

Student Mobile Attendance Application Using QRCode and Integrated with SSO at Universitas Sebelas Maret

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Abstract Mobile attendance is used to record student attendance in a lecture class. This mobile app uses QR Code to identify students' ID. This app facilitates lecturers in recording the attendance of lecturers and students. The accuracy and speed of data can be used as one of the parameters for lecturers' performance according to the efforts that have been done. Lectures at UNS are not only in the classroom, but they also go to the field, to rice fields and even to swimming pools. Therefore it requires a tool that can accommodate the recording of student attendance in all places quickly. One of the proposed solutions is to provide mobile attendance. Mobile attendance application was developed with SDLC method by using Java as programming language, while the authentication uses JWT which integrated with Single Sign-On in UNS. The proposed mobile attendance system can record the QR Code attendance, recapitulate the number of students present and absent and recapitulate the number of lecturers present in the class. The application was tested for its usability using SUS and obtained SUS score of 82.183 with grade A.

Keywords : *mobile attendance, android, single sign-on, mobile, QR Code, JWT*

INTRODUCTION

In daily learning and lecture systems, student attendance is an important factor that determines student activity or attention in the course. Students in universities have more responsibilities and are required to doing by their self. The student has more freedom to attending the class. Most of them, ignoring the attendance. Some universities have minimum rules for student attendance to be able to take the final semester exam or to get the final grade the course. The attendance system of students who are still in use today uses a signature system on paper attendance and runs in students while learning takes place.

The attendance system that is usually used requires a long amount of time because one by one the students must provide a signature every day and each course is followed, not infrequently the system can break the concentration of students when learning takes place especially when taking the exam. The paper used to record attendance can be lost so that all attendance records cannot be tracked.

UNS is one of the academic institutions in Indonesia that has a pattern of financial management in the form of BLU. UNS is currently allowed to provide remuneration to its employees. In remuneration, attendance is one of the determinants of the performance of a lecturer. So the attendance is very important thing in the process learning and performance measurement.

METHODOLOGY

The proposed system has been developed using QRCode as input parameter, this software developed with Software Development Life Cycle (SDLC) method. For the user satisfaction, the proposed system has evaluated with SUS.

TABLE I. WORKFLOW ACTIVITIES

Phase	Activities	Output
Phase of collection requirement from unit	Requirement of user collection	Attendance System with QRCode
Phase of system analysis	The team analysis to identify requirement	List of requirement
Phase system design	Design the interface, class diagram and database design	Unified Modelling language
Phase of implementation	Create and build the database	Attendance application
Phase of evaluation with SUS	Spread the questionnaire with Google form	Report on testing

A. QR Code

Quick Response Code that we know as QR Code as well is a type of two-dimensional symbol also known as 2-D barcode. QR Code can be used to store information and attached to an object. QR Code can identify the object and provided the related information. The QR Code was first made in 1994 by a Toyota subsidiary, then developed until 2000 it was standardized as ISO/IEC 18004[1].

QR Code consist two pattern that is black and white on geometric plane surface in the two dimensions[2]. Black pattern to represent binary number 1 and the white one represent binary number 0. While read the white and black, QR Code has a function or error correcting. There are four level error correction has been defined that is L, M, Q and H. Lowest level that is L with maximum 7% error corrected, M level with maximum 15% error corrected, Q level with maximum 25% error corrected and H level with maximum 30% error corrected [2].

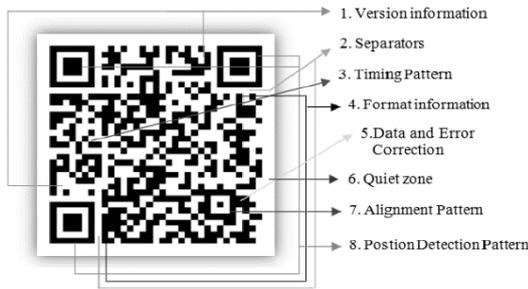


Figure 1. Structure of QRCode

B. JWT

JSON Web Token (JWT) is an open standard (RFC 7519) which is used to transmit information securely between nodes using JSON object [3]. JWT has three components: header, payload and signature that forms a full body in Figure 2, all in their BASE64 encoded form.

```
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFtZSI6IkpvaG4gRG91IiwiaXNTb2NpYWwiOiOnRydWV9.4pcPyMD09o1PSyXnrXCjTwXyr4BsezdI1AVTmud2fU4
```

Figure 2. Structure of JWT

The header explained the hashing algorithm being used such as HMAC, SHA256 or RSA, where a decoded body looks as in Fig 3. This allows an application to decode the header and using the correct signature hashing algorithm to decode the payload. The alg parameter describes the algorithm in short and the typ parameter describes type in short form.

```
{
  "alg": "HS256",
  "typ": "JWT"
}
```

Fia Decoded JWT Header

The payload explained the data content called claim. It contains BASE64 encode. Claims are statements about an entity (typically, the user) and additional metadata. There are three types of claims: reserved, public, and private claims [3]. Public claim can be defined at will by those using JWTs. But to avoid collisions they should be defined in the IANA JSON Web Token Registry or be defined as a URI that contains a collision resistant namespace. An example of payload structure is shown in Figure 4.

```
{
  "sub": "1234567890",
  "name": "John Doe",
  "admin": true
}
```

Figure 3. a Decoded JWT Payload

The signature is lastest component in JWT. This functions as an integrity check for the header and payload should one temper the data within.

JWT has an objective to simplify user/object authentication. JWT can be used to provide Single Sign-On authentication. User just knows one user to access much application.

C. System Usability Scale

System Usability Scale (SUS) method was first introduced by John Brooke in 1986. There are 10 statements distinguished in odd numbers in the form of positive statements, while even numbers are negative statements with likert 5[4]. Item questionnaire with 5 response options shown in Table II.

TABLE II. SUS QUESTIONNAIRE

No	
1.	I think that I would like to use this system frequently.
2.	I found the system unnecessarily complex.
3.	I thought the system was easy to use.
4.	I think that I would need the support of a technical person to be able to use this system.
5.	I found the various functions in this system were well integrated.
6.	I thought there was too much inconsistency in this system.
7.	I would imagine that most people would learn to use this system very quickly.
8.	I found the system very cumbersome to use.
9.	I felt very confident using the system.
10.	I needed to learn a lot of things before I could get going with this system.

SUS Score calculate with equation

$$SUS_{score} = \sum (odd_{score} - 1) + (5 - even_{score}) * 2.5 \tag{1}$$

SUS uses method proposed by [4] and [5] which support a decision usability value and quality of usability which is shown in Table III.

RESULT AND ANALYSIS

D. Software Requirement Specification

First step to develop this application begins with construct software requirement specification. There is eight requirement specification. This specification has to solve and realize the system.

TABLE III. SOFTWARE REQUIREMENT SPESIFICATION

No	Software Requirement Specification
1.	Login authentication with SSO
2.	List of course
3.	List of attendance
4.	List of student
5.	Student with QR Scanner
6.	Attendance verification
7.	Student validation
8.	Print QR Code

E. System Design

Use case system is shown in There are two actors involved in this system teacher and student. Teacher can access system with SSO account, and student can validation the entry of student attendance.

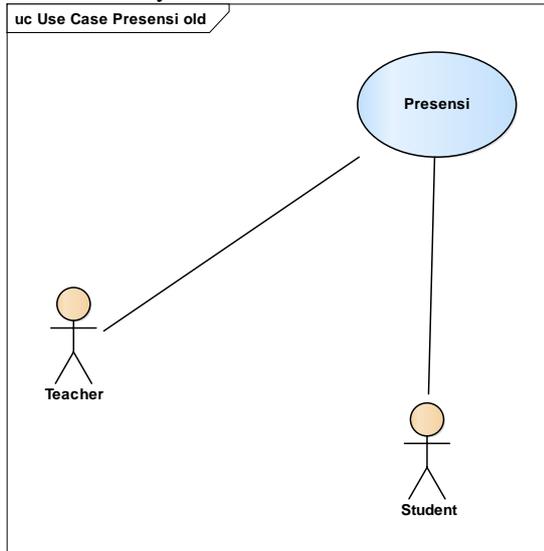


Figure 4. Use Case Attendance

Detail activity is shown in Fig 5. Activity started with login then followed show list of source, list of course topic, list of student, add student attendance, checking student attendance, student validation, authentication with SSO and saving to database. If the authentication of SSO failed will be showed fail message. List of course shows all of course every teacher. List of attendance shows sequential attendance from first until last attendance.

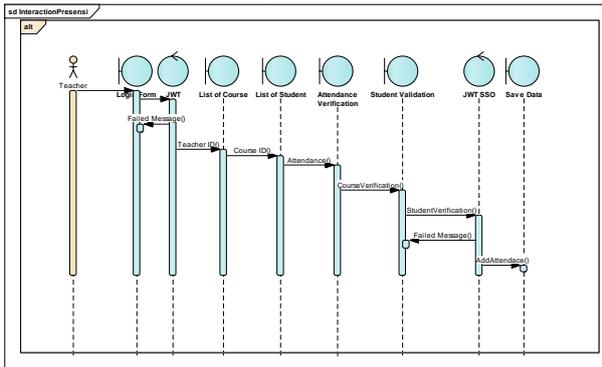


Figure 5. Activity Diagram Attendance System

F. Database Design

Database in this application is designed with MySQL database engine. Database table relationship is showed in Figure 7.

G. Software Implementation

Implementation of this software is used Java as programming language. The proposed system already is done with specification in Table II. Login application is captured as Fig 8. Teacher login with SSO account

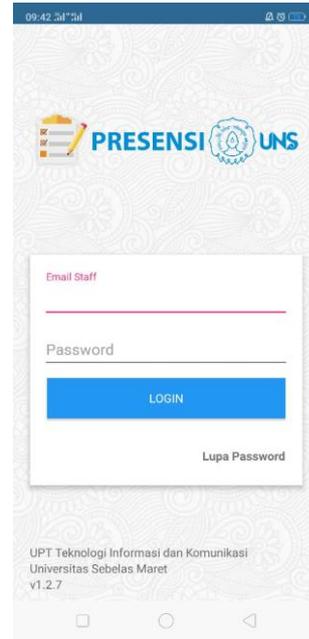


Figure 6. Login Attendance with SSO

After login success, teacher will get a preview list of course as is shown in Fig 8.



Figure 7. List of Course

Every course has a topic for every teacher attendance. Teacher can add topic in every attendance. Topic can be shown in Figure 9.



Figure 8. List of Topic in every Attendance

Teacher can add student who attends the course.
Teacher scan QRCode which is shown in attendance list.
QR code scan process is showed in Figure 10.

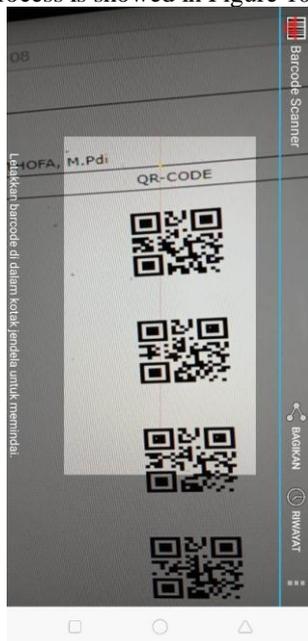


Figure 9. Scan QRCode

H. System Evaluation

The evaluation of this proposed system uses SUS method. This method use 10 questionnaire such as Table II. Result for evaluation 63 respondents is collected and get SUS Score 5177.5. Usability score can calculated with equation

$$Usability = \frac{\sum SUS_{Score}}{\sum Count_{Repondent}}$$

$$Usability = \frac{5177.5}{63} = 82.183$$

Usability score 82.183, it mean has percentile range between 90 – 95 with grade A. It shown the application is very good in usability.

ACKNOWLEDGEMENT

This research is sponsored by Universitas Sebelas Maret under project Hibah Penelitian Sosial Humaniora Dan Pendidikan 2018.

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