Class Attendance System

by

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A Final Year Project Thesis (COMP4004; 3 Credits)

submitted in partial fulfillment of the requirements

for the degree of

Bachelor of Science (Honours)

in

Computer Science and Technology

at

BNU-HKBU

UNITED INTERNATIONAL COLLEGE

December, 2020

DECLARATION

We hereby declare that all the work done in this Project is of our independent effort. We also certify that we have never submitted the idea and product of this Project for academic or employment credits.

_____

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Date: _____

BNU-HKBU

United International College

Computer Science and Technology Program

We hereby recommend that the Project submitted by Yaqi LU (Nika), Rubin ZHOU (Ruby) entitled "Class Attendance System" be accepted in partial fulfillment of the requirements for the degree of Bachelor (Honours) of Science in Computer Science and Technology Program.

    _____

Date: _____   **Date:** _____

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ABSTRACT

Class Attendance System (CAS) is an Android application designed and developed for better attendance management of UIC teaching activities and to avoid attendance cheating. Different from paper-based attendance in the past, this system does not require any paper to record attendance. Instead, it runs as an application on a mobile device equipped with an Android system and connected to the Internet, and realizes data exchange between the application and the Aliyun online database through network transmission. Students, teachers and system administrators all use the same system for attendance operations. When taking attendance, students not only automatically submit their own position, but also may be required by the teacher to submit a picture of the specified content. In addition to operating the attendance of the courses he teaches; the teacher can also remind students to sign in in time by means of a message. All attendance is required to be completed within 15 minutes, and the distance between the student and the teacher should be within 30 meters when a student sign in. Teachers can view the status of students' attendance in the built-in Gaode map in the system anytime and anywhere, and check the location of attendance or submitted pictures. The administrator manages the attendance of all courses and the administrator rights of appointing and dismissing teachers, and can change their account information.

Contents

1 INTRODUCTION

1.1 Background

There are currently two methods of attendance for UIC teachers: one is online attendance and the other is paper attendance. Both types of attendance can take up a lot of time. Online attendance is like iSpace, where the attendance teacher has to take a roll call and tick a small radio button, which is small, difficult to operate, easy to make mistakes and can only be done on a computer, so students must bring a computer if they want to sign in themselves. Paper check-in is much easier as students only need to sign their name on a piece of paper and pass it around, which is convenient. However, students may cheat as they can help other students sign in.

There is already a few attendance software on the market, of which Moodle Mobile Attendance software takes a lot of time for students to operate and students can take their own attendance even when they are not in the classroom. Others, such as Flybook, are targeted at large companies. Some use QR codes to sign in, others use face recognition. Managers can see that there is an average number of hours worked and the number of people out in the field, attributes that students do not have. It also has a Chinese user interface and the operation pages are complicated, so it is like most of the attendance systems on the market, they are not suitable for UIC users.

Compared to these systems, our Class Attendance System can prevent students from skipping classes. It also prevents students from cheating during the sign-in process, as the program can record students' location information and students are asked to upload pictures. Using this system, not only does it reduce the burden on the classroom teacher, but it also allows for the recording and documentation of student attendance. The attendance system supports electronic storage of data by recording and storing digital images of captured student fingerprints in a cloud-based database, helping to reduce the probability of data loss. As CAS attendance system can be used in Android phones, it will bring many benefits to users. For example, users of this portable attendance system can carry this attendance device with them and easily record and store the required data in the database system. It is unlike one of the earliest methods where teachers had to take attendance manually by passing attendance sheets around the classroom and the data needed to be saved on paper, which could cause serious damage to the teacher if a page was missed.

This attendance system will provide a low cost, accurate and efficient user-friendly UI for users, including administrators and teachers. The real-time system application platform enables teacher notifications to be delivered to students in real time.

The paper is organized as follows. Next section presents the theoretical development and the concept behind the proposed system. The components of the proposed system and the design flow are then shown. The next section demonstrates the results of the system as well as discussion on several important findings. Final section concludes the paper, referring perspectives of future work.

1.2 Problem Statement

The phenomenon of university students skipping classes is getting more and more serious nowadays, and some students will even cheat on their attendance marks, sign in and leave the classroom. This kind of behavior that is irresponsible to their own learning should be stopped. There are many campus attendance systems that have been created for this purpose. But one constant problem lies in how to prevent students from cheating on the attendance system. There have been many complaints from teachers that no matter what technology is used, students will find a way to cheat. In other words, there would always be glitches and even loopholes in the attendance system. Now it is the commercially available attendance systems that are generally expensive and of low value to use. Efficient attendance systems often require advanced equipment to support them. Things like fingerprint, clocking, and swiping campus cards require bulky equipment. If the CAS system were to be used on the UIC campus, it would be easy to use the mobile devices that every student has for location-tracked clocking in and out, and students would be asked to upload a photo to sign in as a second method of verification to prevent cheating.

How to prevent students from cheating when using the attendance system? Are there any possible way to design an efficient product with low cost?

1.3 Objectives

At present, attendance taker system has been widely used in enterprises, colleges and other fields. It has brought great benefits to individuals, businesses and governments, but there are still some small issues that need to be addressed in order to propose a better system. Therefore, in order to achieve these goals, we propose a new version of UIC student

portable CAS system:

    a) Development of an attendance system using 3D maps for better user perception.

    b) Have a simple user interface to make it neater and easier to operate.

    c) Add a verification mechanism to prevent students from cheating.

    d) Have a system which is efficient.

1.4 Scope of Study

a) Study the current technology of check-in systems.

b) Study the latest technology for mobile devices.

c) Study mobile application development (Android Studio)

d) Learn the Java language coding system.

e) Learn about JDBC connections to cloud databases

1.5 The Relevancy and Significance of the Project

This is a project which can help teacher to take attendance more efficiently. It can prevent students from cheating. If a student was 30 meters far away from the teacher or the student took this attendance 15 mins later after the course has begun, then this attendance failed. To avoid the situation that student A let student B take A's cell-phone to the classroom to take attendance. The student may be required to upload photos, like selfie with teacher who is on the stage. This system will increase the attendance rate of UIC students and increase the average score of UIC.

1.6 Feasibility of the Project within the Scope Frame

We collected books, journals and technical papers on attendance systems, programming languages and database management systems to research and prepare for the development of this project. In order to better understand this project, we conducted research from time to time. This project focus on most efficient and feasible the way to prevent students from cheating, to achieve that we made some improvements to produce the best and successful design products. In other words, our system is highly adaptable and flexible in UIC.

1.7 Contribution of work

Student attendance system is important to UIC for student attendance improvement. This project also demonstrates the process of converting a student's uploaded photo into a binary stream and an automatically generated timestamp, showing how the data used to prevent cheating is stored electronically.

2 LITERATURE REVIEW

2.1 Introduction of Android platform

LIU and YU briefly introduced the features of Android Operating System and components of Android applications in their paper [1]; they also gave a simple example, the sequence diagram - of a Music Player to explain the mechanism of the Android application.

They focused more on the features, principals and mechanism in Android Operating System and application, which is needed for us - the beginner of Android development; but they focus less on the detailed methods of developing an application.

We may use sequence diagrams like authors in the paper - it is a good way to show the activities of the application, and we are more concerned with the construction of an application, the characteristics of the application, and the thinking about developing the application.

2.2 Introduction of GPS and location awareness

GPS, also known as the global satellite positioning system, provides continuous and accurate location, time and movement services for most areas; in other words, GPS can provide real-time positioning and navigation services. At the same time, GPS can also provide assistance for engineering construction, surveying and mapping [2]. GPS is mainly composed of three parts: space part (satellite), user receiving part (mobile phone, vehicle positioning system and other equipment), ground control part (main control station, monitoring station, injection station, etc.) Large coverage area, fixed timing, movable, efficient, and not affected by any meteorological characteristics make GPS widely used in many fields. Our application can implement the real-time positioning function through GPS position sensing technology and Android devices, working as the position receiver, GPS chip (GPS positioning), Assisted GPS (base station positioning) and WIFI positioning.

Due to regional restrictions and other reasons, we will use the API provided by Gaode Open Platform to implement this function in the application: it can provide real-time positioning service in combination with the GPS module of the mobile phone, and users can use this application within the campus area.

We can add a radius parameter in addition to the coordinates (or location parameters) provided by the Gaode to limit the application scope of the application on the UIC campus. Since GPS uses the WGS84 coordinate system (World Geodetic System—1984 Coordinate System), and Gaode Map uses the GCJ-02 coordinate system, which the coordinate system of the geographic information system formulated by the National Bureau of Surveying and Mapping of China (According to Section 4.1 of Section 4 in "Navigable Electronic Map-Basic Requirements of Security Processing Technology": navigation electronic maps must undergo spatial location technical processing before being published, sold, disseminated, displayed and used. Therefore, in China, any map product is not allowed to use GPS coordinates directly. Map products issued in China are compulsorily added with an offset algorithm, so that the original standard coordinate system (WSG-84) becomes a state-secret custom coordinate system (at least GCJ-02).), Gaode map API will provide its own coordinates. [3]. If longitude and latitude (i.e. GPS coordinates) are used to calculate the application coverage and radius, our calculation may require numerical conversion.

2.3 Related Android attendance application systems

2.3.1 Location and GPS

Sultana and her group proposed an automatic time and attendance employee monitoring system, which is implemented on Android mobile applications [4]. The location of each member can be determined by using the GPS of smart phones.

They used apache derby database to store the data. Different types of users must install the corresponding APK files on their android devices. And they need to store the office coordinates by entering the latitude, longitude and radius of area. The server will receive the employee ID and local time when the employee is in the specific area, then store the data (include status) to the database; when the employee leaves, the server also receive and store data, then update the status of the employee in database. The author says that to run this system accurately, both employee(user)device and the office server must be in the same internet connection.

The description of application from Sultana is quite similar to the requirement in our project: both of them require to do the attendance in a specific location for "login" and "logout" in the server, and they are all required to use GPS. In addition to the features listed above, our

project will do something on displaying the location, taking and storing the photo, and warning for absent students; maybe a facial identification is needed for the student.

To prevent cheating of daily attendance, Uddin and his team developed a mobile application which can be installed on the users mobile [5]. Something different from the research and development we listed above is, what Uddin researched and designed in detail is focused on location, based on the situation that each organization has a specific location determined by GPS. The location of employees can be determined by GPS devices. If the location of the employee is the same as that of the organization, then it should be said that the employee is in the office.

There will be a unique user ID and location (GPS coordinate) associated with their application, which might be similar with our design. It can process the data receive from user mobile and store the information (time, entry and leaving) to the Database. From user to management software, the application determines and checks the location using GPS, then sends information to the system. From management software to database, the data will be sent to database after user identification. It would be better if there is a feedback for teacher of a list of absent students in the course, and a warning for the student in unspecified location; it is easy to implement that we can use the data from database system.

Parida has designed an attendance management system which store map positioning and attendance record of professors and different types of students (for example, undergraduates, masters, and PhD.) [6]. This system uses GPS positioning and database to record data, classify users and mark users' position in time so that students and teachers can record information and view their positioning information within different time periods. In this Android application, the instructor needs to set the attendance time for students to check in within a certain period of time, and judge the student's attendance based on the student's location and attendance status. A special feature of this system is the visualization of user positioning - marking the position of the user (each type of users has a corresponding color) on the map when he finishes the attendance. In addition to the professor can view the location information of all his students, the student can also view the data of himself or his classmates; another interesting point is that, during a period of time, this system only supports users to log in on one device-this is not mentioned in many papers.

We hope to achieve the positioning visualization function, which is a very good function.

Since the user type of our system is less than Parida's system (our system is mainly for undergraduate course attendance services), we will not classify the identity of users by too much color in map.

Ayop's paper proposes an intelligent attendance system based on QR code and GPS technology, which aims to speed up the collection and tracking of students' attendance [7]. The attendance system implemented in this project was developed using Android Studio, and the two main components of the system are the SAMS (Student Attendance Monitoring System) server and SAMS application. This is a system that can be used online and can be accessed via mobile devices. The user type is limited to students and teachers, that is, only authorized students and teachers (already registered) can log in with his unique student ID and password. The Google Map distance matrix API is also used in this application to calculate the distance between the user and the site. The database will store the location tracked by the mobile phone's GPS sensor, the student's login and logout time.

We can set up the administrator's page like the article, and the administrator can more intuitively investigate and record the information of the attendance. And the students who leave the classroom 100 meters before the end of class time are regarded as truancy and recorded as absenteeism, which can be much fairer, so as not to leave after someone signs in.

2.3.2 Wireless Network Connection

In Wang's [8] and Manoj's [9] framework to establish the framework of class attendance system, the system has two servers and a mobile client: one connects the educational administration system which provides the students schedule which include class time and place. Mobile client of the attendance system is distributed to students and the client has to connect the network for getting the location. The detailed of framework is to remind students and teachers to take the course within the stipulated time and specific classroom, which would remind or warn the absent student with a message and record the absent of student. The current timetable and location information of students are used to prevent cheating in attendance.

Ponnusamy designed an attendance system application in the Android mobile device that uses WIFI to connect to the network database and the user [10]. This application provides

services for two types of users: students and teachers: allowing students to log in to the Android application based on the connection to WIFI, and press the "Post Attendance" button to confirm his presence. The student's attendance data will be uploaded and saved in the network database; the professor can log in in the same application, and view all the records within the authority, and set the attendance time. Relative to the application we need to design and develop, this application's attendance method is easy to cheat: the student can let others use his mobile phone to log in and attendance, but absent himself. This is also one of the shortcomings of this system.

This paper also introduces the part we are interested in the connection between the front end (network database-> web server-> firewall-> wireless access point) and the back end (wireless access point -> user's mobile) for the application, shown as below,
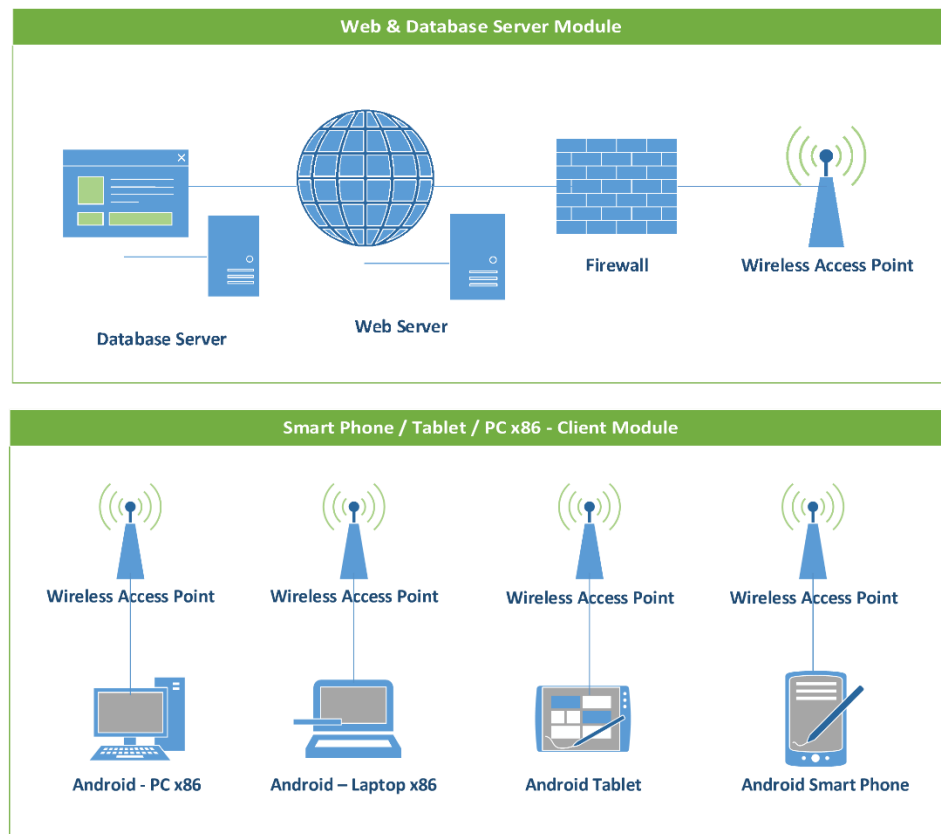
Figure 1. Design of the system [10]

Wireless access point is used as an intermediate between the front end and the back end. Data stored in the front end (stored in the database actually, the database data will be transmitted to the web server, and then passed through the firewall to the wireless access

point) and transmitted to user's mobile. When the attendance record needs to be updated, the modified data uploaded by the back-end will be transmitted to the front-end storage via WIFI again.

Liu's attendance system design mentioned the server-client connection [11]. his server is responsible for responding to client requests. When the client needs to access the server to get the data, it uses the post method. In the check in module, when the student user clicks the check in button, the Android client sends the post request to the server. After receiving the request, the server responds to the corresponding request according to the URL.

Due to Liu's design, we think the server for our system is mainly used to receive the information sent by the client, carry out corresponding operations, return the data to the client, and manage the database on the server. Our system uses socket mechanism to realize the data transmission between server and client, and to standardize the data format.

2.3.3 Database

Kumbhar provides an installable Android APK program - Attendance Monitoring System to supervise students' real-time attendance [12]. This system has a similar design architecture to the previously mentioned systems and applications. That is, it enables students to use the Wi-Fi in the classroom and the attendance system for login and one-click check-in, teacher setting check-in, and the system to generate attendance for administrators and staff Report and send to parents by SMS. Because the functions of this application are relatively simple and easy to implement, this paper provides a detailed design of each function, even have a very detailed explanation of the network connection (server-client). This provides a good reference for us to design the Classroom Attendance Application project. In particular, this detailed design on the database (although other papers have corresponding designs, but this detail is not explained in detail): the teacher sets the flag value to false for all students who have not taken classes in their management page; when the student has After logging in and pressing the check-in button, the flag value becomes true. We are also willing to use this one-click check-in method as one of the student check-in methods, and students must press the "check in" button to check in, in order to have other check-in verification methods, such as taking pictures and storing them in the database.

The student attendance application system designed by Singh also has a very detailed

description in database design [13]. Similar to what Kumbhar described, both students and teachers use the Android app for login and attendance activities. The special feature of this system is that the web module is used as a management server: this system places student data (or user registration), attendance records and reports on the web module, that is, administrators need to update database information on the web page.

In our point of view, this design is reasonable: just as you can enter the IP address in the browser to set the internal information of the wireless router after connecting to the wireless network, this attendance system can also set and monitor the internal information of the system in the web module. Therefore, if you need to set up a web module for the administrator, we consider setting up the administrator function in both the web module and the Android application, so that the instructor or other administrators with higher permissions can use it in these two places. But the administrator can only log in at one place at the same time (which can be set in the database).

The advantage of using a network database in Ponnusamy's design [10] is that all data received or uploaded by users can be updated in real time, which is of great help to teachers' real-time monitoring and management. For us, our design also needs such a network database-based on our system is used in the UIC campus, and the school provides a database that can be used by connecting to the campus WIFI (based on phpMyAdmin), we may use this instead of looking for a cloud storage space as a network database to store data for this application.

2.3.4 Facial recognition

Masalha provided a design of system which is based on a QR code, which is being displayed for students during or at the beginning of each lecture [14]. The students will need to scan the code in order to confirm their attendance. When the information of scanning is received by database through server and wireless network, students are required to send an image of the student himself to the system, which is to store image on file for the students' attendance and compare the facial image sent each transaction. The tutor can check the student's matching score in the attendance sheet, which is updated at any time. When the student prepares for face recognition, the system will prompt the student to point to the start button, and the system's camera program will run and capture the student's face.

The design shows a feasible way to achieve the store and check of uploaded image from the student. It will be simpler and practicable than facial recognition for us to implement. It would be better if the design can use the data from the UIC online system directly, such as MIS UIC and UIC iSpace; in fact, Masalha would like to implement the application as a plug-in module to Moodle, which is a eLearning platform application provided basic services for schools' learning system on mobile electronic devices. If it is needed for us to get the username and account number of all users on the learning platform, we only need to get it from our school's own learning platform iSpace or MIS, not from Moodle: the information obtained by Moodle is also from iSpace, we do not need to obtain the information indirectly.

Baskaran talked about the effective and useful attendance application for the students in Malaysia [15]. After discussed the characteristics of some effective ways for attendance, such as intelligence card, fingerprint, facial, Baskaran decided to use facial identification and use LBPH Algorithm (Local Binary Pattern Histogram Algorithm) to identify faces, and GPS to get the position of students, as description in out project, then make a real-time system. They also do some tests in the campus and display their application and get a good result.

What Baskaran introduced is whole process of designing an application. It's helpful that we know the structure of the design report, the advantages and disadvantages for different tools for attendance system. We can relate to the part of GPS (the actions, the database and the forming methods) in out project in the future. Still, it does not include the detail about map, which is necessary in out description.

Waingankar introduce an algorithm of facial recognition; she also uses these algorithm and other methods, like SVM (Support Vector Machine, which is to improve the separation hyperplane that can correctly divide the training data set and the largest geometric interval), to implement an attendance system in android [16].

To identify the faces from a picture taking by the phone's camera, the system marked image black and white because they don't require colour data to find faces. Then, the HOG person detector (HOG is Histograms of Oriented Gradients, which is to generalized the same object produces as close as possible to the same feature descriptor), uses a sliding detection window which is moved around the image. The image is sub-sampled to multiple sizes.

Each of these sub-sampled images is searched.

Since we might use an API for facial recognition, there might be few similar with this paper. But we learn some ideas of identifying the face in theory. It is helpful for us to learn more in recognition's algorithm.

3 METHODOLOGY AND DESIGN

The main purpose of this project is to improve the existing attendance system like paper attendance and iSpace attendance at UIC.

3.1 Research Methodology

The methodology used for this project is waterfall/hierarchy methodology. Which means that only by finishing the first process then you can keep doing the rest of it. The following Figure 2 shows the illustration of steps taken in Waterfall Methodology. In the stage of demand and analysis, we discussed the development objectives and feasibility of the software and we decided the prevent cheating method that we were going to use in our project. After the frame work of our project is fixed, we started to design the detail of this application. Then the programming and test part we began to write code and test our code to see if it satisfied our original target and if there were any room for improvement.
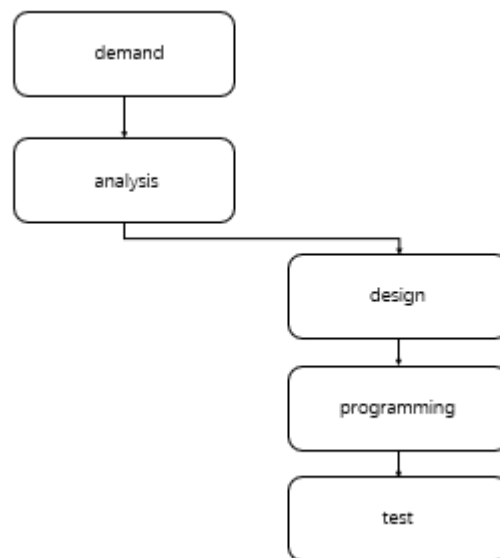
Figure 2. Waterfall model for this project

3.2 Project activities

3.2.1 Data Gathering and Analysis

The project mainly used the Gaode Map API and the Aliyun Cloud API. Early literature research focused on the connection of the cloud database and the use of location tracking technology. Internet tutorials were also used, mainly on help sites such as YouTube, CDS and GitHub.

3.2.2 Project Discussion

To ensure that the software works as expected in an Android device, various applications were retrieved regarding Gaode Maps on Android, including automatically generating timestamps, generating 3D maps, detecting the distance between two target points and setting distance constraints, etc. Considering that the time of map positioning and the accuracy of coordinate positioning have certain errors, distance constraint of teacher and students in setting attendance time should be no more than 30 meters.

At the same time, in order to save teachers and students' attention to the time spent on attendance, and to ensure the accuracy and efficiency of attendance, the time interval for completing the attendance is set within 15 minutes of the start time of attendance set by the teacher. No matter when the student logs in to the system, within the specified time, the student needs to complete all the attendance tasks assigned by the teacher: one-click attendance is a must, and the student will automatically record the attendance in the database after pressing the take attendance button; If the teacher has additional tasks assigned in this attendance, students also need to complete all tasks within the set attendance time period.

3.2.3 Implementation

The CAS system can help to reduce absenteeism problem among students since they can no longer fake their attendance as they used to in order to improve their attendance record.

3.2.4 Process Flow
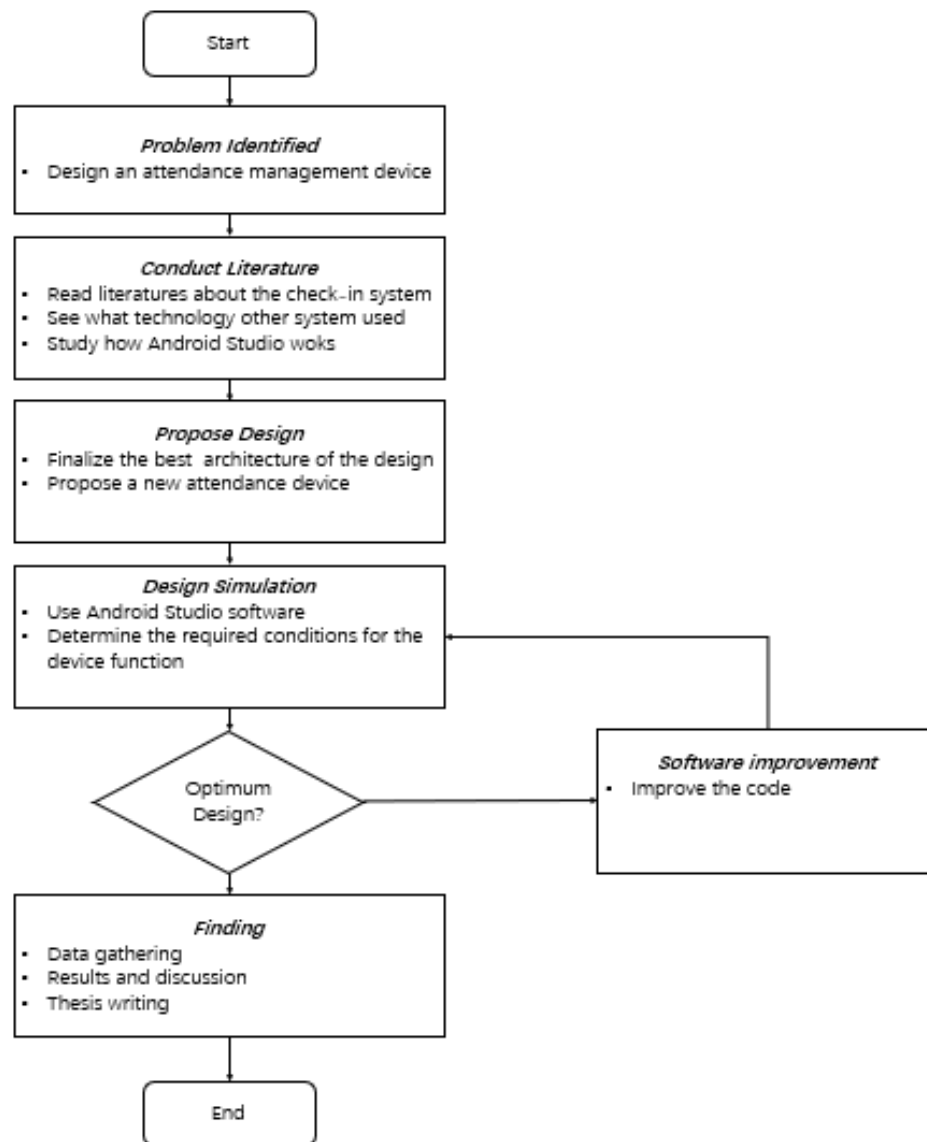
Figure 3. process flow

The process flow of our project is shown in Figure 3. First, we identify the problem that is to design an application which can prevent students from cheating. Then we conduct a literature review by reading articles about the check-in systems and discuss about what kind of technology to be use that students cannot fake their attendance. We also studied the frame of Android Studio working platform. To propose a new attendance device, we finalize the best architecture. After which we started to write the code and repeat checking whether we approach the optimum design. At last, we gathered data and discussed thesis writing.

3.4 Tools and Equipment

3.4.1 Hardware

- HUAWEI Mobile Phone

3.4.2 Software

- Android Studio 3.6
- GaoDe API
- Aliyun RDS Database

3.4.3 Android Studio

Android Studio is an Android integrated development tool from Google for programmers to develop and debug, and supports Gradle builds. There are many tutorials for Android Studio on the web, which is a convenient platform for writing code. Figure 4 shows the work surface of the Android Studio. We use Android Studio 3.6 which is used for develop android software. The language used is JAVA and we mainly use JDBC API and Gaode API.
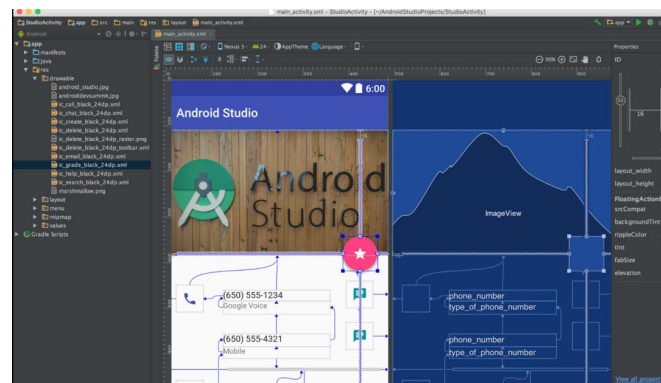
Figure 4. layout of Android Studio

3.4.4 Aliyun Database (RDS)

It is a relational database service and it is built on Alibaba Cloud ECS server which means Elastic Compute Service and it is a cloud database which is connected to the Android Studio by using JDBC (Java Database Connectivity) API method. We also use the DMS (Database management system), provided by Aliyun, to help us visualize the database.

3.4.5 Gaode API

We use locate SDK and map SDK through it in order to show the 3D map and the multiple position on the map. Use Gaode coordinate system to record the locations.

3.4.6 Resource Structure

As showing in Figure 5, the data flow between client and server in CAS application. Data can be upload into RDS database through the connection of Aliyun Cloud and which has an ECS (Elastic Compute Service) built on it. Then data go into the RDS (relational database service) database provided by the ECS.

Figure 5. data flow of client (CAS App) and server

Figure 6 show the brief structure of the usage of our resource. Java projects is built base on the android application provided by Android Studio itself and use the JDBC method to connect the Aliyun Database with Android Studio. We use the Aliyun Database to manage data and pictures. For maps we use Gaode API to show 3D maps and location. Our project is loaded into Android Mobile Devices as an Android Application.
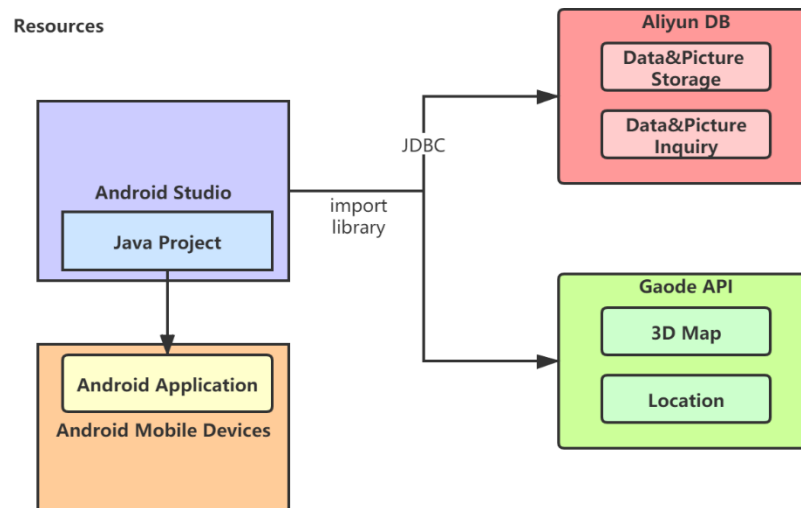
Figure 6. resources and services

4 IMPLEMENTATION

As mentioned earlier, the main purpose of this project is to design and develop a user-friendly attendance management system that can judge whether students are successful in attendance by submitting real-time positioning and designated pictures. As an Android application, users only need to download and install the installation package of the application on the Android mobile device [17] to use the system; however, there are some precautions in the design of the system.

Figure 7. Android mobile device [17]

4.1 Conceptual design of the system

Design of the system is divided into four user modules, which are student, teacher, adminTeacher and administrator; and the main features are included in the modules. It is worth noting that all users will log in on the same application, which means there is only an application is designed instead of four, Figure 8 shows the priority and the relationship of four user modules.
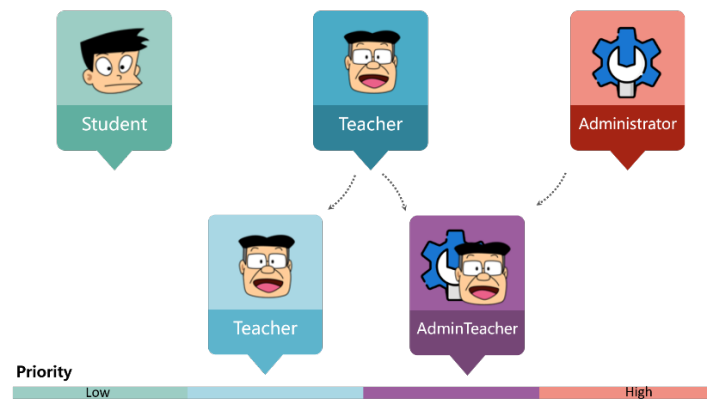
Figure 8. User modules

In this class attendance system, the order of user priority from high to low is administrator, adminTeacher, teacher and student. Among them, adminTeacher has part of the rights of both teachers and administrators, and teacher here refers to ordinary teachers without administrator rights.

The course data of all users has been stored in the database, so the account information and course information of teachers and students cannot be changed; the system only operates the attendance data and the authorization of the system's administrator rights.

4.2 Module design

4.2.1 Login

Shown as Figure 9, all users need to click on the application on the main interface of the phone and log in to their account.
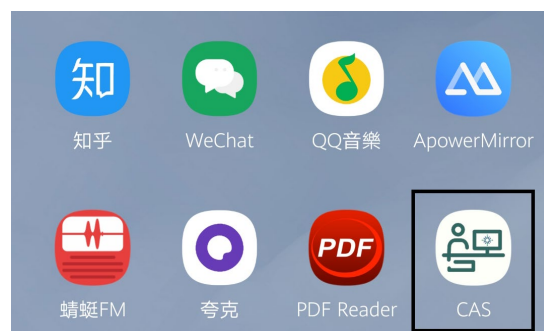
Figure 9. CAS Application in a phone's main page

In the login page, users can choose their own user type and input the correct user name and password to enter the corresponding main page. User should also choose one of these three user types: student, teacher and administrator.

Students can only login as students; both normal teacher and adminTeacher can login as teacher to manage attendance in his course; adminTeacher can also login to administrator's page with his partial administration right; administrator can only type administrator to login his page. Figure 10 displays the login page.

Figure 10. Login page

If user enters the wrong information, a prompt message will pop up at the bottom of the page, which is shown as Figure 11 ,
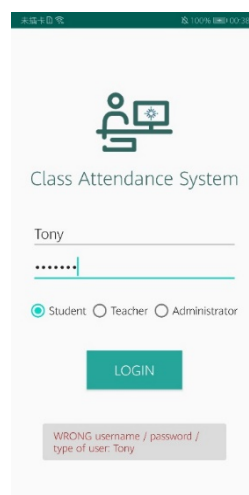
Figure 11. Wrong input of login page

4.2.2 Administrator Module

There is only one administrator in this system. After the administrator has successfully logged in, he will come to this main page to view and modify all information in real time. The main page is shown below,
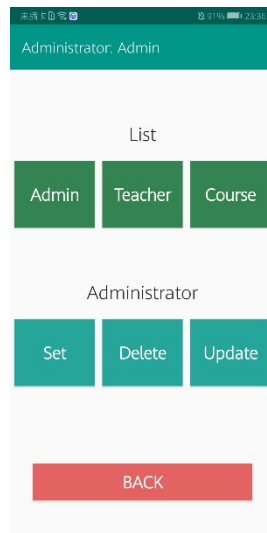
Figure 12. Main page of administrator

Admin List

Admin list page shown in below displays the names and types of users who have administrator rights, including administrators and adminTeacher; if administrator wants to view the latest information in this list, he can press the refresh button below.
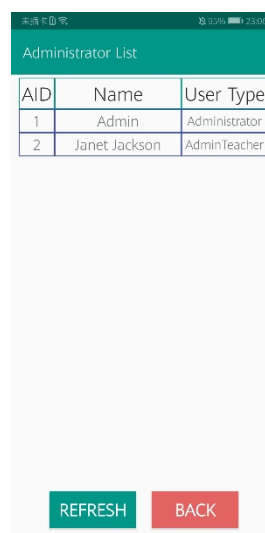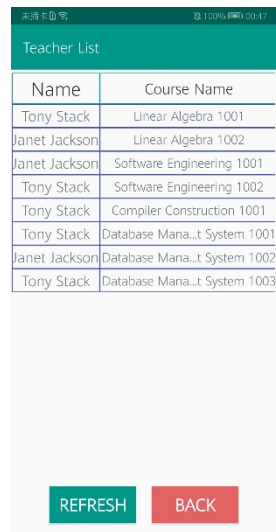
Figure 13. Admin list

Teacher List

This page shown in below displays the names of all users with teacher permissions and the courses he teaches; if the administrator wants to view the latest information in this list, he can press the refresh button below.

Figure 14. Teacher list

Course List

This page displays all courses in the system, which is shown as Figure 15; the administrator can click on the name of any course to operate the attendance data of this course as the lecturer of the course.
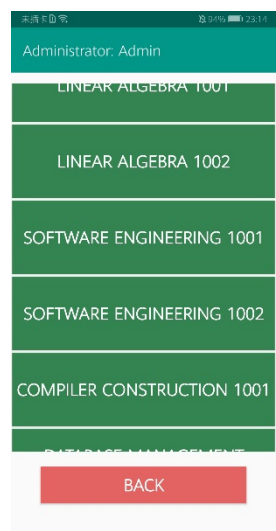
Figure 15. Course list

Set Administrator

The page is shown as Figure 16. By entering the correct teacher's username and administrator's login password, the administrator can grant part of the administrator's rights to the teacher. Because the administrator cannot view the username of any teacher in the above list, the teacher needs to provide his username: This also reflects that the authorization behavior is confirmed by the teacher and the administrator.
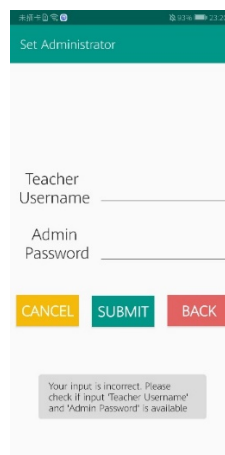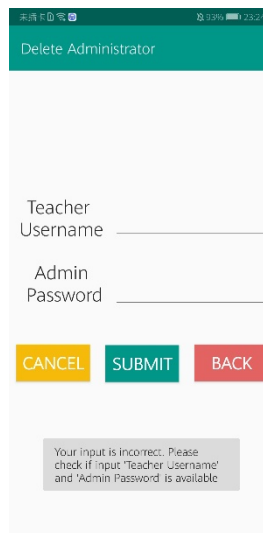

Figure 16. Set admin with inputting wrong information

If the administrator enters the wrong information, an error message will appear at the bottom of the page; if the information entered is correct, the successful sentence, which is shown as below, will be displayed at the bottom of the page, and the user type of the teacher will also change.
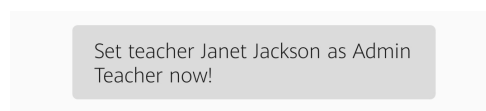
Figure 17. Tips for successful empowerment

Delete Administrator

This page is shown as below. By entering the correct teacher's username and administrator's login password, the administrator can revoke part of the administrator's rights to the adminTeacher. Because the administrator cannot view the username of any teacher in the above list, the adminTeacher needs to provide his

username: This also reflects that the authorization behavior is confirmed by the adminTeacher and the administrator.

Figure 18. Delete admin with inputting wrong information

If the administrator enters the wrong information, an error message will appear at the bottom of the page; if the information entered is correct, the successful sentence will be displayed at the bottom of the page, and the user type of the teacher will also change. The sentence is shown in below.
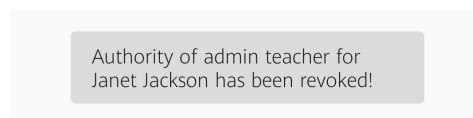

Figure 19. Tips for successful de-empowerment

Update Administrator's Account

Administrator can set his own username and password by entering strings in the corresponding text boxes: the new username cannot be less than 5 strings, and the new password cannot be less than 6 strings. The update page is shown in Figure 20. After the input is successful and the submit button is pressed, the system will pop up the input information and log out, which is shown as Figure 21; the administrator needs to log in with the new account information.
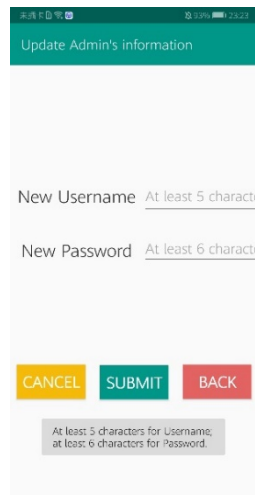
Figure 20. set new account information for administrator with inputting wrong information
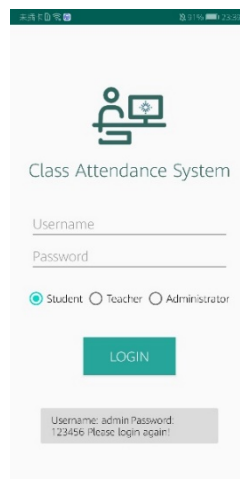

Figure 21. Successfully change the administrator account information and log out

4.2.3 AdminTeacher Module

When adminTeacher logs in and clicks the administrator's radio button, he will enter the adminTeacher page, which is shown in Figure 22. In this page, he has the right to check the list of users who has administrator right, the list of teacher and courses. He could also manage all courses as a lecturer, all these lists display same information for both administrator and adminTeacher; but adminTeacher has no right to operate other functions not mentioned above.
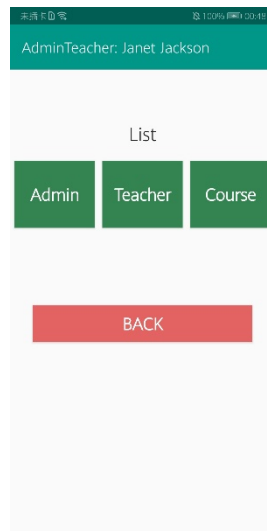
Figure 22. adminTeacher's main page

When adminTeacher logs in and clicks the teacher's radio button, he will enter the teacher's main page.

4.2.4 Teacher Module

For a teacher or an adminTeacher, he could manage all attendance in a course he teaches by clicking the course he wants to in his course list when login. Teacher's management page for this course is shown in Figure 23.
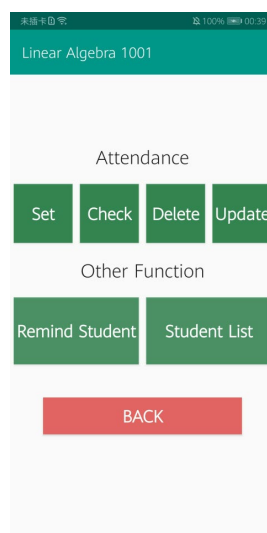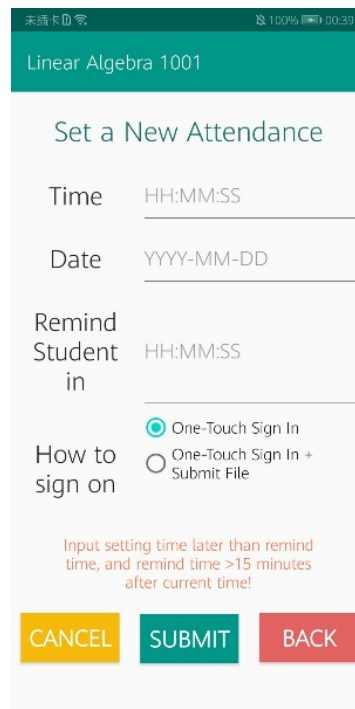

Figure 23. Management page of a course for the lecturer

Set Attendance

First of all, a teacher can set an attendance. As it is shown in Figure 24, An attendance should be set with specific date and time, when to remind student, and the way for student to sign-in. If teacher required student to submit a picture, he should also input the content of submission. The setting attendance time should be later than reminder time, and reminder time should be at least 15 minutes later than now.

Figure 24. Set attendance page

Update Attendance

Similar input is required to update attendance as Figure 25 shows. The difference is that the teacher needs to enter the time stamp of the attendance he wants to modify. After the system verifies that the time stamp exists for attendance, the page jumps to the same page of set attendance: the teacher needs to enter the same information in update page as in set page.
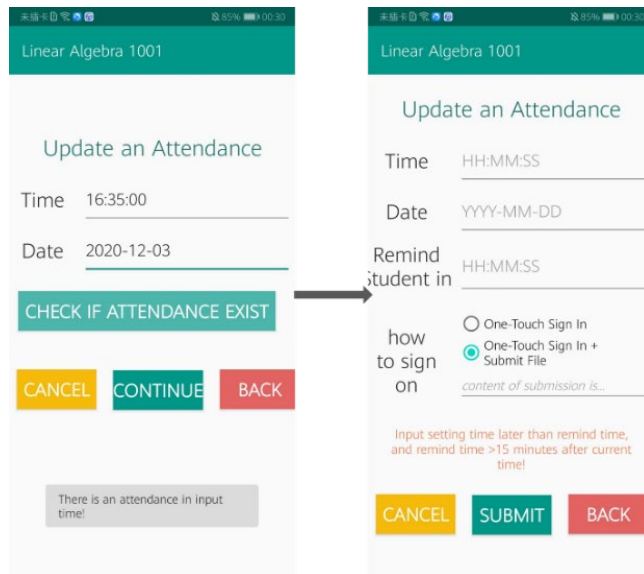
Figure 25. Update attendance page

Delete Attendance

It is also available for a teacher to delete an attendance. He should input specific time and date of the attendance, and check if the attendance exists or not. If the input timestamp has a corresponding attendance timestamp, this attendance will be deleted. The page of delete attendance is shown in Figure 26,
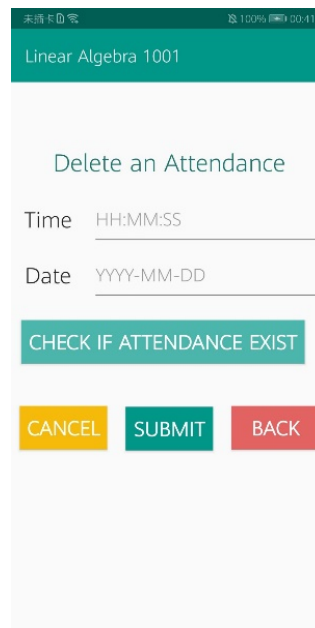

Figure 26. Delete attendance page

Check Attendance

When the teacher wants to check the status of an attendance, he can press 'check' button, and then check the information of attendance in list; If he selects any attendance check, the teacher will first see the setting time of each attendance, when to remind the students, the way the students sign in and the status of the attendance: the number on the left is the number of people who have signed in, and the number on the right is The total number of people who need to sign in. Two pages of checking attendance are shown in Figure 27.
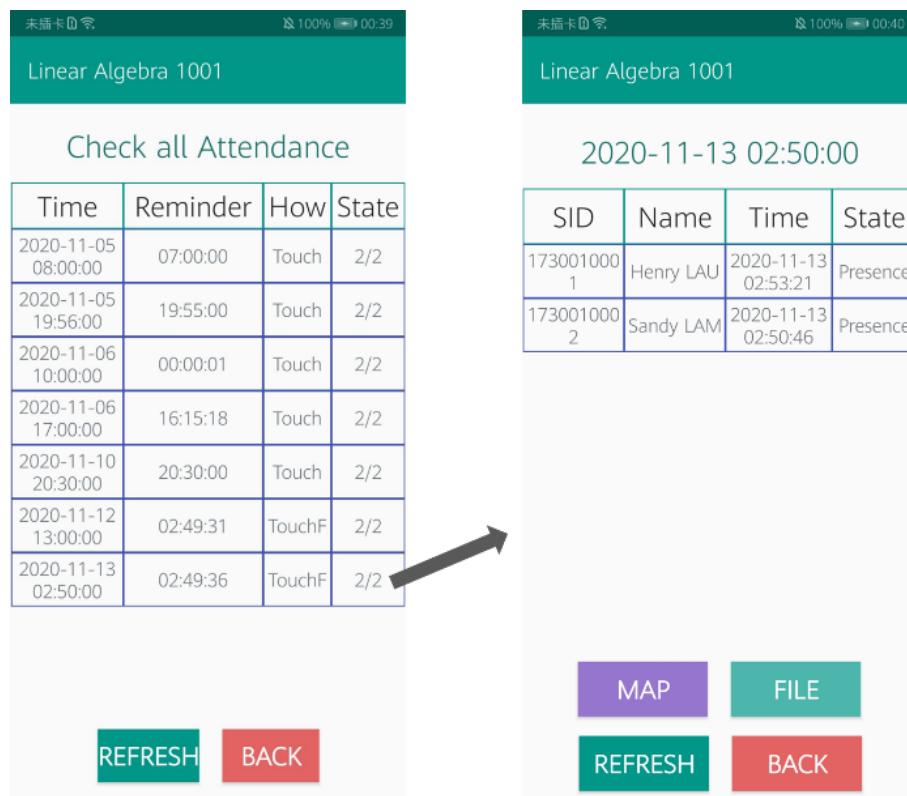

Figure 27. attendance list

He could also check where the student is when he is taking attendance. Pages of checking position and submitted image for an attendance is shown in Figure 28.

Blue point in map shows the current posistion for teacher, who is checking the attendance in a map now; the green point displays the location of Sandy LAM, who studies Linear Algrebra in class 1001 and take the attendance successfully in 2020-11-13 02:50:00, as the information shown above the green point. The toast which displays the attendance information for each marker, or point, will be displayed in 1 second when user clicks the marker; the red point shows another student who does

not finish his attendance but clicking "take attendance" button within 15 minutes of the setting time: he may be out of the legal distance (>30 meters) of teacher at that time period, or does not finish his summitting task in this attendance.

There is also a list to display the file students submitted for this attendance. Teacher should click on the line which display the name, submitted time and submitted file name for the student in this attendance to check the submitted file.
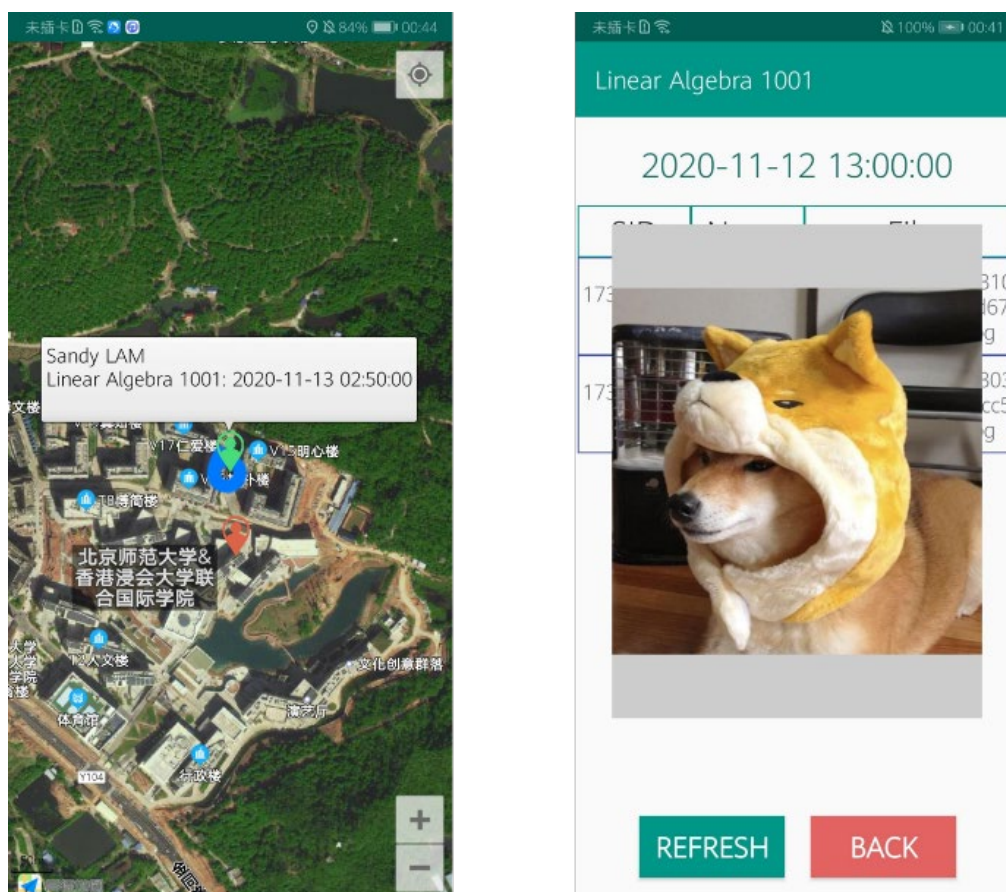

Figure 28. Position and submitted image in an attendance

Remind Student

Teacher can also remind all student in this course to take attendance that has not yet started to sign in by clicking Remind Student button in main page of the course.

Student List

Student list displays all attendance a student takes in this course. Teacher could check all this student's location when he is taking the attendance, which is displayed in Figure 29.
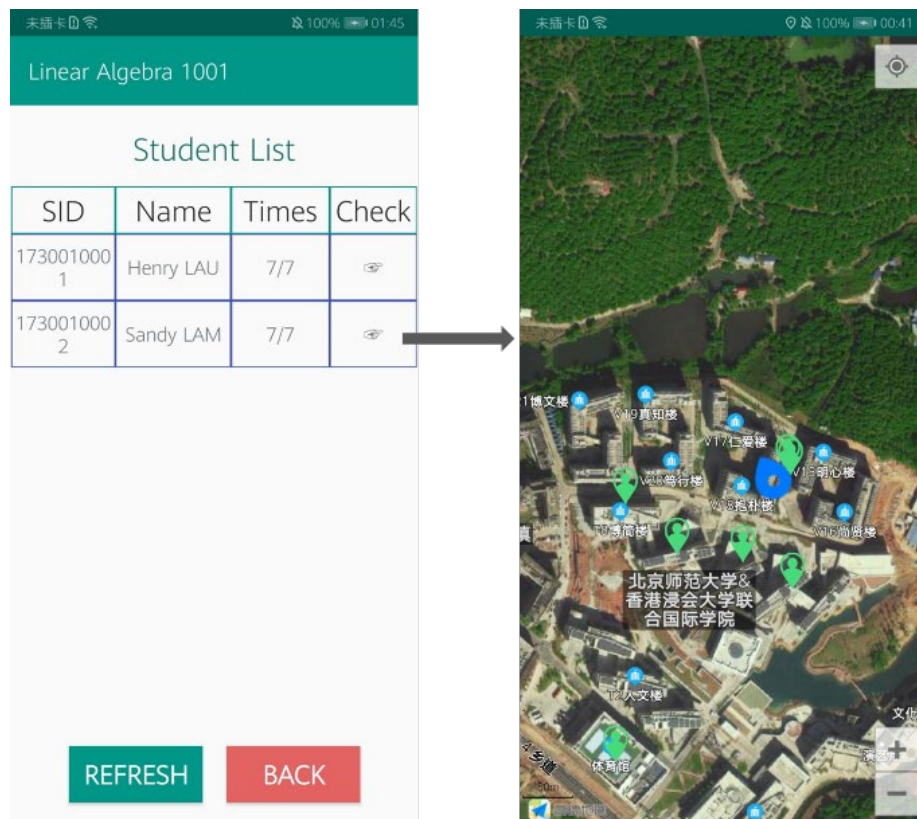
Figure 29. Student list and student's all location in attendances

4.2.5 Student Module

For a student, he could manage all attendance in a course he learns by clicking the course he wants to in his course list when login. The management page of a course for student is shown in Figure 30.
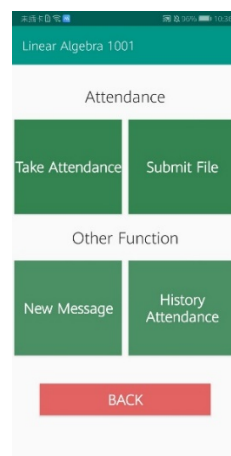

Figure 30. Management page of a course for student

One-Touch button to Take Attendance

For student, when the teacher sets a sign-in, he must press the Take Attendance button within 15 minutes of the set attendance time.

Submitted Image

If the lecturer also requires to submit a file, he should also submit the required picture with 15 minutes of the set attendance time. The page for student submitting image is shown in Figure 31. When the student clicks Select button, he will select a picture in the album directly. He should check what image he will submit to teacher also by clicking right blue area. The picture will be uploaded and be stored in the database; teacher will check what image the student submitted by downloading the corresponding file.
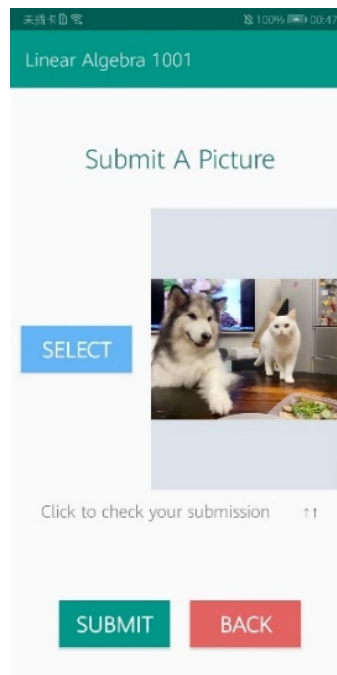

Figure 31. Submit image page

Check Message

Student can check the message list to know when and what he should do for the attendance, which display all message of attendances' requirement; the page is shown in Figure 32. Latest message will be displayed in top, and messages which are more than one day earlier will be grayed out.

Figure 32. Check all message

Check History Attendance

As it is shown in Figure 33, student can also check all information of his completed attendance in his attendance list. He can also check his location and submission for each attendance.

Figure 33. A student's completed attendance

5 CONCLUSION AND FUTURE WORKS

5.1 Conclusion

Our application aims to manage class attendance in mobile phone and avoid cheating on attendance. We do not sign students' name as evidence of presence, but use location and submission of documents as the basis for checking attendance. This alternative way is also an advantage of using a mobile phone to sign in; and we also give an intuitive feedback to teachers, to grasp the students' class status.

Our program provides a more intuitive way than paper check-in for course attendance, not just listing students' names and letting them sign on paper. Without consuming a piece of paper, this application allows teachers and students to set up, view or complete the sign-in just with an Android phone. It is also available to give teachers partial administrator right flexibly by administrator.

When signing in, students need to be limited to the sign-in time, provide their own location, and even submit documents. This requires students to be around the teacher when they sign in, and it is also a good way to avoid the situation where students are not present at the time of sign in and cheat on taking attendance by their friends.

Since we use cloud database, what each user sees is the latest data that is automatically updated in the interface. Regardless of the check-in time, location or submitted files, all attendance data can be viewed intuitively in this application, and there is no need to check many attendance records.

We have a strict time limitation on the attendance here: student need to sign in within 15 minutes of the set attendance time, otherwise the sign in is invalid. This method not only ensures that the sign-in is effective, but also saves a lot of time for sign-in: the original way of attendance is that a piece of attendance paper is continuously passed in the classroom, which is also a waste of time.

5.2 Future Work

Future work for this project will focus on real-time location tracking, file submission – not only selecting pictures in album, but also take a picture or video, even handwriting directly

in application and store the files to the server. Besides, verify identity may be a part we study and develop in the application: we may use QR-code or face recognition technology, such as using Baidu Cloud's face recognition API interface, in our application to identify each student's identity. It is also necessary to have a better UI design, such as a dynamic and stylish design, for the application.

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