2020 the third International Conference on Vocational Education and Electrical Engineering (ICVEE)

Design and Development of Attendance System Application Using Android-Based Flutter

Giri Wahyu Wiriasto
Department of *Electrical Engineering*
University of Mataram
Mataram, Indonesia
giriwahyuwiriasto@gmail.com

Ramadan Wibi Surya Aji
Department of *Electrical Engineering*
University of Mataram
Mataram, Indonesia
rwibisa@gmail.com

Djul Fikry Budiman
Department of *Electrical Engineering*
University of Mataram
Mataram, Indonesia
jodinheva@gmail.com

Abstract—Student attendance application prototype using Android-based flutter: a case study in the electrical engineering department, University of Mataram. It is an application whose purpose is used in student attendance system activities by preventing cheating. This application is equipped with a validation feature using a QR code and geolocation to overcome student cheating during attendance activities. This application development using a flutter software development kit. This application development is used by two users that are students and lecturers, students use the application for attendance facilities, lecturers use the application to set open or close sessions, and check attendance. Tests carried out on the application are installation, application usage, QR code scanning methods, geolocation features, and Mean Opinion Score (MOS). As a result of the development of this application, it can be used to simulate attendance activities in a class attended by 10 students and it takes 5 minutes 58 seconds. This application also gets a mean opinion score measurement of 81.08

Keyword—attendance, Android Application, QR code, geolocation

I. PRELIMINARY

Based on standard documents concerning higher education, Students are students at the Higher Education level. Where students conduct the process of interaction with lecturers and learning resources through lecture activities. In the lecture activities, there is an attendance or attendance list which is one proof that students have participated in lecturing activities. At the Electrical Engineering Department, the University of Mataram, the student attendance system is used to monitor student attendance in class and as a condition for students to take a class or can be used in middle final examinations.

The attendance system that runs now uses a manual attendance system by recording student attendance in books. In the process of implementing student attendance, the lecturer will take attendance books in the department room and then bring them into the classroom. The attendance book will be given to students to take turns in attendance in turn until all students have made attendance. The attendance book is returned to the lecturer for verification or checking and brought back to the department room. The manual attendance system by recording student attendance in books has several drawbacks, such as time efficiency, where attendance depends on the number of students in the class. In addition to these weaknesses, students take advantage of loopholes to commit fraud, for example, students leaving absences to their friends and other examples such as filling out absences for last week's lecture meeting.

Nowadays, smartphones have become one of the supporting tools in the learning process owned by students. These functions can be run through applications that are installed on a smartphone. Learning applications support many types, such as reading books, scientific calculators, word processors, number processors, and others. There is a technology that is increasingly being used today as a feature available in applications, both learning applications, and general applications. These technologies such as QR codes, geolocation, and others. QR codes are widely used to support application performance such as verifying accounts, access to open features, payments, file transfers, directing users to a web address, getting information, and so on. Geolocation is widely used by applications to provide information services about locations, such as the location of a place, mapping, user location, and many other applications.

The application on a smartphone will depend on the operating system used by the smartphone. Today the operating system applications that are often made by application developers are Android and IOS. This is because users of both operating systems are ranked 1 and 2 for the smartphone operating system market. Another thing that makes many application developers make applications for both operating systems is that there are many choices of tools to develop applications and additional support from the toolmakers is still running. Some tools that can be used to develop Android and IOS applications are Android Studio, XCode, Visual Studio Code, Eclipse, Flutter, Ionic, Xamarin, and others.

Therefore, in this study, researchers use Flutter SDK to create an Android application. Some of the advantages of building applications with flutter are reducing code development time and application performance is closer to native ones. An application will be made so that students can attend attendance using smartphones and implement student

978-1-7281-7434-1/20/$31.00©2020 IEEE

attendance validation by utilizing the Geolocation feature and QR code as a parameter for determining student attendance during absences. The problem are manual attendance books by recording student presence has shortcoming that can be used by students to commit fraud, and can be more difficult to create data summary.

II. LITERATURE REVIEW

The attendance system is a system used to record the attendance list of each agency member. The attendance system records the identity of members and the presence or absence of members. The attendance system also has the final results of the report on the presence of agency members [8]. The application of attendance system today has many types, manual attendance which is a way of writing attendance by using signatures. Attendance using a computerized system such as attendance using RFID, attendance using fingerprints, attendance using face recognition, and others.

Flutter is an SDK (Software Development Kit) that is equipped with frameworks, 2D rendering engines, widgets, and tools from Google to build modern, native, and reactive applications for Android and iOS (Flutter, No Year). Along with its development, in addition to being able to build mobile applications (Android and iOS), Flutter can also be used to build desktop applications, embedded devices (Raspberry Pi, etc.), and the web. Application development using Flutter is written in the Dart programming language. Flutter is an open-source project hosted on GitHub with contributions from Google and the community [6].

QR code or in English QR code is a type of matrix code or two-dimensional barcode that was developed by Denso Wave, a Japanese company called Denso Corporation and released in 1994. QR stands for Quick Response or quick response, which describes the concept of development for codes with a focus on high-speed readings [7].

Geolocation is the identification or estimation of the real-world geographic location of an object, such as a radar source, cell phone, or computer connected to the internet. In today's smartphones, GPS modules are always pinned. When the GPS is activated, the user can provide information to other users about where he is, or search for places is an example of the use of geolocation. Most smartphone devices make it possible to determine location using geolocation. The geolocation process on smartphones can be done through the GPS module (Global Positioning System), cell tower triangulation, and through a wifi network [10]. Some geolocation systems use all three (GPS, cell tower triangulation, and wifi) combined, this arrangement is called Assisted GPS (A-GPS). While in the open, the geolocation application on mobile can ensure the position of the cell phone is quite accurate. But if you are in the room the accuracy will be quite reduced.

According to [4] API (Application Programming Interface) is a set of program instructions and protocols used to build software applications. The API acts as the messenger who receives the user's request and tells the system what to do, then provides the appropriate response to the request.

REST (Representational State Transfer) is a web-based communication architecture standard that is often applied in the development of web-based services. Generally, use HTTP (Hyper-Text Transfer Protocol) is a protocol for data communication. REST was first introduced by Roy Fielding in 2000. On the REST architecture, REST servers provide resources (resources/data), and REST clients access and display these resources for future use. Each resource is identified by URIs (Universal Resource Identifiers) or global IDs. These resources are represented in text format, JSON, or XML [5].

Incremental development is one model of software development. This development is based on the idea of developing an earlier implementation, then exposes the results to the user and develops again through several versions until the desired system has been developed. Activity Specifications, development, and validation have relationships that are inserted rather than separated, with fast feedback throughout all activities [9]. Incremental development reflects the way developers solve problems. The method used is to move to find solutions in a series of steps, back when there is an error. With development being done in stages, it's easier to make changes in software as it is developed.

Mean Opinion Score (MOS) is a test carried out by filling out a questionnaire form containing several questions related to the application made and looking for the average value of each question point, then the results obtained in the form of a percentage of application benefits was made. The qualitative assessment criteria used are excellent. Good, fair, poor, and bad.

All of these qualitative assessments can be determined by the amount of data range multiplied by each sample then divided by the number of observations N. Furthermore, the results of the calculation will be entered into a table that will be the source in analyzing the Mean Opinion Score (MOS).

III. SOLUTION

In developing this application, researchers used incremental model software development. In the incremental model, development through several versions until the appropriate application is developed.

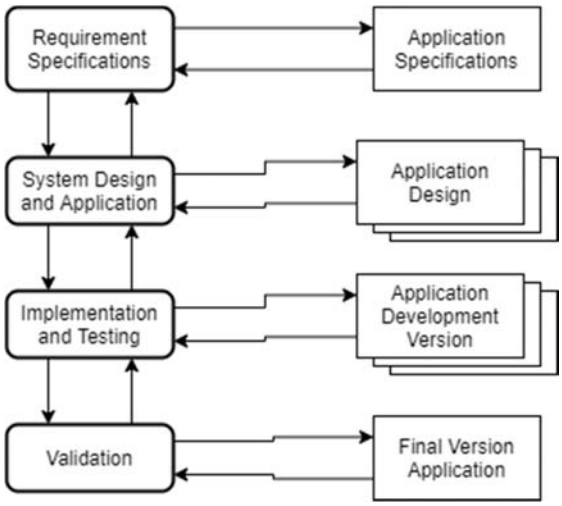

Figure 1. Stages of application development using an incremental model.

From the diagram in Figure 1, it can be seen that there are 4 stages of activities made in developing this research application. Stages starting from the specification activity needs to collect information related to the application made, this stage produces application specification documentation. Then do the system and application design based on application specifications. Continues with the implementation of the design or coding program and directly tested the program. For the design stage and implementation and testing stages, several versions will be developed before the validation stage. The validation stage will determine whether the application developed has become the final version or not. Please note that each stage can be related because it is not a separate process.

A. Requirement Specifications

Requirement specifications are intended so that developers can understand and determine what services are needed from the system or application. This stage is an activity that needs more attention in doing so because the results of this stage become the basis of application development.

In this stage to get the requirements of the desired needs, researchers conducted interviews with employees at JTE FT UNRAM. The result is the researcher can determine the requirements specification which consists of user needs and system needs.

User requirements are abstract statements of system requirements for users and what processes the application system will carry out. This research application is expected to do:

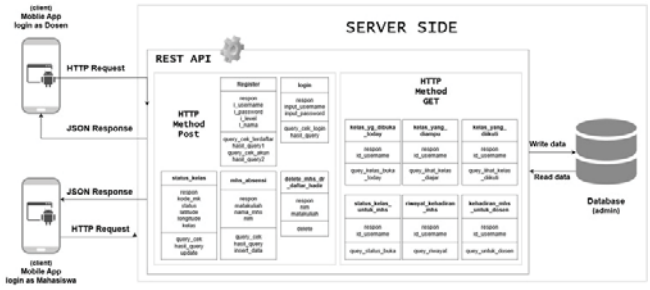

Figure 2. System architecture design.

- The Android application has 2 levels of users with different levels of access rights to the application according to the level of the user.
- The application can handle the attendance process and validate attendance based on the QR code and location of the student user level.
- The application can handle the process of opening and closing attendance sessions at a class from the lecturer user level.
- The application can display attendance history at the level of student users.
- The application can give the lecturer user level the right to check student attendance data.
- Users with admin level can enter class data and can manipulate attendance data.

System requirements are requirements that focus on the behavioral properties owned by the system which are often referred to as service or function constraints offered by the system. The following system requirements of the research application:

- The application runs on a smartphone with an Android operating system.
- The application requests permission to be able to access the camera and GPS on the user's smartphone.
- The application completes the user account with a password.
- The application has a user-friendly interface or display.

B. System and application design

Student attendance application is an android-based smartphone application whose main use as an attendance tool for students in lectures in the Department of Electrical Engineering, University of Mataram. Following the overall architecture of the application system to be built can be seen in Figure 2.

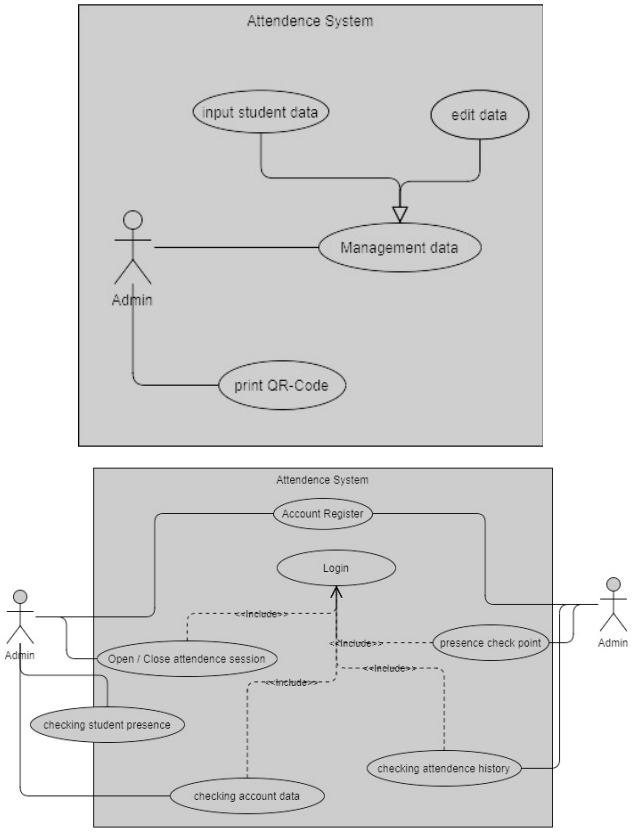

Figure 3. Use case diagram design for student attendance applications.

Figure 2 is a picture of the overall system architecture of the attendance application made. The following explains the process that runs on the system design:

- Users are clients, the whole system is divided into 2 types of users, namely lecturers and students. The two types of users have different access rights in using the application.
- Users as lecturers and students are users who use attendance applications on Android-based smartphones.
- admin is a manager of attendance data.
- The client makes an HTTP request for data to the API or web service using the Post and Get methods.
- API or web service will accept and will provide response data in the form of JSON format under the requested HTTP request method.
- Data received by the API by the Post method will be written to the database. For data requests using the Get method, the API will read from the database.

TABLE I. RESULTS OF APPLICATION INSTALLATION.

BRAND	TOTAL	INSTALLATION	INFORMATION
Asus	5	Was successful	Can be used
Nokia	1	Was successful	Can be used
Oppo	1	Was successful	Can be used
Samsung	3	Was successful	Can be used
Sony	2	Was successful	Can be used
Xiaomi	8	Was successful	Can be used
Reality	1	Was successful	Can be used
HTC	1	Was successful	Can be used

Designing behavior models is useful so that researchers get documentation of the interaction processes that occur between users and applications that are built based on the specifications of a predetermined requirement. The used case diagram of the application to be built can be seen in Figure 3.

Then there are 3 more modeling activities carried out in this study, namely modeling the application structure (class diagram), modeling the database (ER diagram), and modeling the application interface.

C. *Application testing procedure*

Applications that have already been created and can run cannot be directly used or disseminated. That is because the application must go through the testing phase first. Researchers conduct application tests to determine the performance of applications when used in student attendance activities. Testing procedures performed are application installation, application usage, method of scanning QR codes, geolocation features, and MOS (Mean Opinion Score).

IV. TESTING

A. *Application installation testing*

In this test, researchers see whether the application made can be paired and can be successfully run when the application is opened. Applications installed on Android smartphones with various brands. The results of installing the application can be seen in Table I.

From the table I is known that the student attendance application that is made can be installed and run on 8 variations of brand testing android smartphones. At first, some smartphones could not be paired with a warning message the application was not compatible with this version. But the problem was solved when researchers found out why it could happen like that. The problem is that the android application that researchers created only issued an apk with one type of ABI (Application Binary Interface) version. In 2020 there are

4 versions of ABI that are used by various smartphone brands. After releasing the apk with the version under the ABI brand of smartphones, the application was successfully installed and running.

B. Application usage testing

So that researchers know whether the application can be used in its actual conditions, testing the use of the application by conducting a simulation of attendance activities in class. The simulation was carried out on Wednesday, 12 February 2020 at the UNTE JTE Computer and Network lab. The number of participants as many as 15 people who played the role of being students and 1 person becoming lecturers.

In this simulation of attendance activities, students and lecturers have installed the student attendance application into their respective smartphones. Students use the application as student users. The lecturer uses the application as a lecturer user and has brought a QR code that is suitable for the class being taught. In this simulation, the conditioned QR code that will be scanned by students is on the lecturer laptop, so students must come to the laptop to scan.

After recording and observing the running process of simulation activities, researchers can find out several things, namely:

- The application can be used in the simulation of attendance activities carried out, this is taken based on the results of the activities observed at the time of the simulation. These activities can be seen in table 4.3.
- The simulation takes 5 minutes 58 seconds, the time is calculated starting from the time the first attendance data entered until the last data.
- Even though it is said that the application can be used in the attendance simulation, there are still features that are running poorly. These features include:
  - The speed of the application process in loading data (receiving or sending) depends on the internet connection of the user's smartphone.
  - There was an error in location detection. There were student users who were absent when experiencing absenteeism in location detection so that the distance between students and lecturers was obtained outside the classroom area the student was in the classroom. But after repeating the steps to detect its location the student is detected by the application being in the classroom area and can attend.
- The presence of features that are running poorly affects application performance. Application performance is also one of the effects of time spent on attendance activities.

TABLE II. TEST RESULTS FOR SCANNING THE QR CODE BY PRINTING THE QR CODE.

NO	PARTICIPANTS	TIME (seconds)
1	Student 1	11.71
2	Student 2	9.84
3	Student 3	10.58
4	Student 4	10,10
5	Student 5	8.71
6	Student 6	9.01
7	Student 7	11.50
8	Student 8	8.25
9	Student 9	6.66
10	Student 10	9.08
TOTAL TIME		95.44 seconds

TABLE III. TEST RESULTS SCAN THE QR CODE BY DISPLAYING THE QR CODE ON THE PROJECTOR.

A PARTICIPANT UMLAH	TIME
10 students	62.2 seconds

C. Testing the QR code scanning method

In testing the QR code scanning method, researchers have determined two ways to scan QR codes to be carried out by students using the application. Both methods are used in the attendance simulation conducted on Monday, March 2, 2020, at the UNTE JTE Computer and Network lab. Many samples of student participation in this simulation are 10 people and 1 lecturer. The second way to scan the QR code used is the scanning of the QR code by the lecturer providing the printed QR code to the student and then proceeding until all students have succeeded in doing attendance and scanning the QR code by the lecturer displaying the QR code on the class projector then the student scanning until successfully doing absenteeism. The following can be seen as the results in Table III.

It can be seen in table 2 and table 3 that the two ways to scan the QR code performed in the simulation produce a different time. The time required by scanning by printing a QR code is 95.44 seconds in this simulation. The way to scan by displaying the Qr code with the projector takes 62.2 seconds with a maximum scanning distance of approximately 5 meters from the projector in this simulation. With these results how to scan with a projector faster time needed to be used in attendance activities by using student attendance applications in this study based on simulation results.

D. Geolocation feature testing

In testing application usage, researchers compare the original distance and the distance obtained by the application. Measurements were made in two places named in the room (JTE UNRAM Network and Computer lab) and outside the room. To measure the distance from the student attendance application, researchers used two smartphones.

The results are known that the distance measurements carried out by the application inside the room are different from outside the room. It is also known that the use of different

smartphones will result in different distance measurements. So based on these results, the performance of geolocation features on student attendance applications can be influenced by location factors outside or inside the room and smartphones.

E. MOS Testing (Mean Opinion Score)

Mean Opinion Score (MOS) is a test carried out by filling out a questionnaire form containing several questions related to the application made and looking for the average value of each question point, then the results obtained in the form of a percentage of application benefits was made. To get opinions from users who have used the application that researchers made, researchers distributed questionnaires using Google forms as a medium for spreading and filling in.

Data from the questionnaire is obtained, the next step is to do the MOS calculation of each point tested. After getting the MOS from each of the points tests. The next step is to look for total results from MOS testing.

MOS test results conducted on student attendance applications are made. As for getting a percentage value of the points tested can be done with the formula, so the value of the percentage of application benefits gained 81.08%.

IV. CONCLUSION

Based on the results that have been obtained, it can be concluded several conclusion points. Based on the student attendance application workflow that is made, the application meets the requirements specification, so it can be said that the application is running under the specified service. Student attendance applications that are made can be paired on eight Android smartphone brands and can run. In the attendance simulation using the application, the time required is 5 minutes 58 seconds with 10 students. This is caused by the method of scanning QR codes on lecturer laptops which takes a lot of time and the geolocation feature has poor performance. The method of scanning a QR code on-time attendance activities influences the time required. The method of displaying the QR code with the projector is faster than the other methods used in this study. The performance of geolocation features on student attendance applications can be influenced by location factors (outside or inside the room) and smartphones. Testing MOS (Mean Opinion Score) for student attendance applications that are made get a percentage of application benefits of 81.08%.

V. SUGGESTION

Applications that are made still have some shortcomings, therefore several things can be developed so that the application runs better in its use, Things that need to be developed are as follows: For further development, applications can be given features to handle conditional student days (sick, permission, without information). For further development, it can be given additional information about the lecture schedule to fill the Home page on both application's user accounts. Developing the validation feature provided in this research application so that the feature can perform better in detecting student attendance in lecture attendance activities. Develop the user interface or appearance of the application with the aim of informative, user-friendly, and easy to use.

REFERENCES

[1] Akbar M.R. dan Prabowo N., A*plikasi Absensi Menggunakan Metode Lock GPS Dengan Android di PT.PLN (Persero) APP Malang Basecamp Mojokerto*, Majapahit Techno, 5(2), 55-63, 2015.

[2] Cooksey B., An Introduction to APIs, Zapier, 2014.

[3] Dharwiyanti dan Wahono, *Pengantar Unified Modeling Language (UML)*, IlmuKomputer.com, 2003.

[4] Muhano G., *Pengertian API (Application Programming Interface)*, available in developer.erabelajar.com/api-application-programming-interface/, accessed date 10 November 2019.

[5] Feridi, *Mengenal RESTful Web Services*, available at www.codepolitan.com/mengenal-restful-web-services, accessed date 10 November 2019

[6] Napoli L.M., Beginning Flutter: A Hands On Guide to App Develompent, Wiley, Amerika Serikat, 2019.

[7] Qrcode, History of QR Code, available at www.qrcode.com/en/history/, accessed date 31 October 2019.

[8] Rubianti N. dan Harahap W.S., *Aplikasi Absensi Siswa Menggunakan QR Code Dengan Bahasa Pemrograman PHP di SMKIT Zunurain Aqila Zahra di Pelintung*, Jurnal Infomatika, Manajemen dan Komputer, 11(1), 62-70, 2019.

[9] Sommerville I., Software Engineering, 9th Ed, Pearson Education, Massachusetts, 2009.

[10] Vogella, Android Location API with the fused location provider – Tutorial, available at www.vogella.com/tutorials/AndroidLocationAPI/article.html, accessed date 3 November 2019.

[11] Shah Kewal, harsh sinha, payal mishra, "Analysis of cross-platform mobile app development tools", IEEE 5th International Conference for Convergence in Technology (I2CT), 2019.

[12] Sitti UM, Andrew.F, Imelda.R.J, "NFC Based Mobile Attendance System with Facial Authorization on Raspberry Pi and Cloud Server", 6th International Conference on Cyber and IT Service Management (CITSM), 2018.