

## Design and Implementation of College Online Learning System Based on WeChat Mini Program

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**Abstract**— In view of the shortage of teaching resources caused by college expansion, we design an online learning system based on WeChat Mini Program, which effectively solves the low learning efficiency of students caused by large class system of elective courses, the heavy teaching pressure of teachers and too much time and energy wasted in elective course examination. Users can apply online video learning, online testing, online course selection, online elective course learning, online exams, and online discussion and other functions. The development of the system uses the WeChat MINA Framework, which is implemented using WeChat web developer tools and Tencent Cloud Server. The system has an elegant interface, perfect functions and strong practicability, which can satisfy the personalized need of the contemporary university student and can relieve the stress of instructional resource. In the process of using, the system has been well evaluated.

**Keywords**- mini program; video courses; online learning; MINA framework; cloud server

### I. INTRODUCTION

With the rapid development of information technology, especially from the Internet to the mobile Internet, China's online education has developed rapidly and has entered the age of intelligent education with vertical segmentation, diversified learning methods, open sharing of resources and knowledge converted into cash. It has created a way of living, working and learning across time and space, and diversified the way of acquiring knowledge.

At present, the number of college enrollment in China has increased year by year, resulting in the shortage of teaching resources and the increasing number of large-class teaching. This has not only increased the difficulty of teaching, but also caused students' inefficiency in learning, incomprehensible in class, and difficulty in reviewing classes. In addition, with the increase in the number of students, the time schedule for students' classrooms has become more complex. College must consider the arrangement of the courses in order to avoid conflict when arranging classes and time for classes. Therefore, we designed to record some of the elective courses into videos, and post the recorded video courses to the Mini Program, so that college students can take elective courses through this Mini Program. The system utilizes the WeChat Mini Program to be convenient, flexible, fast to promote, and short in development cycle, so that the

mobile network course learning is more popular in the study of college students[1-2].

### II. WECHAT MINI PROGRAM INTRODUCTION

WeChat's official description of a Mini Program is that it's an application that doesn't have to be downloaded and installed, and it's implemented the "touching the fingertips" dream. The user can open the application by scanning or searching. It embodies the concept of "run out and go", users don't have to worry about installing too many applications to take up space. Apps will be ubiquitous and ready to use, but there is no need to install and uninstall.

As a lightweight application, WeChat Mini Program represents the development direction of mobile Internet applications in the future. This lightweight application will also be the main form of mobile Internet application. Currently, WeChat Mini Program is developing rapidly in China, and the development status of the Mini Program is as follows:

- a) There are 1 billion active users of WeChat, the average daily use rate of more than 5 minutes is 7 times;
- b) Around 25,000 enterprises or businesses enter the Mini Program every day;
- c) Mini Program currently total number more than 600000, nearly 200 million the number of access every day.

#### A. WeChat MINA Framework

MINA framework provides a complete set of JavaScript API to the upper layer by encapsulating the file system, network communication, task management, data security and other basic functions provided by WeChat client, so that developers can easily use the various basic functions and capabilities provided by WeChat client to quickly build an application.

On the page view layer, WXML is a set of HTML tags and a series of basic components. Developers use WXML file to build the page view structure, the basis of WXSS file is used to control the display style of the page. The AppService application logic layer is the service center for MINA, which is enabled by the WeChat client to activate the asynchronous thread separately. The data required for page rendering and the page interaction processing logic are implemented in the AppService. The AppService in the MINA Framework uses JavaScript to write interactive logic, network requests, data processing, but you can't use DOM in JavaScript. Each page in a Mini Program can implement data

management, network communication, application life cycle management and page routing through AppService[3]. WeChat Mini Program framework diagram as shown in Figure 1.

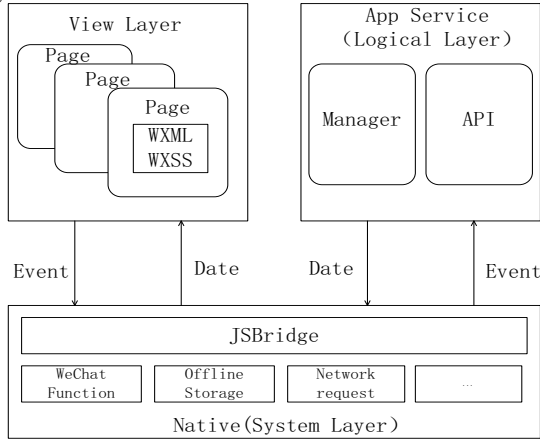


Figure 1. WeChat Mini Program framework diagram

### B. WeChat Mini Program Advantages

1) Low development and promotion costs: Most functions of WeChat Mini Program can be called directly from WeChat without development. Compared with app, WeChat Mini Program need not be downloaded to enjoy services. WeChat, as a social software, has a strong ability to connect users. After the WeChat opens the many inlets to the applet, the promotion costs of the Mini Program within the WeChat are much lower than other platforms.

2) Fast running speed: The main style code is packaged in the WeChat applet, so the opening speed is faster than the ordinary H5 program, close to the native APP.

3) Do not need to install: WeChat Mini Program is a web app. It is an application based on web platform. It does not need to be downloaded and installed on the device. It only needs to be searched and can be opened for use. After it is used up, it can be exited and will not occupy mobile storage space [4].

## III. SYSTEM REQUIREMENTS ANALYSIS

Through a questionnaire survey on the satisfaction of college students' course learning, 46% of the students said that they could not fully understand the contents of the teacher during class, and they had difficulty in self-retent after class; 60% of the students It means that the network elective course can only be learned through the PC and needs a fixed time and place; 90% of the students hope that the school will launch a mobile online learning platform to solve the problem of incomprehension, slow progress, and limited course learning. problem. Therefore, we design and develop a college online learning system based on WeChat applet, so that students can move the classroom outside the classroom, allowing students to make full use of piecemeal time to learn.

In addition, for students who want to learn other professions outside their major, but have no way to do so. In the collection of teaching resources, We try to be

professional and complete when collecting teaching resources. curriculum resources include philosophy, economics, law, education, literature, history, science, engineering, agriculture, medicine, military science, management and art. Finally, for the assessment of elective courses, we found that the vast majority of online elective courses are evaluated in open-book format, and only need to submit the test paper on the specified date. Therefore, when designing the online examination function of the system, the anti-cheating mechanism is not so important[5].

The system supports users of different roles to login. This system mainly sets three levels of authority for ordinary users, college students and teachers.

### A. Analysis of functional requirements of ordinary users

After ordinary users login the system, they can use basic functions of the program, such as watch video, online test, download resources, online discuss, modify Information and other functions. Ordinary users can fast forward when watching video courses. The ordinary user function use case diagram as shown in figure 2.

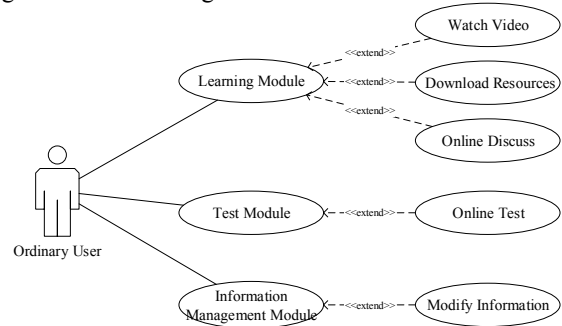


Figure 2. Ordinary users function use case diagram

### B. Analysis of functional requirements of college students

College students can login the system after the university identity authentication. Student users can use other functions such as online select course, online exam and assignment submission. The elective course video can not be played fast into the learning process. The college student user function use case diagram as shown in figure 3.

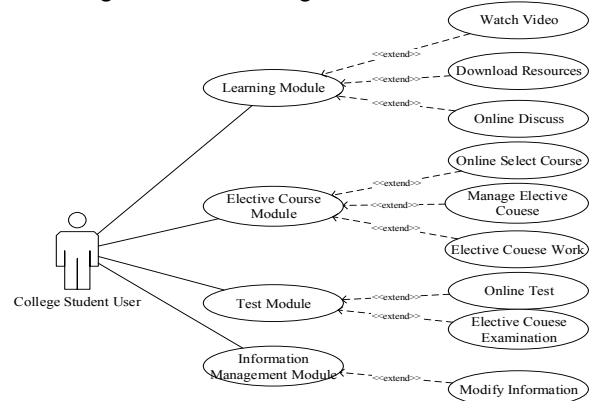


Figure 3. College student user function use case diagram

### C. Analysis of functional requirements of teachers

College teacher after the certification of course teachers. The main functions of teacher users include: manage courses, review paper, issue notice, work placement and modification, online answering. The teacher user function use case diagram as shown in figure 4.

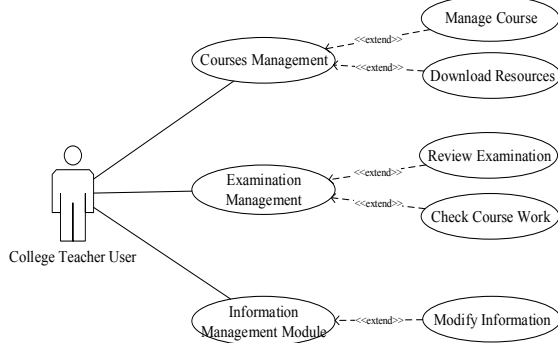


Figure 4. Teacher user function use case diagram

## IV. TEACHING RESOURCE ACQUISITION

### A. Famous teachers on campus record course video

We should give full play to the faculty resources of the university, encourage and organize famous teachers and academically knowledgeable professors of all colleges to record courses, and do post-processing work such as adding subtitles and important knowledge reminders to video, so as to improve the quality of recorded video courses.

### B. Online open course resources upload

Due to the great differences in the scale, level, type, culture and geography of colleges and universities in China, each university has formed its own advantages and characteristics in the long-term process of running schools. There will also be big differences in their curriculum and professional development priorities. Therefore, the sharing of curriculum resources is an important way for experimental colleges and universities to complement each other and benefit each other [6].

## V. SYSTEM DESIGN AND IMPLEMENTATION

### A. System architecture

The existing SDK/DEMO of the Mini Program lacks support to the cloud. It relies on developers to build cloud services module; Mini Program cannot directly connect to the database, and it must connect to the database through the interface. Currently WeChat Mini Program only supports HTTPS; The Authentication process security requirements are high, and it is difficult for developers to complete session management efficiently and safely. For these questions, the Tencent Cloud Server provides a low-latency, high-stable audio and video link for the WeChat Mini Program, which can be used for high-concurrency and online viewing. Tencent Cloud Server natively supports HTTPS/WSS, Certificate application deployment is transparent to

developers and reduces unnecessary troubles for developers. Provide a complete authentication session management service to ensure account security and improve the efficiency of Mini Program development. Therefore, we choose Tencent Cloud Server to communicate with Mini Program.

The system consists of two parts: the first one is the front-end code in the WeChat Web developer tool, and the other is the supporting service of Tencent Cloud Server Solution. The solution includes a security protection mechanism composed of cloud monitoring and BGP high defense, which is then connected to the business server through the access layer of domain name resolution, load balancing and SSL certificate verification. The business server interacts with the database through the load balancing session server of the internal network to complete data storage. When the user operates on the client functionality, The client calls the `wx.request()` method to initiate a network request, and the data that is sent to the server is the String type, and if it's not a String type, it's converted into a String type. Cloud Server generates the JSON data set, after get the request via SOAP method call local server Web Service method sends the data to a local server. When using Tencent Cloud to provide services for Mini Programs, it is necessary to completely copy the development request domain name, then open the `client/config.js` file in the editor, fill in the copied domain name into the host and save it. After saving, the editor will compile the Mini Program automatically, and the left simulator window can display the client local server in real time[7]. The system framework diagram as shown in figure 5.

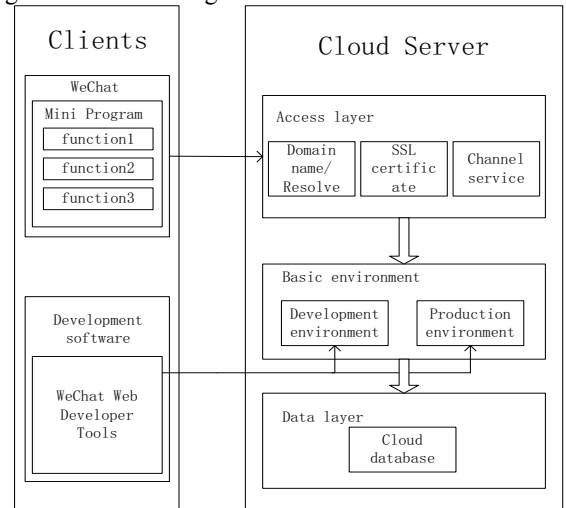


Figure 5. System framework diagram

### B. System database design

The college online learning system database stores many users and courses information. According to the demand analysis, the following database tables are created: a) User registration table, which is used to store all user information using the system; b) Elective courses table, which includes online elective course ID, course name, author, course introduction, course time, etc; c) Test exercises table includes

fields such as test name, test scores and user ID; d) Elective courses examination table, which includes the course ID, examination name and other fields; e) Message information table containing fields such as user ID, user name, message details, message time, etc. f) Elective course assignment table includes the elective course ID, teacher ID, assignment details, release time and other fields. g) Study record table with fields such as course ID, course name, last learning time, etc. h) Personal information management, which includes all the personal information of the student, learning records, test records, total learning time and other fields [8].

TABLE I. USER REGISTRATION TABLE

Field name	Data type	Data length	empty
userid	Int	11	N
username	Varchar	20	N
password	Varchar	50	N
authority	Tinyint	10	N
date	Datetime	8	N

TABLE II. ELECTIVE COURSES TABLE

Field name	Data type	Data length	empty
courseid	Int	11	N
coursename	Varchar	20	N
instruction	Varchar	50	N
authority	Tinyint	10	N
teacherid	Int	8	N
teachername	Varchar	20	N
courseurl	Varchar	500	N

TABLE III. ELECTIVE COURSES EXAMINATION TABLE

Field name	Data type	Data length	empty
paperid	Int	11	N
papername	Varchar	50	N
score	Int	50	N
author	Varchar	10	N
date	Datetime	8	N
courseid	Varchar	20	N
time	Int	10	N

### C. System function design

According to the demand analysis, we will set up different functions for users of three kinds of rights, namely the ordinary user, college students and teachers. System main function modules include: online learning module, online examination module, online discussion module. Each

module sets different functions according to different login users. For example, after the login of ordinary users, the examination module is only used as the normal test function, while the online test function can be used when the users of college students login. The system function diagram as shown in figure 6.

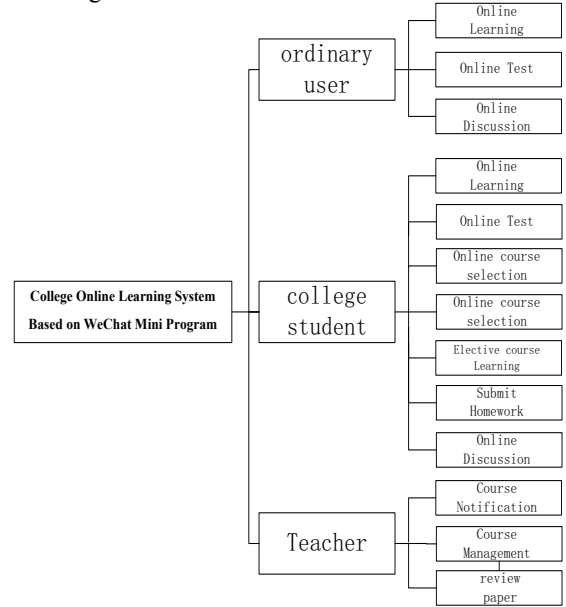


Figure 6. system function diagram

### D. System implementation and key code

1) The screenshots of the functional interface of the system are shown in figure 7. They are screenshot of online learning function, screenshot of online exam function, screenshot of online discussion function.

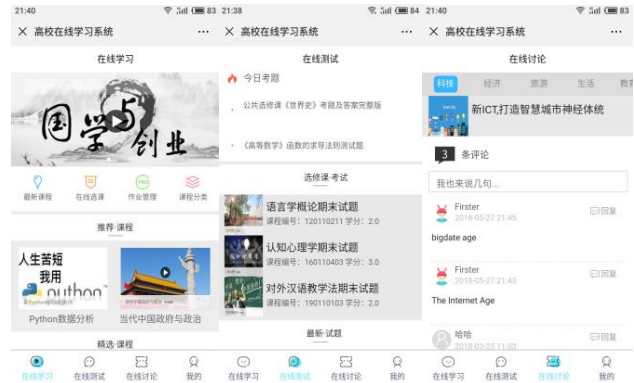


Figure 7. System screenshots

2) The following introduces the main code in the system development process, and details the Cloud Server request method and teaching resource import method.

#### a) Cloud Server request method

All interfaces are Tencent cloud API communicate via HTTPS, provide a highly secure communication channel.

The request method supports both POST and GET requests, and care must be taken not to mix them. That is, if you use the GET method, the parameters are obtained from the Querystring; if you use the POST method, the parameters are obtained from the Request Body, and the parameters in the Querystring are ignored. Formatting rules the same parameters in two ways, typically using GET, POST when using the parameter string is too long. If successful call interface returns the following code:

```
{
  "Response": {
    "TotalCount": LEARNINGSYSTEM,
    "InstanceStatusSet": [],
    "RequestId": "b5b41677-460d-4192-b42e-462cc34b6c1c"
  }
}
```

#### b) System data import method

Use the CreateDBImportJob to create a cloud database data import task to import various data required by the system into the cloud database. The request parameter code is as follows:

```
https://cdb.tencentcloudapi.com/?Action=CreateDBImportJob
&InstanceId=cdbro-ids6j1b3
&User=admin
&Password=123456
&FileName=COURSEVIDEO.sql
&< Public request parameters>
Return parameter code as follows:
```

```
{
  "Response": {
    "AsyncRequestId": "be9f64a6-fa652dc6-f5c878b6-a6a50746",
    "RequestId": "6EF60BEC-0242-43AF-BB20-270359FB54A7"
  }
}
```

## VI. CONCLUSION

WeChat Mini Program is a kind of application that can be used without downloading and installing. It realizes the dream of application being "near at hand", and it is one of the most convenient application forms at present. College

students through this Mini program have not only surpass the limit the number of time, place, learning, and greatly alleviate the pressure of the school's teaching and the teaching cost and promote quality education resources sharing. This system is highly practical and easy to be popularized. In the future, through the improvement of the system, it can attract more universities to join in and promote the development of "Internet + Education".

## ACKNOWLEDGEMENT

This research was supported by the Postgraduate Education Innovation Projects of Shandong Province of China under Grant No.SDYC15042, and supported by the Undergraduate Innovation and Entrepreneurship Training Program under Grant No.201710445199. In addition, the authors would like to thank the reviewers for their valuable comments and suggestions.

## REFERENCES

- [1] Hongwei Liu, "Analysis of Wechat mini program application," Journal of Wireless Internet Technology, no. 23, pp. 11-12+40, 2016.
- [2] Xiaojuan Chen, and Hongpu Chen, "Exploration of tencent classroom online teaching model," Software Herald, vol. 14, no. 08, pp. 221-224, 2015.
- [3] WeChat Mini Program Official Tutorial[EB/OL].2018-5-31, <https://developers.weixin.qq.com/miniprogram/dev/framework/MINA.html>.
- [4] Siyi Wu, Jie Jie, Yu Zhang, and Hou Bingzhen, "Research on the development of WeChat mini program," Wireless Internet Technology, vol. 15, no. 11, pp. 52-54, 2018.
- [5] Yongsheng Zhang, Ying Li, and Aiqin Bao, "Online course selecting system design and implementation," Proceedings of the 2014 International Conference on Computational Intelligence and Industrial Engineering, pp. 559-563, 2014.
- [6] Lizhen Wang, and Lili Tian, "Status of the national quality class teacher education curriculum resource sharing research," Journal of Education Theory and Practice, vol. 37, no. 3, pp. 46-49, 2017.
- [7] Liang Wang, Zhipeng Zhou, and Hong Jiang, "Design and research of doctor-patient communication platform based on WeChat mini program," China Digital Medicine, vol. 12, no. 11, pp. 71-73+99, 2017.
- [8] Yongsheng Zhang, Xiumei Feng, and Aiqin Bao, "The research and design of online examination system," Proceedings of the 7th International Conference on IT in Medicine and Education, pp. 687-691, 2015.