the data is lost in the process of network transmission. This mechanism can detect the integrity of the data carried by a single packet, but if the entire packet is lost, it will be more difficult to detect.

This paper adopts SOAP protocol, which is a network protocol of sending packets sequentially. Then the serial number of the packet can be used to determine whether the received packet is lost. The loss of packets can lead to errors in data analysis, and once detected, the associated data needs to be discarded.

The design system has to discard some data that cannot be processed in time due to the limitation of the performance of the software and hardware of the device and the transmission capacity of the network. The behavior of frame dropping is initialized by the application program, so the case of frame dropping is called active frame dropping. Setting up active frame dropping is a control behavior that has to be made due to the special needs of monitoring. It needs to consider two aspects: when to lose frames and what data to lose. Handling active frame dropping requires control of at least three buffers located in different threads. The first thread is responsible for fetching packets from the network, hereinafter referred to as the fetch thread. It does not care about the contents of the packet and simply stores the obtained packet in the first buffer, hereinafter called packet buffer. The second thread parses the data in the packet into frames, hereinafter referred to as composite threads. The storage space set in this thread is called a combined buffer. The third thread is the frame data into the decoder for decoding, hereinafter referred to as waiting for the decoding thread. The data buffers in this are called waiting queues.

Through the design of the hardware unit and software module, the operation of clinical medical data monitoring system is realized, which provides an effective means for hospital administrators and public health management departments, and provides reliable data support for the development and research of clinical medical industry.

4 System Application Performance Analysis

In order to verify whether the design system can solve the problems existing in the existing system, this study uses MATLAB simulation platform to design experiments. The specific experimental process is as follows:

4.1 Construction of Experimental Environment

The experimental environment is the key to the smooth progress of the experiment, the specific building process as follows:

In order to ensure the stable operation of the system and the response efficiency of data analysis and intelligent supervision, the following hardware environment and corresponding system are planned.

The engine server mainly deploys the rules engine service. In a development environment, multiple engine services are started on a single engine server. Different engine services take different ports to provide communication. Scheduling and other application servers are mainly used for deploying ETL scheduling services, beforehand reminder services, Web application services and other application services.

Auditing engine is the core component of medical big data analysis and intelligent supervision system. The technical architecture of the audit engine is based on Microsoft's. NET Framework development framework. The audit engine is a relatively independent service, which needs to be run in a secure technical and software environment to ensure the security and uniqueness of data transmission and prevent confidential data from being leaked or tampered with. The. NET Framework is developed by Microsoft, a software development platform dedicated to agile software development, rapid application development, platform independence, and network transparency.

It is based on a programming platform which uses the system virtual machine to run, and supports the development of multiple languages based on the general language runtime library. NET also provides new functionality and development tools for application programming interfaces. These innovations allow programmers to develop both Windows and Web applications as well as components and services. NET provides a new reflective and object-oriented programming interface. NET design so that many different high-level languages can be brought together. All languages in the. NET Framework provide a base class library.

This system server uses Oracle 11g as the database. Self-managing data: The ability of an Oracle 11g database to manage its own undo segments means that administrators no longer need to carefully plan and optimize the number and size of fallback segments, or worry about how to strategically allocate transactions to specific fallback segments. Memory management is another area of Oracle 11g where significant management is given. Because of the limitation of space, the management of database system improvement and simplification is not discussed too much.

4.2 System Function Setting

According to the requirements of clinical medical data monitoring experiment, the system functions are reasonably set to ensure the smooth progress of the experiment, as shown in Table 4 (Fig. 4).

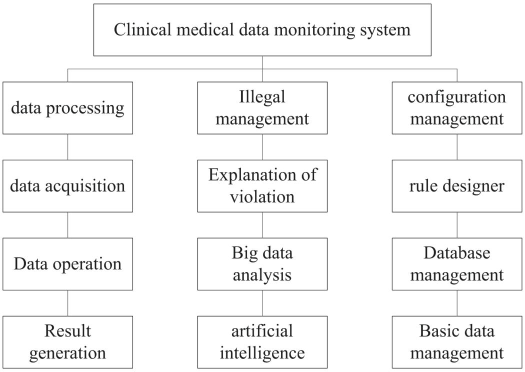

Fig. 4. System function setup diagram

4.3 Analysis of Experimental Results

Based on the abovementioned experimental environment and system functions, clinical medical data monitoring experiments shall be conducted to reflect the application performance of the system through system response time and monitoring efficiency. The specific experimental results are analyzed as follows:

The application performance data obtained from the experiments are shown in Table 4.

Table 4. Application performance data table

Number of experiments	Existing systems	Design systems
(1) System response time		
1	10.23 s	6.12 s
2	9.56 s	5.00 s
3	11.25 s	4.23 s
4	12.45 s	5.01 s
5	12.00 s	3.01 s
6	11.49 s	4.09 s
(2) System monitoring efficiency		
1	45.23%	70.12%
2	56.59%	75.49%
3	58.40%	80.00%
4	60.12%	81.24%
5	51.47%	80.05%
6	52.05%	85.49%

As shown in Table 4, the existing system response time range is 9.56 s–12.45 s, and the monitoring efficiency range is 45.23%–60.12%; the design system response time range is 3.01–6.12 s, and the monitoring efficiency range is 70.12%–85.49%. The main reason is that in the design of the system, big data technology is used to mine and preprocess clinical data, which improves the performance of the system. Compared with the existing system, the response time of the design system is shorter and the monitoring efficiency is higher, which fully proves that the design system has better application performance.

5 Conclusion

By introducing artificial intelligence and big data analysis method, a new clinical medical data monitoring system is designed, which greatly shortens the system response time and improves the system monitoring efficiency.

References

1. Ho, C., Joseph, A., Karel, C.: Ensuring trustworthy use of artificial intelligence and big data analytics in health insurance. Bull. World Health Organ. **98**(4), 263–269 (2020)
2. Kotsenas, A.L., Balthazar, P., Andrews, D., et al.: Rethinking patient consent in the era of artificial intelligence and big data. J. Am. Coll. Radiol. **18**(1), 180–184 (2021)
3. Cheng, X., Chen, F., Xie, D., et al.: Design of a secure medical data sharing scheme based on blockchain. J. Med. Syst. **44**(2), 52 (2020)
4. Li, B., Ding, S., Song, G., et al.: Computer-aided diagnosis and clinical trials of cardiovascular diseases based on artificial intelligence technologies for risk-early warning model. J. Med. Syst. **43**(7), 228 (2019)
5. Goldenberg, S.L., Nir, G., Salcudean, S.E.: A new era: artificial intelligence and machine learning in prostate cancer. Nat. Rev. Urol. **16**(7), 1 (2019)
6. Kalinin, S.V., Lupini, A.R., Dyck, O., et al.: Lab on a beam—big data and artificial intelligence in scanning transmission electron microscopy. MRS Bull. **44**(7), 565–575 (2019)
7. Xu, K., Wang, Z., Zhou, Z., et al.: Design of industrial internet of things system based on machine learning and artificial intelligence technology. J. Intell. Fuzzy Syst. **40**(2), 2601–2611 (2021)
8. Dong, D., Wang, X.: Human-computer system design of entrepreneurship education based on artificial intelligence and image feature retrieval. J. Intell. Fuzzy Syst. **39**(4), 5927–5939 (2020)
9. Ding, Y.: Performance analysis of public management teaching practice training based on artificial intelligence technology. J. Intell. Fuzzy Syst. **40**(5), 1–14 (2020)
10. Foresti, R., Rossi, S., Magnani, M., et al.: Smart society and artificial intelligence: big data scheduling and the global standard method applied to smart maintenance. Engineering **6**(7), 835–846 (2020)
11. Liu, S., Bai, W., Liu, G., et al.: Parallel fractal compression method for big video data. Complexity **2018**, 2016976 (2018)

12. Liu, S., Fu, W., He, L., Zhou, J., Ma, M.: Distribution of primary additional errors in fractal encoding method. Multimedia Tools Appl. **76**(4), 5787–5802 (2014). https://doi.org/10.1007/s11042-014-2408-1
13. Liu, S., Liu, G., Zhou, H.: A robust parallel object tracking method for illumination variations. Mob. Netw. Appl. **24**(1), 5–17 (2018). https://doi.org/10.1007/s11036-018-1134-8