

Design and Implementation of Laboratory Equipment Management Based on Mobile Phone

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Abstract: This paper is a research and application of cell phone based laboratory equipment management system. Because of the large number, variety and rapid update of teaching equipment in universities, there are higher requirements for the management technology and means of equipment. The construction of laboratory equipment management system mainly relies on network, database and cell phone generation technology. The system adopts a combination of computer and cell phone terminal to manage equipment information and complete a series of management of equipment, which can be maintained at any time and anywhere, making the staff more efficient and the workflow more standardized and automated, and improving the efficiency of daily management of laboratory equipment in this college.

Although a large amount of funds have been invested, problems in the management of laboratory equipment in colleges and universities are still visible everywhere at this stage. With the development of practical teaching reform in colleges and universities in China, driven by this trend, colleges and universities have purchased a large number of diverse and complex experimental equipment. However, at the present stage, the management of equipment in most colleges and universities in China is still the traditional manual way, and the management techniques and methods remain in manual registration and inspection, etc. Such traditional and backward management technology does not conform to the development trend of modern information technology, nor can it avoid the situation of human error, thus causing a waste of resources and even hindering the development of teaching and scientific research.

1. Problems in the management of laboratory equipment in colleges and universities

(1) Equipment management means are backward. At present, although the asset information management system has been adopted by most colleges and universities, one label corresponds to one device, but the self-adhesive paper is the equipment label used by most colleges and universities. In this way, it is not possible for managers to check equipment information and change the status of equipment at any time, and the self-adhesive sticker is easy to fall off [3]. As a result, university laboratories still rely on the traditional manual inventory and registration for asset inventory and equipment reservation, which is not only very inefficient, but also inevitable for errors.

(2) Equipment maintenance is not adequate. Since the existing self-adhesive labels are traditionally made and it is troublesome and lagging to change the information of the equipment, it is not possible to update the usage status of the equipment in real time .

(3) The borrowing and return management of equipment is not standardized. At present, the manual record management mode is still the way of borrowing and returning laboratory equipment in most universities. When the equipment is borrowed, the borrower writes the borrowing instructions, and when the equipment is returned, the equipment manager returns the borrowing instructions to the borrower, which lacks useful monitoring and management methods .

To solve the problems of equipment management in universities, the focus of research is on the application technology of cell phones and intelligent terminals, which is an automatic identification technology, which arises and develops in the practice of computer applications. It is designed to

achieve automatic scanning of information and is an effective means of accurate, rapid and reliable collection of massive and complex data. The application of cell phone mobile terminal technology and smart terminals effectively solves the key problems of data entry and collection, and is a powerful technical aid for the reform of instrumentation management.

2. Mobile terminal system design

2.1 Implementation plan

The laboratory equipment management system is built primarily based on the network, database and mobile terminal generation technology. The scanning function of the bar code on the mobile phone can be realized directly through the camera. The client can directly identify the mobile terminal through the mobile phone, so that it can query the information of the equipment already entered, and the database on the server side gets timely feedback, which facilitates the management and subsequent decision making. The architecture of the system is shown in Figure 1.

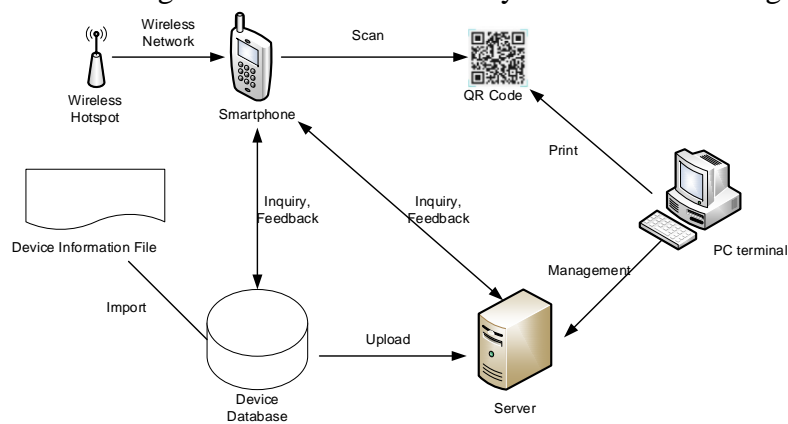


Figure 1: System architecture

2.2 Function design

2.2.1 Background data management function

After purchasing laboratory equipment, laboratory administrator registers equipment information in a timely manner. After forming the device information database, The Administrator generates the mobile terminal label of the mobile phone through the device information and affixes the label to the corresponding device.

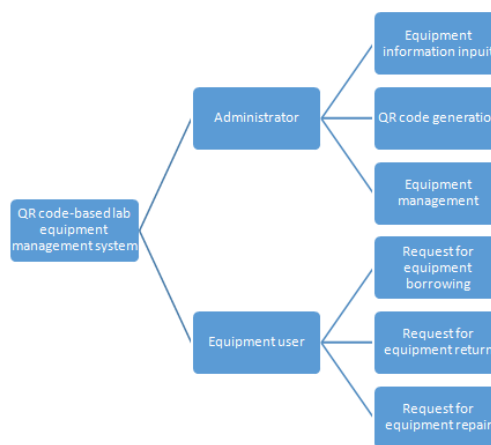


Figure 2: System functional module diagram

2.2.2 APP functions

The administrator has equipment management functions (equipment borrowing request processing, return request processing, maintenance request processing, etc.). After the user logs in,

he/she has the functions of equipment borrowing request, equipment return request and equipment maintenance request, as shown in Figure 2.

2.2.3 Database design

After analyzing the requirements according to the equipment management of the college, the system database uses MySQL to store and manage the data. The database mainly includes equipment table, user table, maintenance company table, equipment maintenance table, and user application form. The E-R diagram of the main tables is shown in Figure 3.

3. Mobile terminal system modeling

Because the record of university laboratory equipment information is very detailed and has many fields, the mobile APP is convenient, but it is not suitable for the management of multi-field equipment information. Therefore, this system combines computer and cell phone for equipment information management. It is easy for the administrator to record and manage the detailed information of the equipment by using the computer, and it is also possible to print the content on the mobile terminal directly by connecting to the printer. Mobile APP makes it easy for users to borrow equipment and request maintenance. It is easy to operate and can be done with a cell phone.

3.1 Implementation of background data management function

The background data management function is mainly used by the administrator to manage the laboratory equipment, so only the administrator can log in. This part mainly includes user management, addition, deletion, modification and checking of equipment information, batch import of equipment information, generation of mobile terminal and printing of mobile terminal, etc.

Under the System Management submenu, the administrator can click on User Management, where users can be managed by clicking on the Add, Modify, Delete, Import and Export buttons. There are two ways to add users: one is to add users one by one by clicking Add, and the second is to import users in bulk via Excel. The second way reduces the workload for administrator and increases its work efficiency.

The administrator can manage the device information by clicking the Device Management button in the navigation bar, and clicking the Add, Modify, Delete and Import buttons in the page. However, due to the large number of device information fields, the administrator has to fill in them one by one, which is time-consuming, laborious, and prone to errors.

The equipment information of colleges and universities is uniformly issued by the Assets Management Office in the form of Excel, and then each college manages the data through Excel. Using the import operation here, the administrator can directly import the Excel sheet issued by the Assets Management Office, which is simple and efficient and improves the efficiency of the administrator.

Since the device number is the information that uniquely identifies a device, the device number is used to generate mobile terminals. There are two ways to generate mobile terminals: one is to select a few devices to generate mobile terminals. This method is suitable for generating mobile terminals for new devices and for generating mobile terminals for damaged or lost devices. The other way is to generate mobile terminal for all devices with one click.

3.2 Implementation of mobile terminal

The APP implementation includes two types of users, administrator and normal user. The normal user is allowed to borrow and maintain the device, while administrator user is allowed to manage the equipment and user devices, and handle the to-do lists.

3.2.1 Functions of the normal user

(1) Device borrowing. After the normal user installs the app, it can click the swipe function on the home page, scan the mobile terminal generated by the administrator and posted on the device. And then it can check the basic information of the device, click the application binding at the

bottom of the picture, thus completing the borrowing request of the device.

When the normal user has finished using the device, it can find the specified device in My Devices, see the details of the device, and click the Unbind button below the picture. After that, the administrator will receive the request and check the status of the device. If the device is in good condition, the administrator will approve the user's request, so the return of the device can be completed.

(2) Equipment repair. If the user's borrowed equipment breaks down, he/she can click the Repair button to see the prompt screen, enter the reason for repair in the prompt box and click OK, then wait for the administrator's review. The administrator will contact the manufacturer to repair the equipment after seeing the application. When the repair is completed, the applicant will click the Repair Complete button to confirm that the repair is completed. If the equipment is damaged and cannot be repaired, it will be scrapped by the administrator.

3.2.2 Functions of the administrator

(1) User device management. The administrator can see the users of unbound devices and users of bound devices in the user management directory of the administrator home page. The administrator can change the user directly to the device that the user already has. By clicking the user to enter the device list, the administrator can check the specific devices, and the current status of the device. The devices are currently in normal and maintenance status.

(2) Device management. Administrators can view unbound devices and bound devices in the User Management directory on the administrator's home page. The administrator can view the unbound devices and assign users to bind the devices. In View Bound Devices, the administrator can view the status of devices that have been used, and can also change the binder.

(3) To-do lists. The administrator can see the normal user's borrowing requests and repair requests in the To Do List, and review them. When the administrator selects and approves the request, and the type of the equipment is being borrowed, the owner of the equipment will change to the applicant. When the type of the equipment is repair, the equipment will be in repair status. The status of the equipment can be changed to normal when the user confirms that the repair is completed. When the administrator chooses not to approve, it needs to fill in the approval comments. If the user needs to borrow the equipment again, he/she needs to re-initiate the request.

This system is of great practical significance. The system will take the popularity of smart phones and network environment as an opportunity to establish a mobile terminal based laboratory equipment management system. The system enables the personnel who manage and use the equipment to scan the mobile terminal by smart phone and complete a series of management of the equipment, which improves the efficiency of the routine management of the current laboratory equipment in the college.

4. Conclusion

This project has two main functions. First, the system uses mobile terminals, and the management of experimental equipment is done through a mobile app. This approach is convenient and allows users to maintain equipment information anytime and anywhere, and is no longer limited to operating in front of a computer. Secondly, the system uses mobile terminal technology. Each device has a unique mobile terminal as the identification, with low costs and high recognition rate.

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