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Information Security Management System for Archives Management Based on Embedded Artificial Intelligence

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***Abstract*—Archival services are one of the main functions of an information security management system for archival management, and the conversion and updating of archival intelligence services is an important means to meet the increasing diversity and wisdom of the age of intelligence. The purpose of this paper is to study an information security management system for archival management based on embedded artificial intelligence. The implementation of an embedded control management system for intelligent filing cabinets is studied. Based on a configurable embedded system security model, the access control process and the functional modules of the system based on a secure call cache are analysed. Software for wireless RF communication was designed, and two remote control options were designed using CAN technology and wireless RF technology. Tests have shown that the system is easy to use, feature-rich and reliable, and can meet the needs of different users for regular control of file room management.**

Keywords—artificial intelligence, file management, embedded systems, information security

I. Introduction

From the deep excavation of archival resources to the diversified intelligence of service methods, the integration and embedding of artificial intelligence technology is needed. "Artificial intelligence +" archives will further promote the intelligent and wisdom of archival services and overturn the original archival service concept and archival service methods [1-2]. Therefore, the deep integration of artificial intelligence into all aspects of archival services can provide technical guarantee and operation and maintenance assistance for archival wisdom services, which is a change to traditional archival information services and a new ecological product of the deep integration of artificial intelligence and archives [3-4].

Myung-Hoon Cha mainly discusses the importance and problems of information archives management in universities under the background of "big data", and proposes corresponding solutions to the problems based on practical experience. Myung-Hoon Cha mainly discussed the importance and problems of information archives management in universities under the background of "big data", and put forward corresponding measures to solve the problems in order to improve the level of university archives management, better serve the teaching and research, and help the construction of "double first-class" universities in the new era [5]. Christos K analyzed the current situation of hospital title file management based on "Internet+" and "big data" technology. He proposed the structure of the title file management system. It includes basic information, communication, super user, multimedia, score and data security subsets. Based on the structure of the title file management system, the workflow of the title network management and network system is established. This includes publishing, intelligence alerts, data reporting, data review, information disclosure, statistical scoring, voting recommendations and results disclosure. The advantages and difficulties of setting up a web-based system are discussed [6]. Giuseppe Riva presents a wearable, lightweight and affordable embedded system designed to provide haptic and kinesthetic feedback in 3D applications. A PCB was designed for the circuit and inexpensive components were used. Kinesthetic feedback is provided to the user's hand via a 3D printed exoskeleton and five servo motors placed on the back of the glove. Haptic feedback is provided to the user's hand via 15 coin vibration motors placed on the inside of the hand and vibrating at three levels. The system is ideal for prototyping and can be customised, thus making it scalable and upgradable [7]. It is therefore relevant to study an information security management system for archives management based on embedded artificial intelligence.

In this paper, an embedded Linux operating system is used for an information security management system for archives management, which is an important improvement on the traditional information security management system for archives management. Under embedded Linux, the information system is able to achieve higher operational performance with fewer hardware resources and significantly lower costs. The use of embedded multi-process real-time Linux technology can solve the problem of parallel processing of multiple tasks in the system, ensure the stability and reliability of the system and improve the operation speed of the system.

II. Research on An Information Security Management System for Archive Management Based on Embedded Artificial Intelligence

A. The Kernel Structure of Embedded Linux

The Linux kernel consists of five main modules: the process scheduling module, the memory management module, the file system module, the process issue communication module and the network interface module.

The process scheduling module controls the CPU resource usage of each process [8-9].

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The memory management module is used to ensure that all processes can safely share areas of host memory [9-10].

The file system module is used to support the processing and storage of external devices [11].

The inter-process communication module subsystem is used to support information sharing between multiple processes [12-13].

B. Construction of A Security Model for Configurable Embedded Systems

The design idea of this security model is that the user can dynamically configure the user interface according to their needs during the use of the system, and the operations of the upper layers are performed through calls to the MiniGUI interface. The MiniGUI encapsulates the passed user configuration files (XML files) into messages and forms message pairs to the security module for security determination. The security module uses three security policies, MLS, DTE and RBAC, to make the determination [14].

The specific roles of several modules involved in the security model are as follows.

(1) XML interface configuration: It provides the end-user with the ability to modify the interface services through a customisation module driven by the message engine and displays the updated interface based on the customisation results saved in the XML document, separating the interface design data from the application logic module.

(2) MiniGUI interface call: its role is mainly to encapsulate the upper layer operations into messages sent to the security module for security judgement.

(3) Security call cache: The addition of buffers helps to speed up evaluation and reduce system overhead [15].

(4) Security policy profile: A profile in which users save their security access requests.

(5) Security policy server: loads and updates security policies to determine access rights.

C. Access Control Process Based on Security Call Caching

The security call caching process is as follows: first, the operation sent by the higher level is sent to the security call cache query interface, which looks for a matching decision in the security call cache and returns successfully if the access matches the decision; otherwise, the security policy server determines the security policy server. The security properties of the operation are first queried in the "Identification/Security" properties worksheet to obtain the appropriate access configuration from the security policy server, and then each security policy checker security policy checker is invoked [16]. Finally, the intersection of the results is determined based on the three security policies to determine if the operation is secure. The corresponding access operation is notified to the audit subsystem to facilitate security management.

III. Investigation and Research on An Information Security Management System for Archive Management Based on Embedded Artificial Intelligence

A. RF Reader Hardware

RF reader selects MP1584 as buck control chip, input voltage range from 4.5V~28V, maximum output current is 3A, with the characteristics of fast power circuit feedback, rapid voltage compensation and small occupation area.

When the voltage is less than 1.2V(R1+R5)/R5=7.2V, the chip stops working. Resistors R2 and R4 are used to set the output voltage of the switching power supply. The internal reference voltage of pin FB is 0.8V. When the voltage between R2 and R4 is greater than 0.8V, the chip output PWM duty cycle decreases and the output voltage decreases through negative feedback adjustment; when it is less than 0.8V, the duty cycle increases and the output voltage rises. Assuming that the voltage of pin FB is VFB and the output voltage is VCC, it can be seen that:

$$\frac{V_{FB}}{R_4} = \frac{V_{CC}}{R_2 + R_4} \tag{1}$$

Equation (1) is obtained by substituting the data:

$$V_{CC} = 0.8V.\frac{27k + 5.1k}{5.1k} = 5.03V \tag{2}$$

The output voltage of the switching power supply is about 5V, then the RF reader uses ASM1117 to convert 5V to 3.3V. ASM1117 is a DC voltage regulator with overload and short circuit protection function, the maximum error of output voltage is 1.5% and the maximum output current is 1A to meet the system requirements.

B. Software Design of Wireless RF Communication

(1) Wireless remote control

Low-power microcontroller MSP430 has five low-power modes, combined with the actual needs of the system, the remote control system initialized to work in LPM3 mode, interrupts can wake it up and enter the active mode, wait until the interrupt program is executed, the system re-enter the LPM3 low-power mode. The main program of the wireless remote control system is mainly responsible for the initialization of the microcontroller clock, interrupts, other devices and the display of the initial page of the segment LCD, etc. After that, it will enter the low-power mode and wait to be woken up by interrupts.

(2) Keypad interrupt program

The wireless remote control is mainly operated by the keypad. Because the key pin is connected to the MSP430 microcontroller with interrupt function P1 port, the key press triggers an interrupt to wake up the microcontroller in low-power mode, the interrupt subroutine in the P1 port uses the query method to determine the key value and execute the corresponding control program. The key value acquisition procedure is designed using the row scan column cycle detection method, while the jitter elimination algorithm is used to prevent misoperation.

(3) Wireless transceiver module for the local control system

The wireless transceiver module in the local control system uses the same communication protocol as the touch screen control module and the CAN communication control module, so the control commands sent are the same as the latter two.

Not logged in state first need to check the machine number bit, only in the premise of the machine number is correct to continue to determine whether to log in and other information. If the system has been logged in, then the cabinet matching the machine number will execute control commands such as move door, move floor, etc.

IV. Analysis and Research of An Information Security Management System for Archive Management Based on Embedded Artificial Intelligence

A. Functional Modules of the System

The system is subdivided into the following modules and the system functional module diagram is shown in Figure 1:

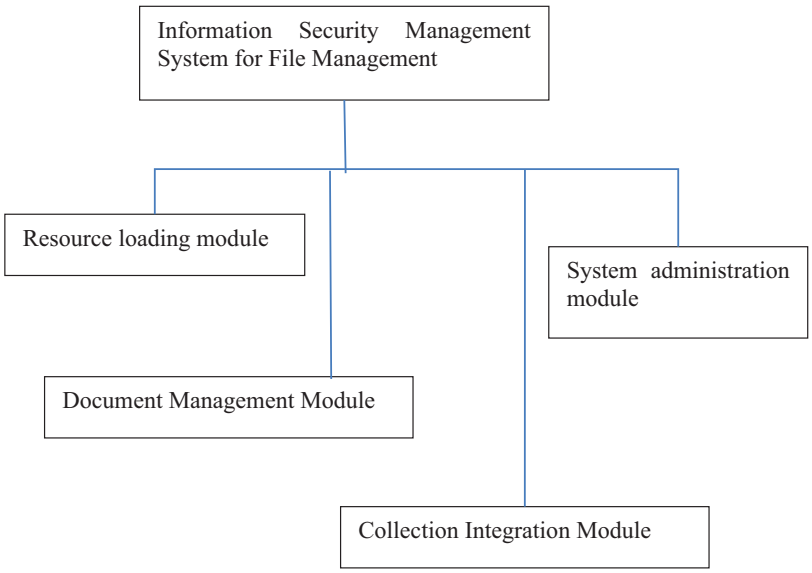

Fig. 1. System functional module diagram

(1)Resource loading module: Through this module, departments load electronic documents distributed centrally to document system administrators, and then the electronic documents go into reorganization.

(2)Document management module: This is one of the main modules of document management business, including information resource management, document business management, digital document management, physical document management, business document management sub-module, each module deals with different business. Information resource management is mainly to complete the entire volume, add and delete document resources; business document management refers to records of information related to file identification, acceptance and destruction; records of physical document management regarding document storage, use of annotations and other information; digital document management is mainly to complete the archiving function of electronic documents; archive warehouse management will record various archive warehouse information, such as warehouse temperature and humidity, facility management, etc In addition, this module has an important function. In addition, this module has an important function that enables the administrator to export electronic documents to reports, including excel and XML files.

(3) Collection Integration Module: This is another core module of the system and includes two file identification and integration sub-modules.

(4) System Management Module: The administrator uses this module to ensure the security of the archive files. The module accomplishes two main functions, one is the recording and viewing of archive utilisation and maintenance logs, and the other is the management of users and their permissions.

B. Electromagnetic Interference Environment Test

The wireless remote control is used for the control of filing cabinets. The operation of the sliding door and floor motors and the switching on and off of AC contactors in the environment in which it is used can cause significant electromagnetic interference to the communication circuit. For the test, a laboratory room with the same strong electromagnetic interference was selected.

Experimental site: laboratory room.

Experimental conditions: The local control system is powered by the microcomputer power supply WD990 with a voltage of 5.17V; the remote control. The remote control is powered by a rechargeable battery and the voltage of the remote control is 3.23V.

The test was conducted by placing the local file system circuit board in the laboratory room, and the tester went around the building while operating the remote control to test the success of communication, the results are shown in Table I.

TABLE I. COMMUNICATION RELIABILITY TESTS IN COMPLEX ENVIRONMENTS

Testing distance	Number of tests	Valid times
Same room	10	10
Same floor	10	10
Same floor	10	8
Outside the building	10	6

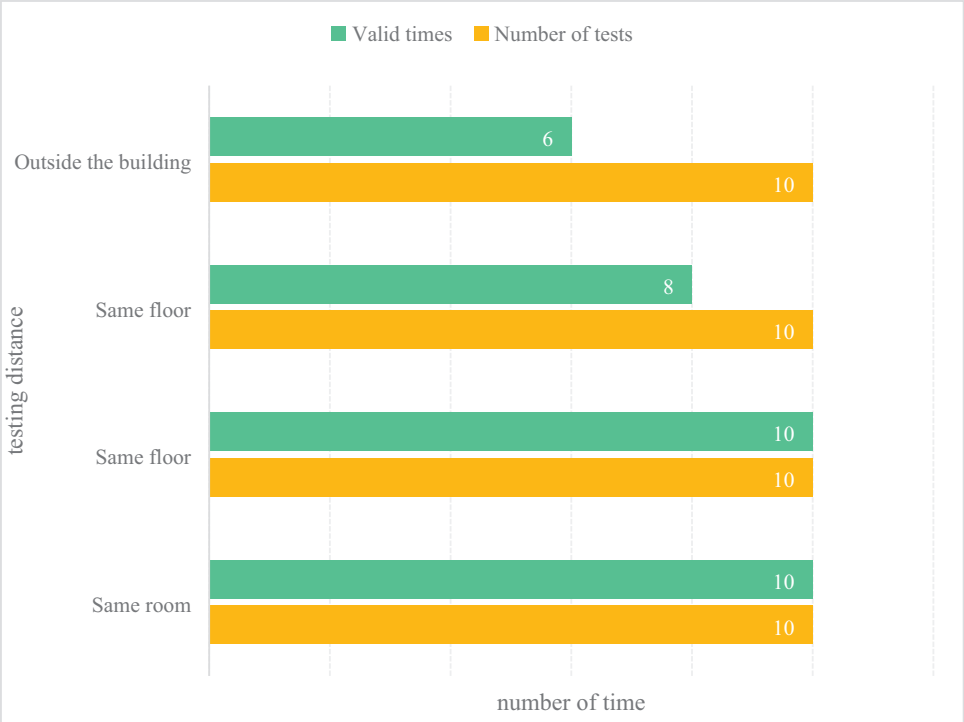

Fig. 2. Electromagnetic interference environment test results

As can be seen from Figure 2, the communication success rate is up to 100% when communicating in the same room and on the same floor. Given that in practice, it is generally operated in the same room, this wireless remote control fully meets the needs of practical applications.

V. CONCLUSIONS

In the context of the era of big data and artificial intelligence, the total amount of archival information resources and user data is exploding, the demand for archival information resources is increasing, and the public's demand for archival resource services is also getting higher and higher, which urgently requires the transformation and upgrading of archival service wisdom, therefore, the study of "artificial intelligence +" archival wisdom service has This paper establishes a security model for embedded systems, which is based on the use of an embedded system. This paper establishes an embedded system security model using three security policies, namely MLS, DTE and RBAC, to determine the security of requests made by upper-level users and to improve the security of the embedded system to a certain extent; in addition, a security policy profile is added to the security model, which can enable different users to flexibly configure the required security attributes according to their respective needs, effectively improving the security of the system. flexibility. However, due to the complexity of the problem itself, as well as the constraints of time, manpower and material resources, further in-depth research is needed, for example, the security policy profile in the model in this paper requires the setting of security attributes before the system can be run.

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