Smart Bookcase Based on Image Recognition Technology

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Abstract. In order to improve the efficiency of readers' book borrowing and book management, research and create the intelligent bookcase, which is based on image recognition technology, supplemented by WeChat applet. Through the research on the relevant background and the technology used, we have inspired an intelligent bookcase based on image recognition technology, and made a prospect.

Keywords: Image recognition, WeChat Mini Program, smart bookcase.

1. Research background
Nowadays, with higher material living standards and changes in ideological concepts. People are paying more and more attention to the importance of books. This has led to the increasing collection of books in the library and the rapid increase in the number of borrowers. However, this has also led to a large number of randomly placed books in the shelves. When we want to check a book, we can only rely on the general direction and vague memory to search, it has caused the difficulty of searching for books and a lot of time wasted. This has brought trouble, and undermined the reader's good review experience.

Almost all libraries in today's society use purely manual access methods, that use barcodes and magnetic strips for manual management. The handling mode of libraries that use both barcode technology and magnetic stripe alarm technology will have played a pivotal role in the near future. The biggest advantage of this method of using barcodes and magnetic stripe alarms is its low price its and higher stability and it has been improved over time. There are also a small number of small smart bookshelves that use RFID technology. To achieve the effect of judging the position of books, it does not require the participation of human power. It can read multiple book tags at the same time, and can also borrow books in batches at one time. The effect of library management has been significantly improved. However, RFID technology has specific limitations. For example, firstly, electronic tags must be added to each book, which is expensive; secondly, tag recognition efficiency is not high enough. RFID includes two basic components: reader and tag, only when the two are parallel, the RFID system can have the best reading effect, which causes the RFID tag cannot read or reading the wrong information; then, the RFID tag has a certain electromagnetic radiation performance, which is harmful to the human body, especially those who work in the library for a long time; finally, RFID reading will be affected by the interference of metal materials, which will cause missed readings and result in inaccurate data. So external factors are also a problem that cannot be ignored; however, there is no smart bookcase based on image recognition in the society.

Based on the results of online questionnaire surveys and offline visits to a large number of universities and public libraries, the following statistical table is made.
2. Technical background

2.1. Image recognition

Image recognition technology is mainly based on identifying the key features of the image, including the size, direction, color, overall shape and local shape characteristics of the image. Analyzing from the current existing information technology level, computer image recognition technology can actually be considered as a combination of image processing and recognition [1], using computer technology to convert the image obtained by the detection side sensor into specific digital information, the computer recognizes its size, direction, shape, etc. and stores it in the image library. When a similar image is encountered again, it will be compared with the content in the image library. When it is consistent, the image recognition process of the entire image is completed. In general, the general process of image recognition includes four categories: image acquisition, image preprocessing, key feature extraction, and image classification.

- **Image acquisition**: The focus of image acquisition is to use cameras to make the digital image information which is processed by computer along with graphics, characters, sounds, etc displayed on the computer screen at the same time.

- **Image preprocessing**: During the image collection process, information loss and quality degradation may occur. The function of preprocessing is mainly to use image enhancement technology and image restoration technology to enhance, transform and restore image color, contrast, and sharpness, thereby enhancing these features.

- **Key feature extraction**: Each image has its main features, such as color, direction, size, texture, overall or local shape, and spatial relationship. For example, A has a sharp corner, the horizontal and vertical strokes of Chinese characters, etc, and extract features with small dimensions as much as possible. The main goal of feature extraction is to extract a set of features with the smallest possible dimension, achieve the maximum recognition rate with the least features, and generate similar feature sets for a variety of identical symbol instances [2], that is, using features with small dimensions as much as possible to achieve the purpose of image recognition.

- **Image classification**: after a large number of training to determine the rule of judgment, a certain feature classification can be obtained through the recognition rule, and the recognition error rate can be reduced to the lowest level, so that the image recognition technology can obtain a more efficient recognition rate.

Computer graphics and image processing rely on the powerful processing technology of the computer to carry out a series of enhancement and restoration of graphics or image information [3].

2.2. WeChat Mini Program

The WeChat Mini Program is an application developed based on the WeChat platform that can be used by scanning QR code. Users only need to scan the QR code or directly search for the WeChat Mini Program name or key so that it can be used.

The WeChat mini program runs on the WeChat platform and can be divided into three layers in terms of technical architecture: view layer, logic layer and system layer [4]. The view layer is composed of two parts: wxml and wxss, which complete the layout and style configuration; the logic
layer is composed of js script files, responding to the view layer (wxml and wxss) event feedback, and at the same time, it can respond to the event processing results of this layer return to the view layer. The title file structure can be divided into four types, page structure: wxml, style: wxss, logic implementation: js, configuration: json.

(1) Wxml: It is used to modify the style and belongs to the view layer architecture. It can complete the creation of the basic content of the page together with the basic components of the program and the event system. It determines what content is included.

(2) Wxss: It is a scripting language opened by the applet itself, which describes the style of page layout, and is used to determine how components are arranged in the applet page.

(3) Js: used for the realization of page logic, through the compilation of js files to achieve the purpose of processing user behavior, logic processing and network requests can be performed.

(4) Json: Mini program settings, such as title bar, status bar, etc.

3. System design and implementation

3.1. System introduction
Aiming at the campus library scene, the research adopts WeChat applet + image recognition technology to design. The stored books can record the book name and location through image recognition technology and upload and store in the cloud. When users use it, they only need to pay attention to the WeChat applet. After setting up personal information, you can search for the corresponding books according to your own needs, and the corresponding cloud information, that is, the location, can be fed back to the WeChat applet interface.

The research smart bookcase is mainly composed of three parts: recognition terminal, cloud server and mobile terminal applet. The functions of each part are described as follows:

(1) Detection terminal: It consists of STM32 main control module, camera module, infrared thermoluminescence sensor and steering gear, and stores the obtained image in the cloud.

(2) Server: It can respond to the service request of the terminal and perform a series of processing. The server uses image recognition technology to convert the image information sent by the detection terminal, such as name and location, into digital signals for recording, and ensures that when the user makes an operation, it can provide data processing capabilities and timely feedback the corresponding information obtained from the processing To the WeChat applet.

(3) Mobile terminal: Use WeChat mini-programs to meet readers' desire for reading books to meet their needs for efficient reading. Users who follow the WeChat applet can directly search for book names or categories, the cloud server feeds back the specific location or name of the book on WeChat applet interface, enabling users to find the target book efficiently.

3.2. Mode of operation
The overall design framework of the smart bookcase is shown in the figure below. It is mainly composed of self-designed small programs, self-developed databases, self-built servers, WIFI modules, STM32 main control modules, camera modules, infrared thermoluminescence sensor and steering gears. Partial composition.
Figure 2. Overall design

Infrared thermal sensors can detect whether someone has come to the bookcase to pick up or return a book. When it detects that someone has come to the bookcase to pick up or put a book, the steering gear will pull the STM32, use the camera module to take pictures of the book, and process the result through the WIFI module. The information is uploaded to the server. According to the image recognition technology, the key features of the image are extracted and classified and stored. The server communicates with the database, and the database stores the book data. The two work together to ensure the long-term stable operation of the service and ensure data security. Improve user access efficiency. The user searches for the book name or category through the WeChat applet, and the server feeds back the specific location of the processed book to the user interface. There is no need for users to look for rows of bookshelves, nor for managers to put books in place, which saves users and managers to a large extent.

4. Outlook
The library has become an indispensable source for people to pursue the enrichment of the spiritual world. However, it is undeniable that the current problem of library access to books is it is also adapting to the development of the technological age, but there are still some problems that cannot be ignored. For example, when looking up books, we always need to spend a lot of time to find the location of the books we need; or, for example, if the borrower returns the books in an improper location, this requires the librarian to deal with the aftermath, and the same people spend time looking for books when borrowing. It also takes a lot of time for library managers to put books in place.

This application solves the problem that people in traditional libraries are time-consuming and laborious to read books, and the administrators are inefficient in restoring the location of the books one by one. It uses intelligent technologies such as image recognition and WeChat applets to solve the problem of book placement, inconvenience and management efficiency.

The traditional library has introduced smart technology, which has injected fresh and full of vitality and vitality into the traditional library, so that the traditional way of reading has a greater competitive chip with the way of reading electronic books. The application of information technology in smart bookcases makes it serve the mass society, liberating part of the labor force and making the meaning of science and technology to a higher level.

5. Conclusions
Smart bookcase is a product that combines traditional libraries with information technology in the new era. It is a product that serves the public and is committed to improving the efficiency of book management. At present, the society has limited ideas for smart bookcases, and the related technologies are not mature enough, so that there is still more room for development. The research is
based on image recognition technology, combined with cloud services, and small programs to solve the problem of people’s difficulty in borrowing books and the difficulty of restoring the location of books, making the intelligent management of bookcases possible. Such intelligent bookcases conform to the trend of social and era development. Informatization is one step forward on the human progress ladder.

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