Practice of Laboratory Extracurricular Open Management Based on Mobile Internet Technology

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Abstract. In order to solve the problems of laboratory construction and management, this paper puts forward the practice of laboratory extracurricular open management based on mobile Internet technology. Design and complete an intelligent open laboratory system by using mobile Internet and Internet of Things technology. The bottom layer of the system is composed of wireless sensor network nodes and coordinators. The mobile terminal sends different instructions to each sensor through the network control coordinator to realize the control of laboratory terminal equipment. The system is easy to operate and improves the intelligence of laboratory management.

Keywords: mobile internet; Laboratory; Open management; intelligentize.

1 Introduction

Under the current historical background and opportunity of mass entrepreneurship and innovation, higher education shoulders a special mission in cultivating innovative spirit and innovative talents. The source of innovation in colleges and universities lies in the laboratory, which is the basic condition for the implementation of innovative education, an important place to cultivate innovative thinking and innovative ability, and the best place for students' potential ability to play [1]. The innovation laboratory plays an important role in the innovation training of college students. It not only provides the necessary material conditions for students' innovative practice activities, but also creates a relaxed environment for students to realize their innovative ideas. Adhering to the traditional concept of open, shared and low-carbon educational resources, with the development of Internet of Things, big data and cloud computing, the traditional laboratory has been out of keeping with the development of the times. Aiming at the purpose and permission of university laboratories, the intelligent open laboratory system was designed and completed by using Internet of Things and mobile Internet technology [2-5]. The bottom layer of the system consists of ZigBee sensors (nodes) and ZigBee development board (coordinator). The mobile terminal sends different instructions to each sensor through the network control coordinator to realize the control of the laboratory terminal equipment, thus effectively saving resources and manpower [6].

2 System function design

Using wireless sensor network and mobile programming technology, an "open laboratory" is designed and completed. The system is easy to operate, achieves the purpose of low carbon

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and energy saving, and improves the intelligence of laboratory equipment control. The overall framework design of the system is shown in Figure 1 and Table 1 [7]. The open laboratory design based on mobile Internet joins the cloud server platform to meet the data sharing of various terminals and realize the development and access of different devices. The addition of wireless transmission control and mobile Internet makes the operation of the system more flexible, allowing managers to monitor the situation of the laboratory at any time; The system conforms to the concept of open, shared and low-carbon educational resources, and the brand-new way can make more students willing to enter the laboratory experiment. In order to prevent the mobile terminal from being out of control due to network failure, the system also designs an emergency plan. In case of network failure, local LAN control can be started [8-9]; The normal use of the network will not affect the local control, and the two systems can run at the same time without affecting each other. The construction scheme design of laboratory management platform based on internet plus is shown in Table 2 [10]. The framework structure of the whole laboratory adopts three-layer structure design [11].

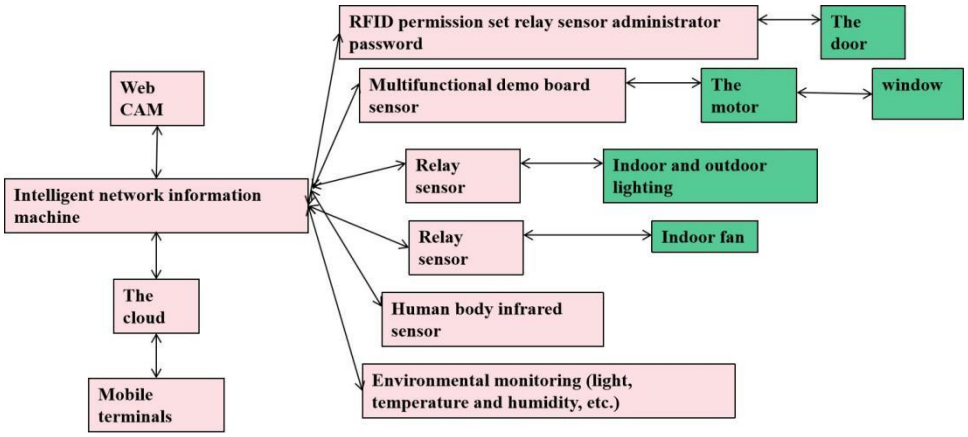

Fig. 1. Overall system framework design

Table 1. Contents of Intelligent Network Information Machine

Intelligent network information machine
RFID permission setting relay sensor administrator password
Multifunctional demonstration board sensor
Relay sensor
Relay sensor
Human infrared sensor
Environmental monitoring (light, temperature and humidity, etc.)

The first layer is the system platform, which mainly uses cloud computing products to build a private cloud environment of an experimental training center [12]. Considering the cost performance of cloud products such as VMware, Eucalyptus, OpenStack, etc., combined with the budget of laboratory construction investment, choose to purchase or use open source cloud for secondary development.

The second layer is system resources. This layer mainly deploys virtual desktop, server virtualization and Web services on the basis of system platform. Virtual desktop is mainly used for the network terminal or computer in each laboratory. According to the requirements of experiment, experimental teaching and management, desktop system and application software are installed to provide working desktop environment and computing services for teachers, students and laboratory staff. Server virtualization refers to the virtualization of servers according to the needs of laboratory management system integration, such as the virtualization of servers required by the installation and deployment of management software such as laboratory course arrangement system, fixed assets management system, laboratory open service system, scientific research management system, etc., and the storage and management of interactive interfaces and background databases of various systems. Use virtual server to publish, register and manage WebService. WebService is a functional component of various self-developed or secondary developed laboratory management systems, which is used to realize the business logic functions of each system.

The third layer is the access interface of the user connection platform. This layer provides a variety of client connection programs such as Web, VNC, remote desktop connection and Android, which is convenient for users to log in and access. Users can connect to the virtual desktop and virtual server of the management platform through tools such as VNC, remote desktop and Web to obtain the required computing services, experimental teaching and management system, whether they are on the computer equipment in laboratory or computer room or on the Internet terminal equipment. The laboratory staff can use the mobile client to connect the experimental management platform to carry out the daily management of the laboratory and the maintenance of the computer room [13].

Table 2. The content of laboratory management platform architecture based on internet plus

resources	Virtual Desktop	Virtual Server	Web Service
system platform	Eucalyptus	OpenStack	VMware

3 System function design

Using wireless sensor networks and mobile programming technology, Design and complete the "open laboratory" "The system is easy to operate, achieving the goal of low carbon and energy saving, and improving the intelligence of laboratory equipment control. The open laboratory design based on the mobile Internet joins the cloud server platform to meet the data sharing of various terminals, realizing the development and access of different equipment; the introduction of wireless transmission control and mobile Internet makes the system operation more flexible, allowing managers to monitor the laboratory at any time; the system conforms to educational resources With the concept of openness, sharing and low carbon, more students are willing to enter the laboratory in a new way. In order to prevent the problem that the mobile terminal cannot control due to network failure, the system also designs an emergency plan. In case of network failure, the local LAN control mode can be started: the normal use of the network will not affect the local control, and the two systems can operate simultaneously without affecting each other.

4 System function realization

In the realization of the specific functions of the intelligent "open" laboratory, the software must cooperate with the hardware to complete the corresponding functions, and the two are indispensable and complement each other. Users can apply for the duration of using the experimental equipment according to their own requirements, and gain access to the laboratory by swiping the campus card (resident ID card), network request or system password. The experimental equipment used by users can control the user's usage time by turning on and off the power, and it's almost time for voice to remind the computer to save data or turn off the power [14-15]. The system automatically controls the classroom lights, fans, curtains and doors through wireless sensor networks, monitors the situation of the laboratory at any time through network cameras, and can monitor the intrusion of the whole laboratory after starting the anti-theft mode. System administrators can monitor the laboratory through mobile terminals anytime and anywhere. When the automatic mode is enabled, the user can open the classroom door by swiping the card. When the human body sensor in the classroom detects someone, the coordinator will automatically choose whether to turn on the indoor light according to the light intensity. When the external light is too strong, the curtains will automatically open; Automatically choose whether to turn on the indoor fan according to the indoor temperature; When the classroom is empty, the classroom door will automatically close [16].

5 Conclusion

The intelligent open laboratory system conforms to the modern concept of open, shared and low-carbon public resources. With the addition of multiple equipments, laboratories and schools, the whole laboratory resources can be shared and extended to other school resources and public resources. For example, educational resources such as sports facilities, library materials and tourism resources, using big data and cloud technology to establish a management platform for unified management can make different educational resources shared and promote social development. At present, only some courses, laboratories and laboratory management software modules are used to conduct simulated, preliminary and small-scale experimental tests. In the future, the laboratory management platform based on "Internet plus" will be gradually improved by purchasing and upgrading server equipment, storage equipment and optimizing the network structure, so as to realize the full integration of "Internet plus" and laboratory construction, and promote the reform and development of experimental teaching.

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