

## Development of Student E-Attendance System using QR-Code and WhatsApp Gateway with The Iterative Model Based on Android

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**Abstract**—The rapid advancement of technology not only creates new industries but also reshapes global competition. In higher education, learning implementation must meet standards for content, process, and assessment. Student attendance plays a significant role within these standards. Using Android smartphones for attendance tracking resolves issues related to student presence, saves time, and enhances the efficiency and accuracy of the attendance recapitulation process for lecturers. This study explores an innovative system that integrates QR-Code and WhatsApp Gateway using an iterative model on a single platform. Blackbox testing confirmed that all features and functions of the Android application work as intended. Furthermore, a Likert scale evaluation scored 89%, indicating that the e-attendance system effectively facilitates student attendance and helps lecturers summarize attendance data more accurately and efficiently. The system then provides this data as administrative monitoring reports for the academic department regarding the conducted lectures.

**Keywords**— *Android, e-Presensi, Monitoring, QR-Code, WhatsApp Gateway.*

### I. Introduction

The increasingly advanced and faster development of technology not only creates new industries and changes global competition, but also changes the structure of people's lives in terms of socioeconomics. Technology is essential for governments, businesses, and strategic planning of research [1]. In higher education, the basis for the implementation of learning must comply with the standards for learning content, learning process standards and learning assessment standards as set out in the Regulation of the Minister of Education and Culture No. 3 of 2020 on National Standards for Higher Education [2].

Learning, which is defined as the process of student interaction with lecturers and learning resources in a learning environment. In the process, the presence of students has an important role in supporting the continuity of the teaching and learning process. The presence of every student and lecturer in the learning process has an important role, where attendance is one of the supports

that can be used by lecturers as one of the factors in considering and determining grades for students [3].

The presence of students in the learning process is documented and recorded in the attendance book. Attendance is an activity that aims to find out the level of achievement of attendance and discipline in an institution or company. It is important for lecturers to know the presence of their students [4]. The use of technology for attendance is one of the important things [5]. The use of communication technology that is now proliferating is smartphones with one of the operating systems used is the Android operating system. Android provides a platform for users to create apps [6]. The Android operating system makes applications in the form of software or applications[7].

WhatsApp Gateway is a platform that is connected through an Application Programming Interface that functions as a communication tool [8]. AppSheet is a platform for building mobile and web apps. AppSheet apps can be created from data sources such as Google Sheets, Excel, Cloud SQL, Salesforce, and other similar connectors. App user activity is synchronized with the connected data source. The dynamic app can be used via a mobile device or browser [9]. The development of communication technology via the internet with the development of many applications on smartphones that serve communication via the internet, one of which is WhatsApp which makes it easier for users to send text messages as well as video and audio in real time using the internet data packages [10].

The Software Development Life Cycle (SDLC) is a structured process used for the creation and development of systems, typically computer systems or information systems. This methodology includes several phases,

which are planning, analysis, design, implementation, and testing [11]. SDLC includes several models for implementing the process phases, such as the Sequential Model or Waterfall, Parallel Model, Iterative Model, Prototyping Model, Rapid Application Development (RAD) Model, Spiral Model, VShaped Model, and Agile Development [12].

The underutilization of technology for attendance taking [13] and the lack of a centralized platform for attendance management using various technologies [5]. are prevalent issues. Additionally, direct observations at the Information Systems study program of B.J. Habibie Institute of Technology revealed that student attendance is still recorded manually using signature sheets for each course. This manual attendance system is susceptible to manipulation, such as students forging signatures or signing in for absent classmates. Moreover, manual attendance recording is time-consuming and inefficient, leading to inaccurate attendance data and administrative inefficiencies for instructors.

In light of the persistent challenges associated with manual attendance recording methods in the contemporary educational landscape, the development of an innovative technological solution is demonstrably necessary. This system should strategically leverage advancements in technology, specifically QR codes and WhatsApp Gateway, integrated through the AppSheet platform. QR codes will function as unique student identifiers, enabling the electronic attendance system to efficiently scan and record the presence of each student attending lectures. WhatsApp Gateway will be employed to disseminate automated notifications to students, conveying their individual attendance records for each course. By implementing this system, the university can facilitate a more streamlined attendance process for students, enhance the accuracy and efficiency of data collection for instructors, and ultimately generate comprehensive attendance reports for the Academic Affairs department. These reports will contribute significantly to effective monitoring and administrative processes, ensuring proper documentation of completed course sessions.

## II. Research Methodology

The research methodology employed in this study adheres to the Systems Development Life Cycle (SDLC) the iterative model. This model comprises several distinct phases, including planning, system analysis, implementation, testing, and evaluation, is presented in Figure 1 [14].

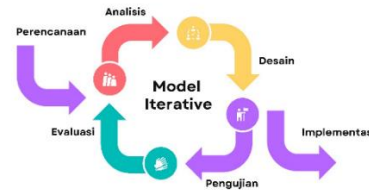


Figure 1. Systems Development Life Cycle (SDLC) with Iterative Model

### A. Planning

Sometimes, research methodology is demonstrated in form of diagrams or tables. Author(s) should ensure that those diagrams and tables are clearly readable if placed in one column, however, if the diagrams or tables require more spaces, the diagrams or tables can be placed in two columns, but it should still confirmed in balanced format.

In this planning, the data needed to design a student E-presence system was collected using QR-Code and an Android based on WhatsApp gateway.

### B. System Analysis

The proposed e-attendance system utilizes QR codes and WhatsApp Gateway to streamline the attendance process for both students and instructors. The system operates as follows:

#### Step 1 : QR-Code Registration

Each student is assigned a unique QR code linked to their student ID. This QR code is embedded on their student ID card.

#### Step 2 : Lecture Initiation

Upon commencing a lecture, the instructor logs into the e-attendance system and activates the QR code scanning feature.

#### Step 3 : Student Attendance

Students individually scan their QR codes using the e-attendance system's mobile application. The system verifies the student's identity and records their attendance.

Step 4 : Data Storage

The e-attendance system securely stores the attendance data for each lecture.

Step 5 : Attendance Notification

The system automatically sends personalized WhatsApp messages to each student, informing them of their attendance status for the respective lecture.

The flowchart depicting the Android-based student e-attendance system utilizing QR codes and WhatsApp Gateway is presented in Figure 2.

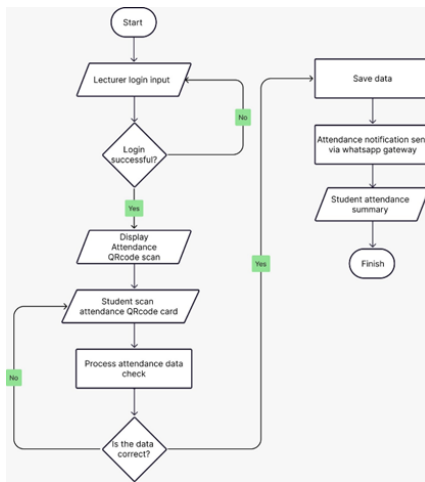


Figure 2. Flowchart of the Lecture Attendance Process

C. Implementation

This stage constitutes the practical application of the Android-based student e-attendance system utilizing QR codes and a WhatsApp gateway. The purpose of this stage is to verify the system's functionality and absence of malfunctions.

D. Testing

System testing is conducted using black-box testing and portability testing methods to verify that the system functions as intended and aligns with the design specifications.

E. Evaluation

System testing is conducted using black-box testing and portability testing methods to verify that the system functions as intended and aligns with the design specifications.

The system evaluation is conducted based on valid testing results and using a Likert scale with students who utilized the e-attendance system. Below is the assessment instrument along with the Likert scale table 1.

Tabel 1. Likert Scale Rating Table

Evidence	Grade
Strongly Agree (SA)	4
Agree (A)	3
Disagree (D)	3
Strongly Disagree	1

Presentation Formula for Likert Scale Values:

$$Y = \frac{(N.R)}{Ideal\ Score} \times 100\% \quad (1)$$

Where:

Y = Presentage Value

N = Response Value

R = Number of Respondents

Ideal Scor = Total Number of questions or assessments

### III. Results and Discussion

The development of research on attendance has been carried out by several researchers using different technologies, Zulkanain and Rahim conducted research by conducting an experiment using a survey to determine students' perceptions of the presence of a supervisor in blended learning [15]. Gisni produces an attendance system using AppSheet and Google Access technology which is expected to overcome problems in conducting attendance quickly, precisely and accurately, as well as in the application of Google access such as Google form which is used to input attendance data [16]. Patresia et al. conducted a study that produced a practical attendance application using QR Code so that it can optimize the attendance filling process in Educational Institutions [14]. Unlike previous studies, this research presents a groundbreaking advancement in technology systems. It leverages cutting-edge technologies like QR codes and WhatsApp Gateway through AppSheet. This innovative approach contributes significantly to the development of

information and communication technology (ICT) systems. The key benefit of this approach is its practicality. It streamlines the attendance process for students, making it convenient and efficient. Additionally, it empowers lecturers to effortlessly gather accurate and effective attendance data. This data serves as a valuable administrative report for the Academic section, providing insights into completed lectures.

The research aims to develop an Information and Communication Technology (ICT) system utilizing QR-codes and WhatsApp Gateway through Appsheet to streamline student attendance management, assist lecturers in compiling accurate and efficient attendance data for administrative monitoring reports, and enhance the overall lecture monitoring process.

A. *E-Attendance system page*

1. Icon Page

The app icon page serves as the initial icon displayed before accessing the e-Attendance application, as illustrated in Figure 3.



Figure 3. The App Icon Page

2. Login Page

The login page serves as the initial interface that greets users upon launching the application. It presents distinct login options for both students and lecturers, each requiring the entry of a valid username and password.

3. Main Page

The Main Menu Page is the interface that appears after a user launches the application. It presents several

options, including user data, schedules, and summaries, as illustrated in Figure 5.

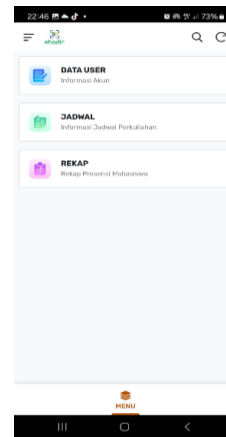


Figure 5. Main Page

4. Schedule Form Page

The main menu features a schedule form that initiates the attendance activity. This form displays course information (course name, meeting number, class, and lecturer's name). Additionally, this menu includes a QR-Code attendance button for the active course and meeting number as per the day's schedule.

5. QR-Code Scan Page

Upon pressing the QR-Code attendance button, the QR-Code scan page will appear.

Students mark their attendance by scanning the QR code on their student ID cards (each student's ID card has a unique QR code generated by the e-Presensi system). Figure 8 shows an example of a student ID card.



Figure 8. Sample Student ID Cards with Unique QR Codes

Upon successful attendance marking through QR-code scanning, the system automatically sends a WhatsApp message to each student, including their attendance data and a "present" notification for the ongoing lecture.

6. Summary Form Page

The main menu features a summary form that displays the attendance list of students who have marked their presence. The summary form includes

several filter inputs: course selection, class, semester, lecturer, and study program.

Upon entering data into the filter form, a "Print PDF" button will appear, allowing users to generate a PDF file containing the attendance list of students based on the applied filters, as illustrated in Figure 11.



Figure 11. Print pdf. Button

7. PDF. Document page

The PDF Attendance Summary Document provides a comprehensive overview of attendance records for a specific course. It encompasses all attendance sessions conducted within the course, along with a detailed breakdown of student attendance for each session. This document serves as a valuable tool for instructors to track attendance patterns and identify areas for potential intervention.

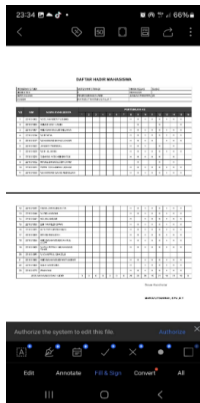


Figure 13. PDF. Attendance Summary Document

B. E-Attendance Web Interface Overview

1. Main Page Page

e-attendance main page is illustrated in figure 14.

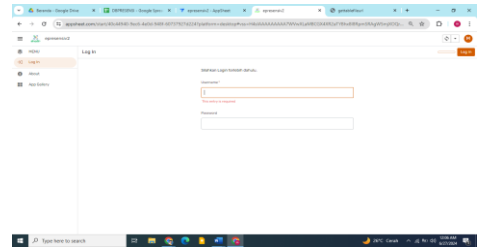


Figure 14. e-attendance main page

2. PDF. e-Attendance Summary Document PDF Attendance Summary Download Page, shown in Figure 16.

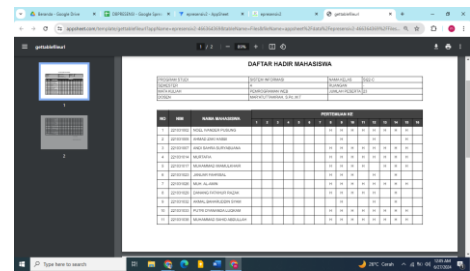


Figure 16. PDF e-Attendance Summary Document

C. E-Presensi System Testing

After the application is finished, testing will be conducted. The testing performed is black box testing. This testing aims to ensure that the features in the application work properly. This testing is done by comparing the test results with the expected results. The results of the black box testing are shown in Table 2.

Table 2. Results of Blackbox Testing

Test Description	Validation Criteria	Input	Test Outcome	Results
Login Form Functionality	Verification of Username and Password	Username and Password Credentials	Successful Login Achieved	Validated
		Login Credentials Invalid	Login Failure Observed	Validated
Lecture Schedule Feature Evaluation	Accessing Android Application and Selecting Lecture Schedule Menu	Lecturer Selects of Available Lecture for Student Attendance	Application Successfully Renders Lecturer's Schedule	Validated
Attendance Functionality Assessment	Access to Android Application	lecturer Selects the Lecture and Initiation of	Successful Completion of Attendance Process	Validated

Student Attendance				
Student ID QR Code Scanning Evaluation	Access to Android Application	Mahasiswa Student Scans QR Code on ID Card for Attendance	Successful Completion of QR Code Scanning Process	Validated
WhatsApp Gateway Feature Assessment	Access to Android Application and Initiation of Attendance	Student Attendance Data	Application Successfully Transmits Attendance Data Message to Student's WhatsApp Number	Validated
Attendance Recap Feature Evaluation	Access to Android Application and Selection of Recap Menu	Student Attendance Data	Application Successfully Displays Class-Wise Student Attendance Summary	Validated
Attendance Recap Print Feature Evaluation	Access to Android Application and Selection of Print PDF Menu	Student Attendance Data	Application Successfully Renders Student Attendance Summary in PDF Format	Validated

Based on the results of the black box testing, it can be concluded that all features and functions on the Android application are working properly in accordance with the expected results.

*D. Evaluation of E-Attendance Using the Likert Scale*

The evaluation employed a Likert scale to assess user feedback on the student e-attendance system, which utilizes QR-Code and WhatsApp Gateway on an Android platform. Out of 40 respondents, the average percentage of those who strongly agreed with the system was 89%. This result indicates that the e-attendance system is effective in assisting students with class attendance and aiding lecturers in more accurate and efficient recapitulation of attendance data. The collected data will be used for administrative monitoring reports to the Academic department.

**IV. Conclusion**

Based on the design and testing of the Android-based student e-attendance system using QR codes and WhatsApp Gateway, the following conclusions can be drawn:

1. Enhanced Efficiency and Effectiveness: The system streamlines the attendance monitoring process, enabling lecturers to effortlessly track student attendance and Convenient Access to Attendance Information: Students can conveniently access their attendance records, fostering transparency and accountability.
2. Comprehensive and accurate administrative reports, the system generates detailed and accurate administrative reports for effective monitoring of the lecture process.
3. The Blackbox testing of the e-attendance system confirms that all features and functions of the Android application operate as intended and meet expectations. The Likert scale evaluation, with a result of 89%, indicates that the e-attendance system is beneficial in helping students with class attendance and assisting lecturers in accurately and efficiently summarizing attendance data.

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