Design and Development of "IC Campus Second-hand Book Market" Campus Public Welfare Platform Based on WeChat Mini Program

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Abstract: With the rapid development of the Internet+, the public welfare industry on campus has also shown a high degree of digital innovation. This project focuses on the integration of second-hand books public welfare projects on campus and WeChat mini program platforms. In order to provide a browsing and releasing platform for second-hand books, e-books and campus information for students in the school, the author designed and completed WeChat Mini Program"IC Campus Second-Hand Book Market"based on the WeChat application.The students can freely trade and public second-hand books, e-books, information on the campus public welfare platform, creating an environment-friendly and economical campus culture, improving the utilization rate of old books, realizing the reuse of old things, saving limited resources, and improving the utilization rate of old books.This project contributes a new beneficial exploration for the development of campus public welfare projects in China by means of WeChat mini program in middle school.

1. Introduction

In the new year of IC graduation season, senior three students left a large number of books such as textbooks, reference books, and examination books(including e-books) after three years of study. The books of international education, such as TOEFL, ACT, SAT, professional AP books and original English novels are relatively expensive, but these old books can only be sold as scrap. Every year, when IC freshmen go to school, they do not know where to buy the books they need for class. The electronic version of the books are not very convenient to use. Due to copyright issues, the purchasing channels are very limited. The freshmen are eager to buy textbooks, reference books, and examination books in a more convenient way. If there is a public welfare platform where senior graduations can trade and publish information, the books and e-books they have carefully collected can be transferred to senior one and senior two students without reservation.

The mini program"IC Campus Second-Hand Book Market"developed by the author specially provides a public service platform for students in the school to deal with second-hand books and e-books, allowing students to freely trade and donate books(e-books), recycling the used books and e-books, saving limited resources, cultivating an environment-friendly and economical campus culture, and improving the utilization rate of goods.In the hands of the younger students, the idle old books and e-books can be recycled to achieve the sharing of public welfare resources. In the operation and management of the public welfare project, WeChat mini program not only plays the role of data exchange center, but also undertake the function of public welfare platform interacting with the participants.

In addition, it is urgent for IC to provide a self-service messages release platform, where students can freely launch notices and make announcements on various club activities, training classes, and activity teams. The mini program also can promote the communication between the students and graduates, and cultivate helping each other ideology and public welfare culture on campus. The public welfare platform is convenient for students to communicate and interact online, increase the numbers of message audiences and interactive participants, make daily messages release more convenient, and allow many students who are socially terrified or not good at communication to express their ideas.

2. Method

The core and soul factors of the system design of this applet are how to provide a campus public welfare network platform with low operation and maintenance cost, low promotion cost, convenient service, and digital efficiency, and allow more students can learn and participate in public welfare activities. Firstly, "IC campus second-hand book market" WeChat mini program can launch application services faster. As it does not need to build a website, or install a mobile phone APP, the development efficiency excels that of APP, and its development cycle is shorter than that of APP. Secondly, the cost of mini program is economic. Now almost everyone has a mobile phone, and everyone has their own WeChat. The early development of WeChat mini program cost free without investment. During the operation and maintenance of programs, the cost depending on CDN traffic packets, database request packets and cloud function request packets for Cloud Base needs, is only tens of yuan per month. Thirdly, the back-end interface has excellent operation in the convenience of maintenance. In the traditional development mode, the front end calls a back-end interface with a request, and the back-end interface can operate the database. In the Cloud Base of WeChat Mini Program, the mini program is the front end. Through the Cloud Base provided by WeChat, it can directly operate the database. "IC Campus Second-Hand Book Market" WeChat mini program is very suitable for the group of students to undertake public welfare activities.

2.1 System design of the mini program

In this project, "IC Campus Second-Hand Book Market" program in this project is based on Javaweb system architecture, which is similar to a container provided by WeChat. The pages are the key contents of the development of the WeChat mini program, and generally includes an index page and a logs page, all in the pages directory(Liu, et al. 2020)[3]. It designs and implements functional modules, databases and system interfaces which is shown in figure 1. The front-end functions include register, log in, book inquiry, book browsing, book release, book update, personal collection and other modules. The back-end functions of the system include database, cloud storage and cloud function module(Jiang&Li, 2021)[6].
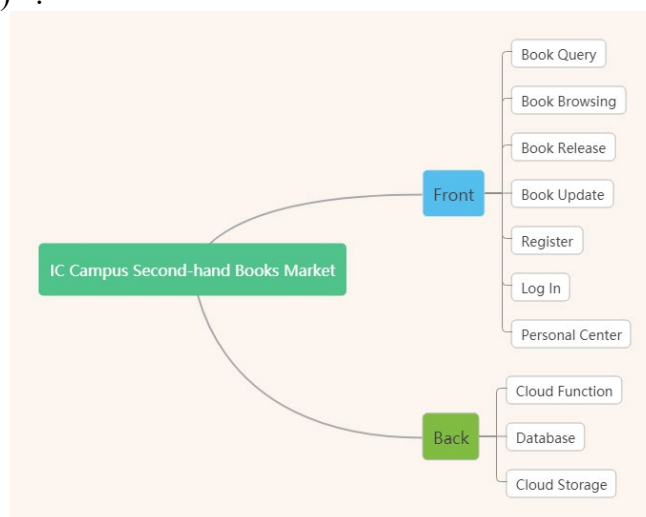

Figure 1. The Design of the Project

The front-end development needs JS/CSS/HTML foundation, which is completed by WXML, WXSS and JavaScript, among which WXML is responsible for the implementation of data binding, component style and other designs; WXSS is responsible for rendering the component styles of WXML; JavaScript is responsible for the design of application logic layer. The back-end uses the Cloud Base (cloud function, database and cloud storage) provided by WeChat officially. WeChat Mini Program is equal to the logic layer plus view layer, plus the json configuration file. The logic layer uses JavaScript to process business logic. The view layer is used to render the page. According to "WeChat mini programming guide"(Tencent, 2022)[5], the description language is WXML and the view style is WXSS. The process of initializing page is that the data is transferred from the logical

layer (js files) to the rendering layer (WXML). Every page must be registered under pages, and the framework will automatically find json, js, wxml and wxss files under the path for integration(Wang, Wang &Zhu, 2018)[2]. The program structure is shown in figure 2 :
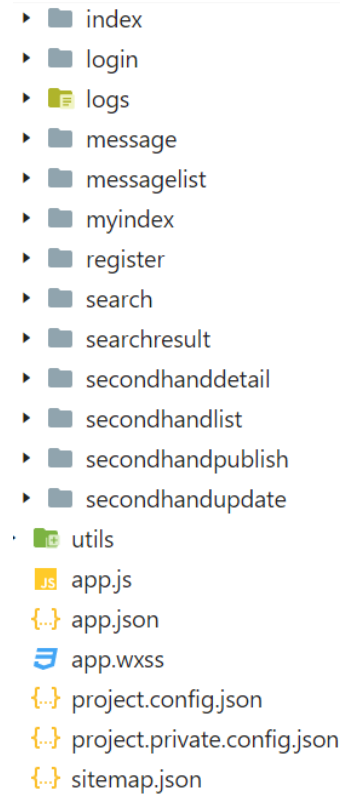
```
▸ ■ index
▸ ■ login
▸ ■ logs
▸ ■ message
▸ ■ messagelist
▸ ■ myindex
▸ ■ register
▸ ■ search
▸ ■ searchresult
▸ ■ secondhanddetail
▸ ■ secondhandlist
▸ ■ secondhandpublish
▸ ■ secondhandupdate
· ■ utils
  JS app.js
  {..} app.json
  ∃ app.wxss
  {..} project.config.json
  {..} project.private.config.json
  {..} sitemap.json
```

Figure 2: The Program Structure

2.2 Front-end

Interface design is an important part of screen products. The program uses iphone5 screen as the development and testing interface.

2.2.1 Bottom navigation icon

1) Home page

The homepage consists of book search engine, carousel map (showing the latest five books published by users), navigation bar (consisting of four columns: search engine, book released, e-book released and information released) and IC second-hand book list (showing the latest 20 pieces of data after the five books published by carousel map). The interface design of homepage is shown in figure 3 left.

2) Books page

It is in the form of a list, showing thumbnails of books, book names and prices. We can click to view the book details, call the cloud function and display it in pages, with 20 pieces of data displayed on each page. At present, the latest 100 pieces of data can be called from the database at one time, depending on whether the trial test situation is improved in use.

3) E-books page

It is in the form of a list, showing thumbnails of data, data names and prices. We can click to view the data details, call the cloud function and display it in pages, with 20 pieces of data displayed on each page. At present, the latest 100 pieces of data can be called from the database at one time, and whether it is improved in use depends on the test situation. The interface design of *E-books browsing* page is shown in figure 4 middle.

4) Information page

It is the form of a list. Because there are no pictures, the latest 100 pieces of data are retrieved from the cloud database by using the cloud function at one time, and no paging is carried out. Whether it

is improved in use depends on the test situation.

5) User page

Get user login information (profile photo and WeChat name), register as a member of "IC Campus Second-hand Market" (user name, set password, real name, mobile phone number and WeChat account number) and log in (enter user name and password). At the same time, you can view the books and materials collected by users under the "My Collection" column. User login and register interface is shown in figure 4 left and middle.
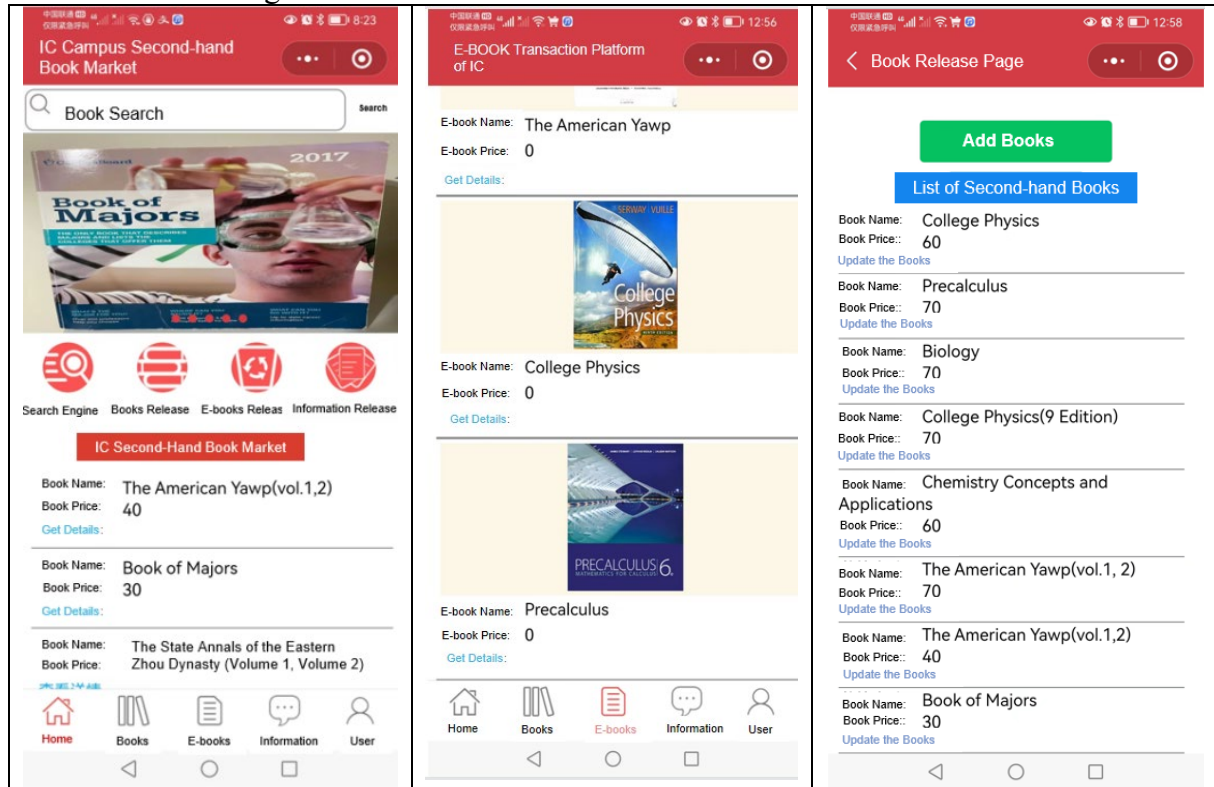

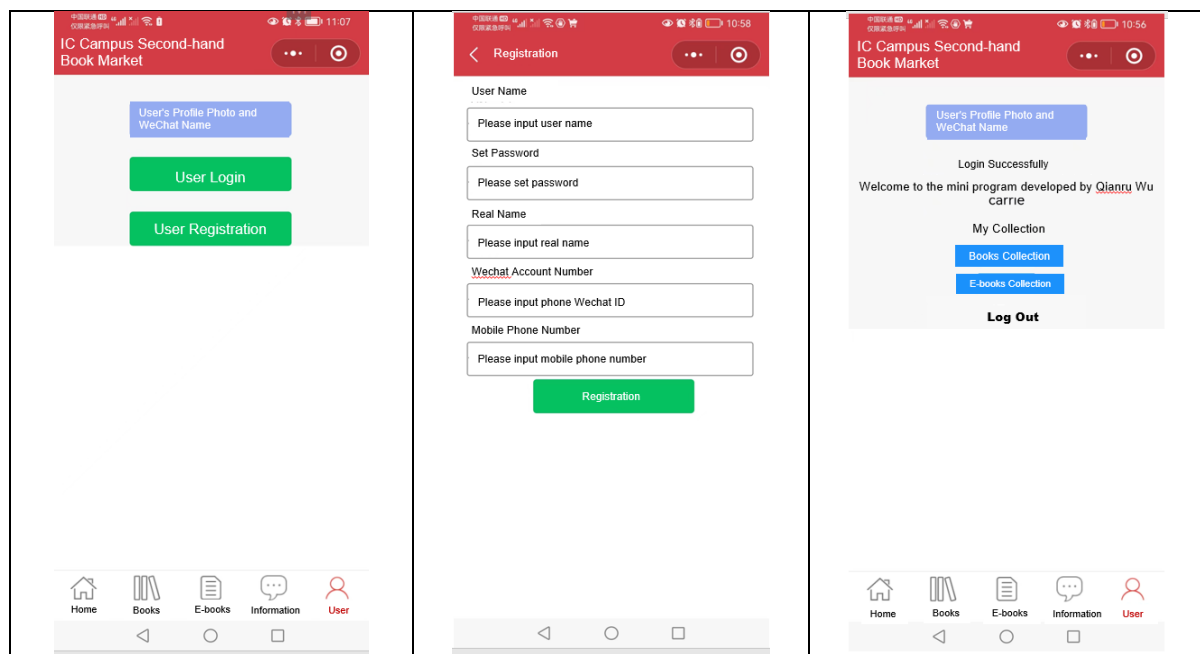Figure 3: The Interface Design of Homepage(Left),E-books Browsing(Middle) and Updating Pages(Right)

Figure 4: The Interface Design of User login(Left) and Registration(Middle) Page, Personal Information Center(Right)
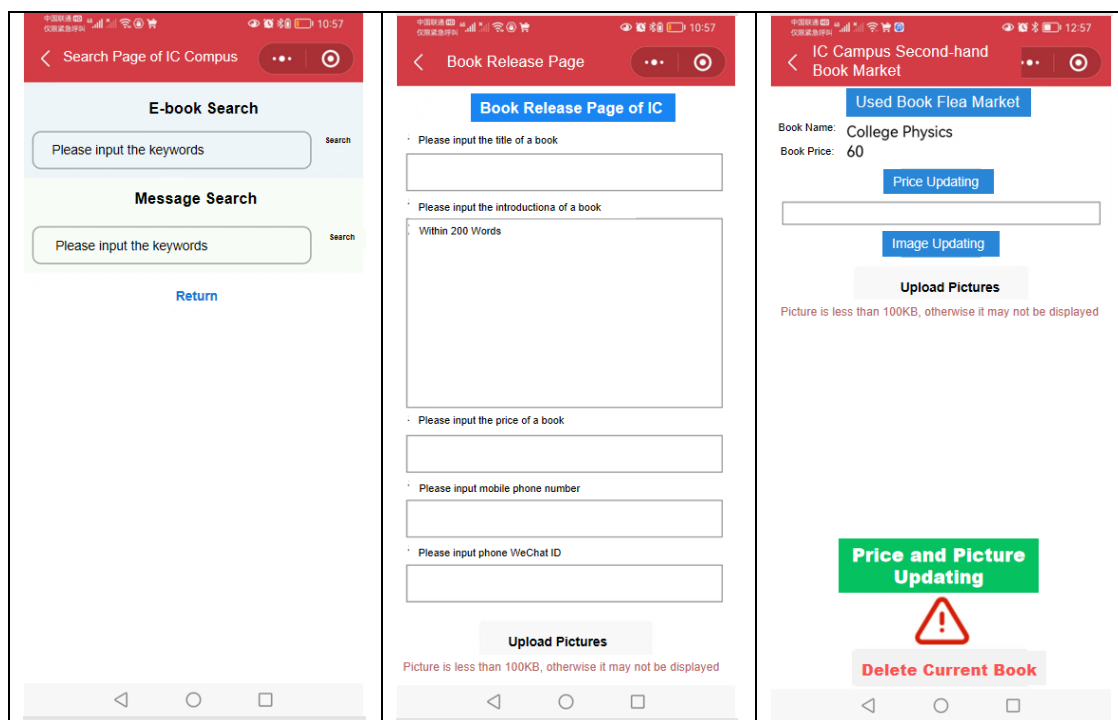
2.2.2 Other pages

Figure 5: The Interface Design of User Searching(Left), Publish(Middle) and Updating Page(Right)

1) Search page

The program designed the book search on the home page, and set the navigation icon of the search engine. After clicking, it will enter the information search and message search page. For example, "Book Search" can search the contents of book names and book introductions that contain keywords, and the search results will jump to the book search results page for display; "Data Search" can search the data name and the content containing keywords in the data introduction, and the data search results will be displayed on this page; "Message Search" can search the content with keywords in the title and information, and the message search results will be displayed on this page. The interface design of user searching page is shown in figure 5 left.

2) Book (data, information) releasing page

For the publication of books and E-books, users can independently input the book (material) name, book introduction, book price, mobile phone number and mobile phone WeChat, and upload book pictures. For information release, users can independently enter the message title, message content, message name, mobile phone number and mobile phone WeChat. The entered message can be updated in real time, and the message just entered into the database can be quickly viewed in the "Message Details" of this page. All published pages are set with "Back" button, which can return to the previous page. The interface design of user publishing page is shown in figure 5 middle.

3) Books (e-books) updating page

The "Update Commodity" button of "Second-Hand Book List" on the book released page can update the pictures and prices of the entered books, which is convenient for users to update the entered books. Set the "Back" button on the updated book page to return to the previous page. The interface design of user updating page is shown in figure 5 right.

4) Details page

It includes the book details page and the information details page, you can display the pictures, names, introductions, prices, mobile phone numbers and WeChat of books and information, and you can also collect them through the collection button below. Set the "Back" button on the page for details to return to the previous page.

5) Personal information center

You can view the basic information of the modified individual and the personal collection goods on My page. Books and materials can collect 20 items, which can be viewed in "My Collection" in

"My Collection" in the navigation bar at the bottom of the program. The interface design of personal information center is shown in figure 3 right.

2.3 Backstage

The back-end function modules for administrators include:

2.3.1 Cloud function

The program defines eight cloud functions in Cloud Base, which respectively perform the functions of querying, deleting and updating four databases.

2.3.2 Database

Cloud Base database includes four databases: books, materials, messages and users.

2.3.3 Cloud storage

It includes two folders of materials and books, which are used to store uploaded materials and pictures of books.

2.4 Functional modules

The "IC Campus Second-Hand Book Market" developed by this project contains 18 pages, 8 cloud functions (JavaScript), 4 cloud databases (determining index keywords) and 2 cloud storage files (storing picture information), as well as four global configuration files: app.js, app.json, app.wxss and project.config.json. At the bottom of the program's page, there are navigation buttons for quick interface switching (program icons are all from www.iconfont.cn), including five functional modules: Home, Books, E-books, Information and My. You can switch the five functional modules back and forth by clicking the buttons.
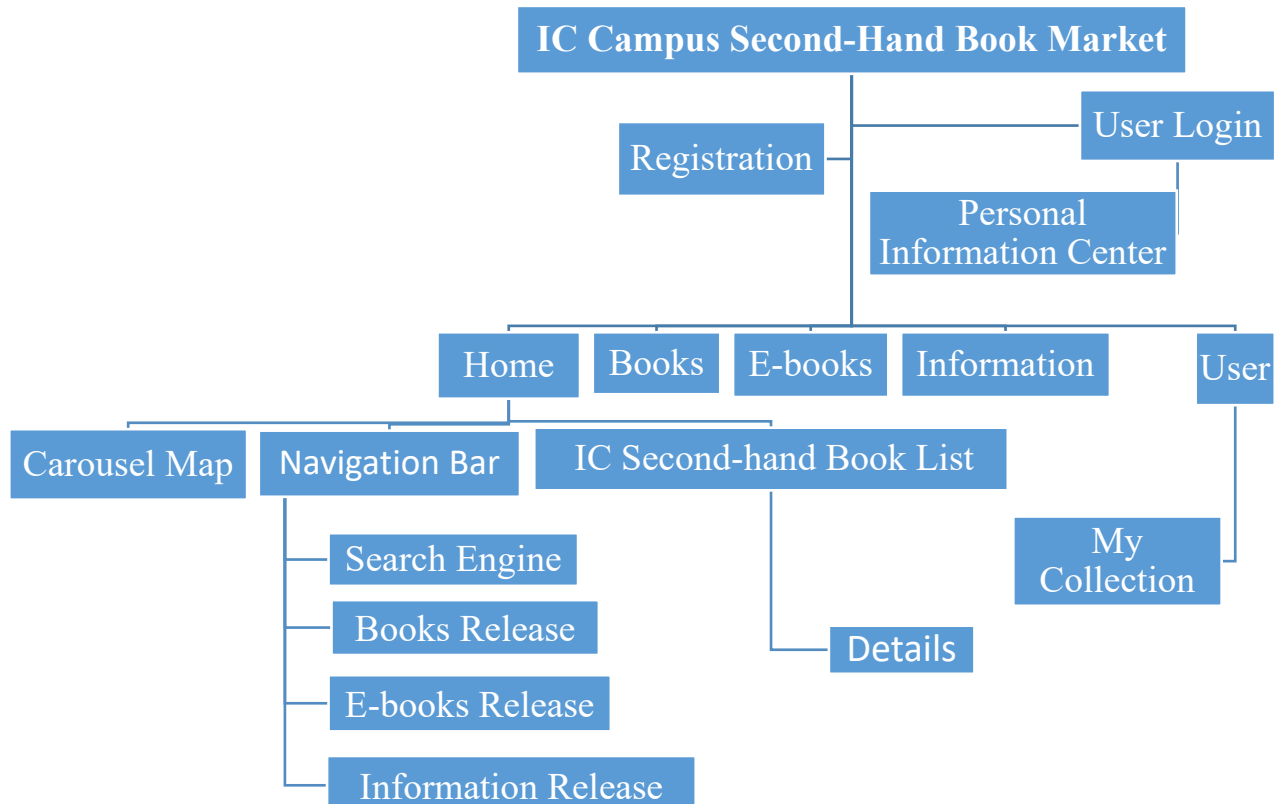

Figure 6: The Functions of Each Module of "IC Campus Second-Hand Book Market"

The functions of each module of "IC Campus Second-Hand Book Market" WeChat Mini Program are shown in figure 6.

2.4.1 Get the user ID

Use wx.getUserProfile to obtain user information. Every time the developer obtains personal information of a user through this interface, the user needs to confirm it. Then, the user's profile photo and nickname data are uploaded to the database through onLoad () function, and its code is as follows:

```
onLoad() {
    if (wx.getUserProfile) {
        this.setData({
            canIUseGetUserProfile: true
        })
    }wx.switchTab({
        url: '../../pages/myindex/myindex',
    })
},
getUserProfile(e) {
    wx.getUserProfile({
    desc: 'User's Info',
        success: (res) => {
            console.log(res)
            this.setData({
                userInfo: res.userInfo,
                hasUserInfo: true
            })
        }
}
```

2.4.2 Register the login module

If…else statement is used to judge the user name and password entered during registration, which cannot be blank, otherwise the system will pop up the prompt "User name cannot be blank" or "Password cannot be blank". According to"Mini Programs on the WeChat Official Account Platform"(Tencent, 2022)[4], its code is as follows:

```
if (nickname == '') {
        wx.showModal({
        title: 'Warn',
    content: 'The user's name cannot be blank',
        showCancel: false,
        success: function (res) {
        }
    })
    } else if (password == '') {
        wx.showModal({
        title: 'Warn',
        content: 'The user's password cannot be blank',
        showCancel: false,
        success: function (res) {
        }
    })
```

2.4.3 Search engine module

The search engine of the program can perform fuzzy search, first define the function get Key1 () to obtain keyword variables, then define the search function go Search1 (), and perform fuzzy query in the book name and book description library through the where statement; Only when the input is blank, the user is reminded to switch to the search content. According to"Mini Programs on the WeChat Official Account Platform"(Tencent, 2022)[4], the code is as follows:

```
getKey1(e) {
    this.setData({
        key1: e.detail.value
    })
},
goSearch1() {
    let key1 = this.data.key1
    if (this.data.key1) {
        db.collection('secondhand')
            .where(_.or([{
                name: db.RegExp({
                    regexp: key1,
                    options: 'i',
                })
            },
            {
                desc: db.RegExp({
                    regexp: key1,
                    options: 'i',
                })
            }
        ]))
        .get()
        .then(res => {
            this.setData({
                list: res.data
            })
        })

    } else {
        wx.showToast({
            icon: 'error',
            title: 'Please input data',
        })
    }
}
```

2.4.4 Book (information, message) released module

The published books can be updated in real time after they are entered into the cloud database. The "Second-Hand Book List" uses the cloud function to directly retrieve the latest 100 pieces of data from the cloud database, and the newly entered books can be quickly viewed in the "Second-Hand Book List" on this page. The uploaded pictures are stored in the cloud storage by time. Define the functions get Name (), get Desc (), get Price (), get Tel () and get WeChat () to get the book name, book introduction, book price, mobile phone number and mobile phone WeChat respectively; Use the upload () function to save the uploaded pictures to the book picture library in cloud storage according to the time stamp, and at the same time, transfer the ID of the input data to the book details page. According to"Mini Programs on the WeChat Official Account Platform"(Tencent, 2022)[4], the code is as follows:

```
getName(event) {
    name = event.detail.value
},
getDesc(event) {
```

```
      desc = event.detail.value
   },
   getPrice(event) {
      price = event.detail.value
   },
   getTel(event) {
      TEL = event.detail.value
   },
   getWeChat(event) {
      chat = event.detail.value
   },
upload() {
      let that = this;
      let timestamp = Date.parse(new Date());
      wx.showToast({
         icon: 'none',
    title: 'Please upload the book pictures'
      })
      wx.chooseImage({
        count: 1,
        success: chooseResult => {
         wx.showLoading({
           title: 'Uploading…',
         })
         wx.cloud.uploadFile({
           cloudPath:'bookImage/'+ timestamp ,
           filePath: chooseResult.tempFilePaths[0],
           success: res => {
             wx.hideLoading()
             this.setData({
               imgUrl: res.fileID
             })
             that.addImgList(res.fileID)
           },
         })
        },
      })
   },
   getDetail1(event) {
     wx.navigateTo({
        url: '/pages/secondhanddetail/secondhanddetail?id=' + event.currentTarget.dataset.id
     })
}
```

2.4.5 Books (materials) updated module

This module is mainly aimed at books and materials published by users themselves. It can modify the pictures and prices that have been entered into the database, define the function update (), judge whether the price input is empty through the if……else statement, and update the prices, pictures and timestamps in the cloud database when the conditions are met. Finally, the console.log () is used to debug the success of entering into the database. According to"Mini Programs on the WeChat Official Account Platform"(Tencent, 2022)[4], the implementation code is as follows:

```
   update() {
```

```
    if (price == '') {
      wx.showToast({
        icon: 'none',
     title: 'The price cannot be null'
      })
    } else {
      let that=this;
      wx.cloud.database().collection("secondhand")
        .doc(id)
        .update({
          data: {
            price: price,
            picUrl: this.data.picUrl,
            time:that.getNowFormatDate()
          }
        }).then(res => {
      console.log('Commodity price modification was successful', res)
          this.getDetail()
        })
        .catch(err => {
      console.log('Commodity price modification failed', err)
        })
    }
  }
```

2.4.6 Personal Center (Collection) Module

Through this module, users can view personal information and collection information in the cloud database, and through the definition function get Book Collect (), they can view the previously collected goods when browsing the details of books and materials. According to"Mini Programs on the WeChat Official Account Platform"(2022)[4], the code is as follows:

```
getBookCollect(){
        wx.cloud.database().collection("Books")
        .where({
            favorite: true
        })
        .get()
        .then(res => {
          this.setData({
            list: res.data
          })
        })
        .catch(err => {
        })
  },
  getDetailUsed(event) {
        console.log(event)
        wx.navigateTo({
            url: '/pages/bookdetail/bookdetail?id=' + event.currentTarget.dataset.id,
        })
  }
```

3. TEST

3.1. Testing environment

Android system: HUAWEI Mate 20 X, HarmonyOS 2.0, WeChat version Version8.0.23, CPU Huawei Kirin 980, RAM of 6GB.

IOS system: new iPhone 11 Pro Max, iOS15.0.2, Version8.0.25 of WeChat, with A13 CPU and 4GB RAM.

3.2. Test results

3.2.1 Testing based on login registration function

Test of registration and login function of mini program is shown in table 1 as follow :

Table 1 Experimental Results of Login Registration Function

Test item	Test of registration and login function based on WeChat Mini Program
Purpose	Test the functions of WeChat login and WeChat authorization when users open programs.
Test flow	When the user is using the program for the first time, get the program and enter the "My" page; The WeChat authorized access to public information page pops up, and the user can choose to allow or reject it.
Test result	When the user chooses to allow, the personal information displays the user's WeChat profile photo and nickname; When the user refuses, the default profile photo and nickname of the system will be displayed.

3.2.2 Testing based on browsing function

Test of browsing function of mini program is shown in table 2 as follow:

Table 2 Experimental Results of Browsing Function

Test item	Testing the browsing function of books, materials and information based on WeChat Mini Program
Purpose	Test whether users can browse books, materials and information smoothly when opening programs.
Test flow	Enter the program to browse books, materials and information.
Test result	The interface runs smoothly.

3.2.3 Testing based on releasing function

Test of releasing function of mini program is shown in table 3 as follow :

Table 3 Experimental Results of Releasing Function

Test item	Function Test of releasing Books, Materials and Information Based on WeChat Mini Program
Purpose	Test whether the function of releasing books, materials and information of programs can be realized.
Test flow	Enter the program releasing page, and enter the related contents and pictures of books, materials and information.
test result	The releasing function can be realized.

3.2.4 Testing based on updating function

Test of releasing function of mini program is shown in table 4 as follow:

Table 4 Experimental Results of Updating Function

Test item	Update function test of books and materials based on WeChat Mini Program.
Purpose	Test whether the update function of program books and materials can be realized.
Test flow	Enter to the program releasing page and update the prices and pictures of books and materials.
Test result	The update function can be realized.

3.2.5 Testing based on searching function

Test of searching function of mini program is shown in table 5 as follow:

Table 5 Experimental Results of Searching Function

Test item	Test of Books, Materials and Information Search Function Based on WeChat Mini Program
Purpose	Test whether the search function of books, materials and information can be realized.
Test flow	Enter the homepage of the program for book search or click the search engine icon to enter the information and message search, and enter keywords.
Test result	Search function can be realized.

3.2.6 Test based on collecting function

Test of collecting function of mini program is shown in table 6 as follow:

Table 6 Experimental Results of Collecting Function

Test item	Collection function of books and materials based on WeChat Mini Program
Purpose	Test whether books and materials can be collected.
Test flow	Enter the homepage of the program for book search or click the search engine icon to enter the information and message search, and enter keywords.
Test result	Search function can be realized.

4. Conclusion

The "IC Campus Second-Hand Book Market" is an IC campus nonprofit community for browsing, trading, and publishing used books, e-books, and information. The public welfare service platforms that appear in the market can not fully meet people's expectations of doing public welfare(Zhu et.al, 2021)[1]. Changes in traditional public welfare to campus second-hand book trading platform represented by micro-philanthropy which not only transform the innovation and development of the public welfare model, but also highlight the value appeal of contemporary technology to pioneer scientific and technological progress, focus on subjective initiative, and constantly upgrade public welfare means. The author take full advantage of the WeChat applet cloud development tool to build a shared public welfare platform for students on campus to freely publish second-hand books, e-books and campus information, allow senior students to collect their unused books and e-books and sell them at low price to freshmen, enhance their sense of social responsibility to achieve self-worth, cultivate the culture of helping each other on campus. It is the ultimate goal of my project to guide students who widely participate in volunteer service activities to serve others.

Through online measurement, the six complete experiments were all valid for WeChat mini program testing, the "IC Campus Second-Hand Book Market" is a successful WeChat mini program. With the help of Student Activity Office, the "IC Campus Second-hand Book Market" mini-program

has been launched online from June 25, 2022. Graduates of our school have successively released old books and e-book on the public welfare platform. The freshman who will go to school in September, is also buying books by this public platform of "IC Campus Second-Hand Book Market" since July 25. The WeChat mini program can basically meet the needs of browsing second-hand books and materials and releasing information of dozens of people. Now, the applied CDN traffic is 25G per month, and the database size is 2G.

However, as a campus public welfare project, it will provide a browsing and releasing platform for second-hand books, e-books and campus information for more than 300 people in Beijing No.4 High Middle School in coming new semester. As the amount of data and the number of users increase, whether it is necessary to add CDN traffic packets, database request packets and cloud function request packets for Cloud Base needs to be observed and continuously improved during the operation and maintenance of programs after the school opens in September.

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