

Research on Intelligent Management System for Portable Training Equipment in Higher Vocational Colleges

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Abstract:

In order to manage portable training equipment in higher vocational colleges efficiently, and promote equipment management to process, standardization and intelligence, an overall plan for intelligent management system for portable training equipment is designed from the perspective of information construction. This system integrates equipment registration, examination and approval administration, equipment inventory, equipment monitoring with intelligent storage functions. Through the introduction of RFID technology, identification, access control, and the process of audit, it realizes and promotes the standardization of use and efficiency of management for the portable training equipment, making the equipment management more refined and intelligent in higher vocational colleges.

Keywords: Higher vocational college, Portable training equipment, RFID, Intelligent management, System design.

I. INTRODUCTION

In higher vocational colleges, practical teaching is an important part of training application-oriented high-skilled talents, for which equipment is an important material condition. The training classroom is like the production workshop of the factory, in which the completion of the training teaching can not be separated from the support of the corresponding equipment as the basic material conditions, so the standardized, orderly and meticulous management of the training teaching instruments and equipment is an important link to complete the training teaching^[1]. In recent years, the increased practice teaching in higher vocational colleges promotes the investment and construction of training equipment to show a rapid growth trend, which brings higher management difficulty to the life cycle management of equipment purchase, purchase, storage, reservation use, inventory check, etc.

In most higher vocational colleges, traditional manual methods are adopted to manage training instruments and equipment, including manual input of equipment information, manual writing of loan and return information, etc., which are relatively backward and unable to meet the current development needs of training rooms in higher vocational colleges. Portable training equipment is usually characterized by

small size, portability and frequent use, which makes it more difficult to manage and easy to be scattered in various experimental training rooms, resulting in the loss of equipment resources in the process of loan and return, repeated purchase of similar instruments and equipment, inability to share and other problems. Therefore, it is necessary to study the intelligent management construction of portable training equipment in the information environment.

II. MANAGEMENT STATUS OF PORTABLE TRAINING EQUIPMENT

Portable training equipment, with small size, long service life, large number of users and high coordination requirements, has always been a difficult problem in the management of equipment assets in higher vocational colleges, which is mainly reflected in the following aspects:

2.1 Comprehensive Quality of Equipment Managers to be Improved

Training room managers, often with lower academic qualifications and professional titles than full-time teachers, spend a lot of time and energy on trivial routine work, and less time to improve their professional ability, and even can't be familiar with and master the basic job responsibilities and procedures^[2]. As a result, they mostly adopt traditional manual methods for extensive management, with weak information awareness and weak ability to effectively use information technology, which cannot meet the new requirements of instrument and equipment management under the new situation.

2.2 Equipment Daily Management Process to be Standardized

At present, most colleges and universities in China adopt a two-level management model for equipment management^[3], i.e. the property rights of the instruments and equipment are vested in the schools, which are scattered to each department for separate management, and laboratories are established according to the specialties, and the right to use the instruments and equipment is vested in each laboratory^[4]. In this case, training instruments and equipment can't be shared uniformly, which is not conducive to improving the utilization rate of equipment. In addition, similar instruments and equipment may be purchased repeatedly. For instruments and equipment with high storage environment requirements, drying ovens should be placed in each training room, which can't maximize the utilization of storage space and increase unnecessary costs and expenses. Moreover, cross-borrowing among training rooms, if any, increases the risk of equipment damage and loss, which makes it impossible to realize responsible management. Combined with the characteristics of portable training equipment, such as many varieties, small size, high borrowing frequency and scattered use locations, it is easy to cause problems such as nonstandard equipment use registration, untimely borrowing and equipment loss.

2.3 The Daily Use Environment of Equipment Assets to be Tracked with Difficulty

The multi-campus running and limitation of school space in colleges and universities leads to the fact

that a teaching and research unit often has offices and laboratories distributed in multiple campuses or scattered in different buildings in the same campus. As a result, great inconvenience is brought to the management of instruments and equipment, such as frequent registration of borrowing and movement of instruments and equipment^[5]. The asset inventory of training room equipment is mostly verified by manually checking the card or bar code label of the asset equipment, which not only makes the inventory extremely inefficient, but also makes the inventory more difficult due to the inability to accurately locate the assets, and also makes the equipment responsibility unclear and the inventory process difficult. In addition, due to the common use of manual management, equipment managers lack dynamic knowledge of the operation and use status of instruments and equipment, and can't realize real-time location tracking and data tracking of equipment assets.

III. OVERALL SYSTEM DESIGN

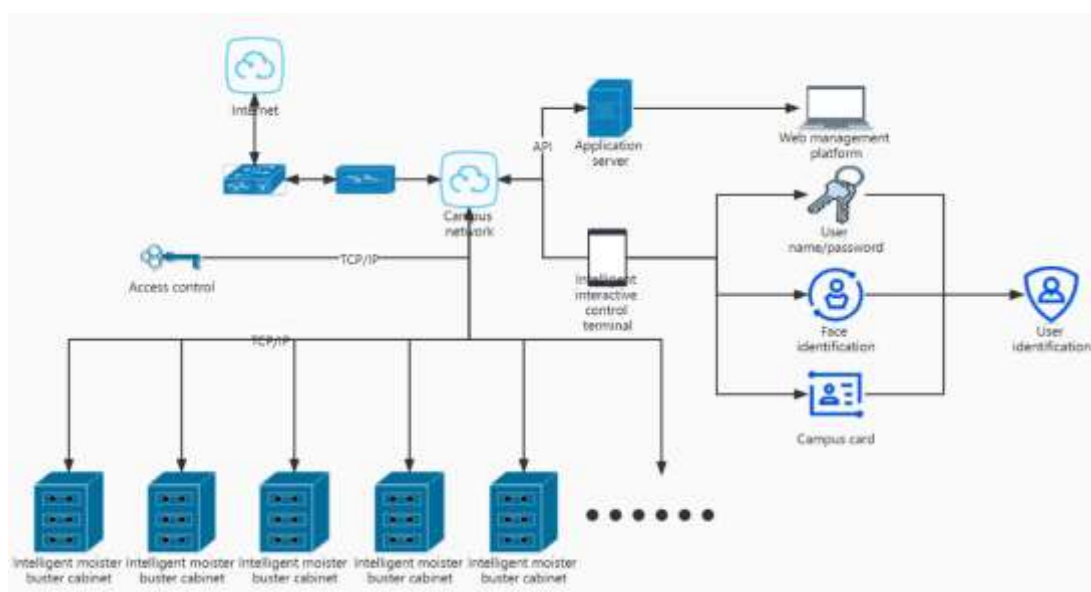
In the *Education Informatization 2.0 Action Plan*, it is pointed out that the Education Informatization 2.0 Action Plan is an inevitable choice to adapt to the development of education in the intelligent environment and an effective way to accelerate the realization of education modernization. Information technology and intelligent technology should be deeply integrated into the whole process of education, to promote the improvement of teaching, optimize management, and improve performance. Under this background, based on the characteristics of portable training equipment itself and the requirements of storage security and orderly borrowing, it will be the advantages of the intelligent management system of portable training equipment to achieve identity authentication, equipment identification, use approval, and data borrowing and returning. The specific design structure is shown in Fig. 1, and the system consists of the following four points:

(1) RFID technology: RFID technology is introduced into the intelligent moisture buster cabinet to identify the corresponding RFID tags of storage devices. The RFID tag has the advantages of large amount of stored data, long service life, long reading distance, data encryption, modification of stored information, adaptability to harsh environment^[6], water resistance, magnetic resistance, high temperature resistance, capability of penetrating non-metallic materials and strong anti-interference capability^[7]. Automatic equipment inventory is carried out during equipment borrowing and returning, and the difference between the inventory and the current RFID tag reading record is compared to obtain the real-time status of the equipment, so as to record the real-time borrowing and returning account of the equipment.

(2) Identification: The identity of the current borrower is confirmed through biometric identification such as face identification, fingerprint identification, or the use of campus card and unified identity authentication. Face identification, which has been widely used in various industries in recent years, is safer and more convenient than traditional password authentication^[8].

(3) Access control: Through the comparison of the borrowing process by the identified personnel, it is confirmed whether the current identified person can enter the storage space for borrowing and returning

(4) The process of audit: Equipment borrowing is subject to audit process, and online application and online approval are required for equipment borrowing. Subsequent operation of equipment storage space can be carried out only after approval.



With the completion of the above design, real-time inventory of portable training equipment, borrowing and returning of users, no perception record of lending, access control of storage space can be realized from the aspects of identification of equipment borrowers, automatic access of storage space, automatic inventory of equipment, intelligent identification of identity, transparency of asset information, information of inventory counting and traceability of lending and returning records.

IV. DETAILED DESIGN OF SYSTEM MODULE

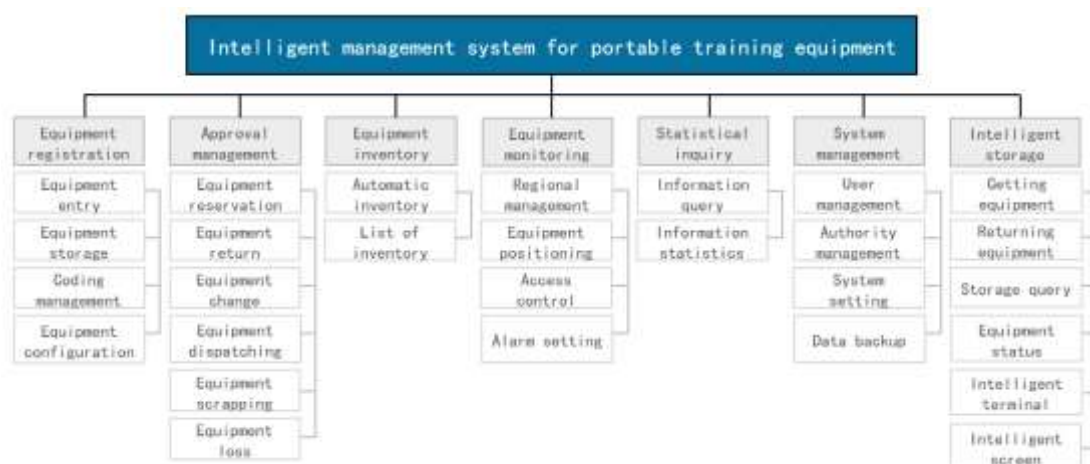


Fig 2: Functional modules of intelligent management system for portable training equipment

4.1 Equipment Registration Module

After the new portable training equipment is purchased, relevant information (brand, model, quantity, photo, number, etc.) is entered into the system and labeled with RFID tags for encoding and storage. The inventory information can be accurately obtained in equipment configuration, which promotes the sharing of instruments and equipment, effectively avoids the occurrence of waste phenomena such as repeated purchase, and provides a timely and reliable guarantee and basis for management decision-making^[9].

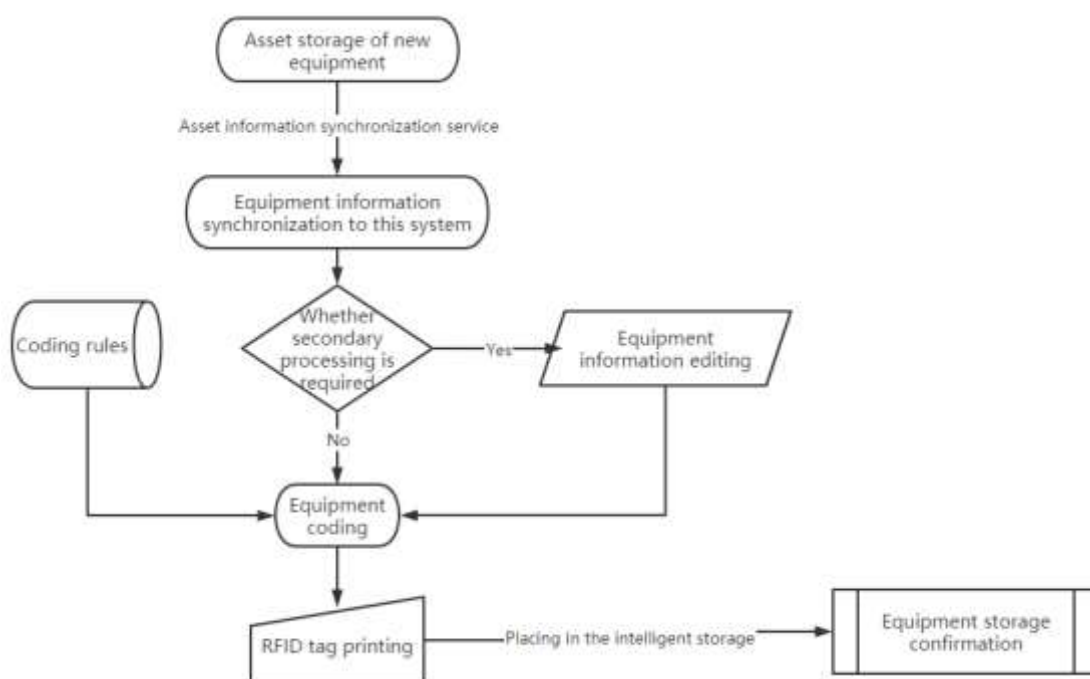


Fig 3: Registration process of portable training equipment

4.2 Approval Management Module

After the user initiates an online reservation application for the portable training equipment, the system automatically displays a list of available equipment to avoid initiating an invalid reservation because the equipment is not in the library, and then the equipment manager reviews the reservation application submitted by the user. Users can go to the intelligent storage to realize identity authentication by means of campus one-card or face recognition, and the intelligent storage opens the access control so that the users can receive the portable training equipment for appointment.

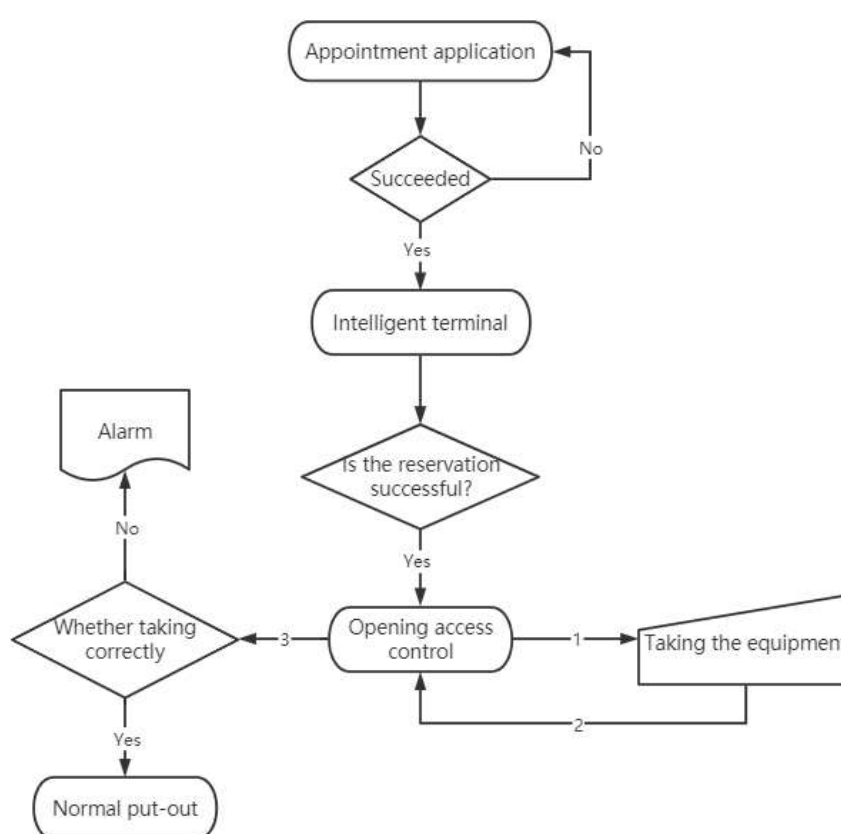


Fig 4: Appointment review process of portable training equipment

4.3 Equipment Inventory Module

The system automatically counts the portable training equipment in the storage in the area by accepting the regular and manual remote counting task command and reading the RFID information through the intelligent storage cabinet, and simultaneously generates the counting list, which is convenient for equipment manager to consult and manage assets.

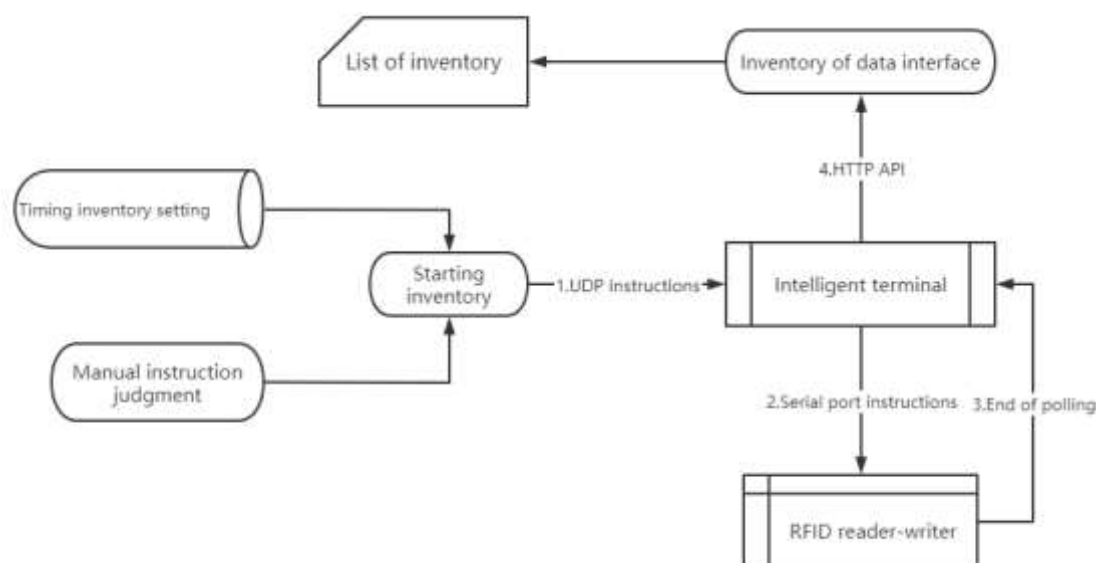


Fig 5: Inventory process of portable training equipment

4.4 Equipment Monitoring Module

The intelligent display interactive panel placed in the intelligent storage displays the reserved equipment and the equipment to be returned before the user collects and reserves the portable training equipment. After the user gets or returns the equipment, the intelligent display interactive panel can display the list of returned or collected equipment, which is convenient for the user to confirm whether the equipment is returned or collected correctly.

Equipment manager can query and monitor the return and collection of portable training equipment based on the equipment inventory and the user's reservation and approval status to realize accurate management and monitoring of equipment use.

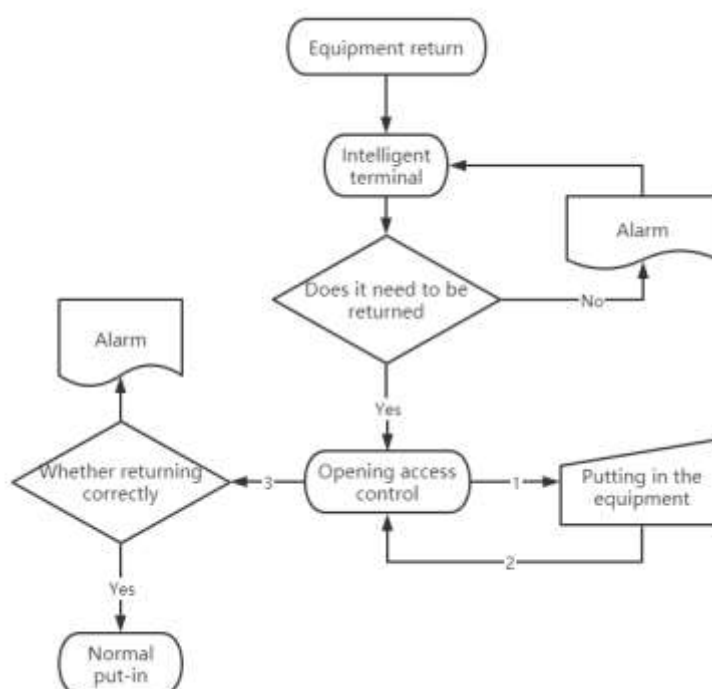


Fig 6: Return process of portable training equipment

4.5 Intelligent Storage Module

The intelligent storage module consists of an intelligent terminal, an intelligent access control, an RFID module (consisting of an RFID read-write module, an RFID read-write antenna, a UHF branch device, etc.), and a storage cabinet.

First of all, the storage process is designed to solve the intelligent control of out-put and in-put system and the visual supervision of equipment in the storage ^[10]. On this basis, the intelligent storage module, as the core storage space and hardware carrier of the system, can realize the classification and safe storage of the portable training equipment, as well as the identity authentication of the user, the access control of the storage space, the inventory execution of the portable training equipment and the reading of the RFID information.

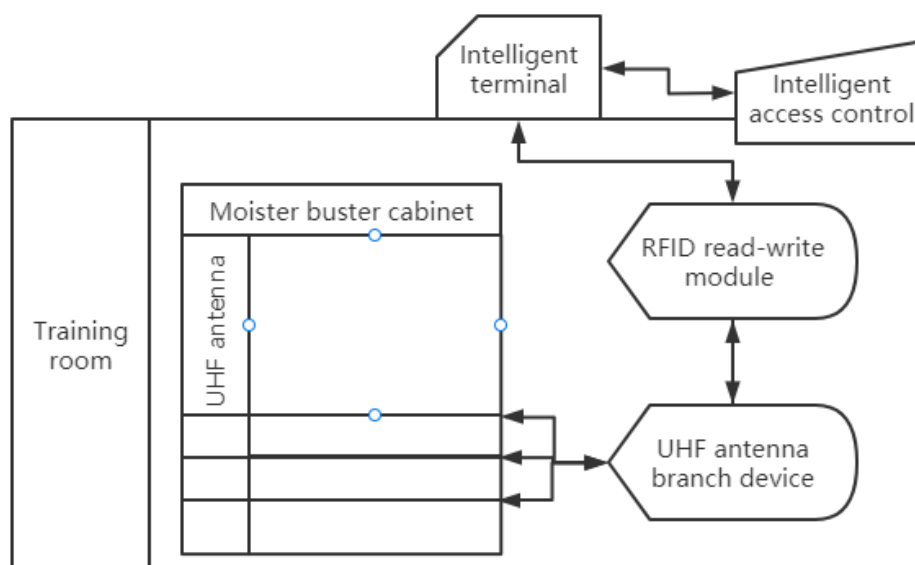


Fig 7: Composition of intelligent storage

4.6 Statistical Inquiry Module

The system provides query capability: equipment status query—query whether the current equipment is in storage, the current equipment requisitioner, the used time, the remaining return time, whether to use overtime, etc. Equipment in-storage query -query the equipment currently in storage, and display the location of storage cabinet and equipment information. Equipment usage query—query information such as current equipment collection status. The intelligent screen can also be used to query and display the information of equipment to be returned, have returned and time information.

The data of equipment utilization rate, equipment reservation times, equipment value utilization rate, personnel reservation, etc. are statistically analyzed through the system operation retained data, which provides data support for portable training equipment management and decision support for teaching equipment purchase.

4.7 System Management Module

System management is the basic data support maintenance module running in the whole system, including: authority management, system operator role and authority management; user management, system operator configuration management and system operator face configuration; system setting, process design, process query, frequency configuration of automatic storage inventory, access control parameter configuration; system data backup.

The system design focuses on the management of portable training equipment, organically integrates personnel information, equipment information and its management process, reengineers the business

process to control from the source, identifies the portable training equipment with the aid of internet of things technology and RFID tags, automatically identifies objects and obtains relevant equipment through non-contact automatic identification technology, performs information collection on the data of each link of instrument and equipment put-in-storage, put-out-storage, inventory checking and other aspects, and monitors in real time, in order to effectively avoid unclear equipment assets and nonstandard equipment storage caused by manual management, and at the same time assist equipment manager to get rid of daily problems such as data statistics and summarization, so that equipment manager can query the equipment data through the system database, master the usage, operation status and inventory of each portable training equipment, promote the equipment management to be process-oriented, standardized and intelligent, and improve the management efficiency of equipment assets.

V. CONCLUSION

Based on the management practice of portable training equipment in Shanghai Publishing and Printing College, the system has optimized the equipment management process, developed the design using RFID technology features, provided an information-based and standardized model for the training room, realized the positioning and tracking of portable training equipment within a certain range, and gave a systematic alarm to the equipment assets leaving the specified range, so as to achieve the objectives of refined management, intelligent inventory and safety supervision of portable training equipment, and improve the modern management level of portable training equipment in higher vocational colleges effectively with application orientation.

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