Design of Mobile and Web-Based Geolocation Attendance and Payroll Information System for Teachers And Employees at Madrasah Aliyah As'adiyah Meneng Ketapang Banyuwangi

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Article Information	ABSTRACT
	Attendance recording and payroll management are important elements in maintaining discipline and operational efficiency in madrasahs. Currently, Madrasah Aliyah As'adiyah Meneng Ketapang uses a manual system based on attendance sheets and spreadsheets, which are prone to errors and data manipulation. To address this issue, this study designed and developed a geolocation-based attendance and payroll information system accessible via mobile and web platforms. Key features include location validation within a 20-meter radius, selfie photo verification, fake GPS detection, and automatic payroll calculation based on attendance and teaching hours. The system was developed using the Waterfall model through field observations, interviews, and literature reviews. Evaluation using Blackbox Testing involving actual users showed that all system functions operated as expected, with no significant errors identified. This system improves accuracy, efficiency, and transparency in the attendance and payroll processes. However, this research is limited to small-scale madrasahs and Android-based platforms. Future development should include better fraud detection methods and integration with broader academic management systems to enhance scalability and functionality.

INTRODUCTION

Attendance recording is an important element that must be carried out by every institution to ensure smooth operations and discipline (Al Imron et al., 2023). Attendance is the process of recording the presence of individuals in an organization or agency (Zahroh et al., 2024). Attendance has an important role as an indicator to assess the discipline and responsibility of employees in carrying out their duties and responsibilities (Iksan et al., 2020). In the world of education, especially in madrasah, teacher and employee attendance is often used as a reference for evaluating performance, attendance, and payroll (Widiati & Widiyanti, 2020). Currently, there are many madrasahs that still adopt a manual attendance process.

The same thing is also found in Madrasah Aliyah As'adiyah Meneng Ketapang, which has been using attendance sheets as a medium for employee attendance. At the end of the month, the treasurer will recapitulate the attendance for one month to be used as a reference for paying employee salaries, in this case teachers and madrasah staff. The process of recapitulating attendance and payroll at this institution still has several obstacles, including the treasurer

sometimes making mistakes in using formulas in Microsoft excel, which results in errors in the recapitulation of attendance and payroll.

In addition, things that may occur in the manual attendance process and do not rule out the possibility of also happening at Madrasah Aliyah As'adiyah is the manipulation of attendance (Meyliana, 2020). In addition to manipulation that is prone to occur, the manual attendance process also has weaknesses in the data recap process where, the recap process becomes more difficult and takes time (Halimatussa'diah et al., 2022). Therefore, the manual attendance and payroll process is no longer relevant to be adopted, given the constraints and problems that arise in its implementation.

As technology develops, the attendance process transforms from manual to automated systems following the rapid pace of technology (Komarudin et al., 2023). The attendance process that implements an information system can make it easier for institutions to access data recording and reporting. So that attendance data is not managed manually and has been integrated in the attendance system (Halimatussa'diah et al., 2022). Thus, the integration of technology in the attendance and payroll system allows for increased accuracy, efficiency, and transparency in data management.

Despite the existence of various attendance systems, very few have been implemented specifically in the context of small-scale madrasahs, particularly with advanced features such as geolocation-based attendance verification and fake GPS detection. This highlights a research gap in developing a context-specific and secure attendance system tailored for smaller educational institutions like Madrasah Aliyah As'adiyah Meneng Ketapang.

Based on the problems that have been described and various relevant references, researchers took the initiative to design a presence and payroll information system that is able to minimize fraud in the attendance process and provide convenience in the payroll process and data recording. This system is expected to optimally meet the needs of the institution, especially in the process of presession and teacher payroll at Madrasah Aliyah As'adiyah Meneng Ketapang. In this case, the researcher offers a solution to minimize attendance manipulation by utilizing geolocation technology and selfie photos as input. This technology utilizes the Global Positioning System (GPS) to accurately identify the position of objects (Prasta & Halim, 2023).

By utilizing geolocation technology, the attendance process becomes more focused because it can only be done at a predetermined location and within a predetermined radius of 20 meters from the reference point. One of the advantages of this system is that it allows each employee to take attendance independently using their own personal devices, so that attendance is more flexible because it can be done anywhere as long as it is within the tolerated radius. In addition, this system is also integrated with the payroll system, making the payroll process faster and more efficient.

To overcome the fake GPS problem, the attendance feature is developed in the form of an android application that has better security than web-based applications, so that the risk of manipulating attendance through fake GPS can be minimized. One technical approach that can be used is the integration of a mock location detector, a method that allows the system to detect whether the location sent by the user is manipulated or comes from a third party application such as fake GPS.

The novelty of this research lies in its integrated approach to solving attendance and payroll issues in a small-scale madrasah environment using a geolocation-based mobile and web system with built-in fake GPS detection. While existing systems often address attendance or payroll separately, this study combines both into a unified solution, optimized for institutions with limited resources and personnel. This innovation is expected to enhance operational transparency, reduce fraud, and improve the efficiency of administrative processes in educational institutions.

RESEARCH METHODS

This research uses a field research approach, which is a method carried out directly at the research location to obtain real data related to the attendance process and teacher payroll at Madrasah Aliyah As'adiyah Meneng Ketapang. This type of research was chosen so that researchers can deeply understand the problems that occur in the field and obtain empirical data that supports system design. Through direct observation and interviews with stakeholders, the researcher gains a comprehensive view of the workflow and the challenges faced.

Data Collection Technique

1. Observation

    Observation was carried out directly by researchers on the attendance and payroll process running at Madrasah Aliyah As'adiyah Meneng Ketapang. Researchers recorded every activity related to the manual attendance system, the obstacles faced by the treasurer in recapitulating, and potential weaknesses such as data manipulation and delays in salary processing. This observation provides a contextual understanding that is the basis for the needs of the system to be developed(Admin, 2023).

2. Interview

    Interviews were conducted with four key informants, namely the Head of Madrasah, Treasurer, and two administrative staff who are directly involved in the attendance and payroll process. Through this interview, the researcher explored more in-depth information related to work procedures, technical constraints, and user expectations of the new system to be built. The interviews were semi-structured to remain flexible but focused.(Nurnazmie et al., 2022).

3. Literature Review

    Literature studies were conducted to strengthen the theoretical basis and support the design of attendance and payroll information systems. Researchers reviewed scientific journals, research articles, and documentation related to the application of information systems, geolocation technology, and software development models. Information from the literature study was used to compare existing methods with the specific needs of the madrasah.

System Development Method

The system development method used in this research is the Waterfall model, which is one of the approaches in the System Development Life Cycle (SDLC). Waterfall has a gradual and structured workflow, starting from requirements gathering to system maintenance. This approach was chosen because it provides clarity of process and good documentation at each stage.(A. A. Wahid, 2020).

The stages in the Waterfall method are as follows:

1. Requirments

    This process begins with the information gathering stage which is carried out to deeply understand the needs of the system to be developed. This step involves various methods, such as interviews, observations, and analysis of related documents, to ensure that all aspects needed by users or organizations can be accurately identified. The results of this phase become the basis for the next stages in the system development process. (Putri et al., 2023).

2. Design

    This stage is an important step in system development, where the main focus is to design the structure and function of the system based on the needs that have been identified. Design includes creating frameworks, models, and documentation to ensure the system can be implemented in accordance with the objectives. (Putri et al., 2023).

3. Implementation

At this stage, the system design that has been prepared is translated directly into the form of programming code to build a system that can be run. In this project, researchers used the PHP programming language. (Putri et al., 2023).

4. Verification

This stage involves testing and validating the system to ensure that all functions work as intended and the system is free from critical errors. The Blackbox Testing was carried out using Android smartphones (real device) and simulated fake GPS applications to verify the effectiveness of location validation and spoofing detection. (Putri et al., 2023).

5. Maintenance

After the system begins to be used by users, a maintenance process is carried out which includes repairing errors that were not detected in the previous stage. This maintenance aims to ensure that the system remains effective and efficient within a certain period of time, as well as to identify if adjustments or improvements are needed. (Putri et al., 2023).

RESULTS AND DISCUSSION

Identification of System Requirements

This attendance and payroll information system was developed to overcome various obstacles that arise in the manual system, such as attendance data recapitulation errors, delays in the payroll process, and potential data manipulation. This system aims to automate the geolocation and photo-based attendance process, as well as simplify the process of calculating teacher and employee salaries. With the integration of web-based and Android systems, the attendance process becomes more flexible and accurate, and can be directly connected to the payroll system.

System Design

System design is based on the needs that have been analyzed through observations and interviews at Madrasah Aliyah As'adiyah Meneng Ketapang. To describe the data flow and system structure, three types of modeling are used, namely:

1. Context Diagram

Context Diagram is a visual representation that shows the scope of a system in the form of one main process (Jurnal & Yunita, 2021). This diagram is the highest level of the Data Flow Diagram (DFD) and is used to describe all data flows that enter the system as well as the outputs produced, providing an overview of how the system works as a whole.

The following is an overview of the Context Diagram of the Presence and Payroll Information System:
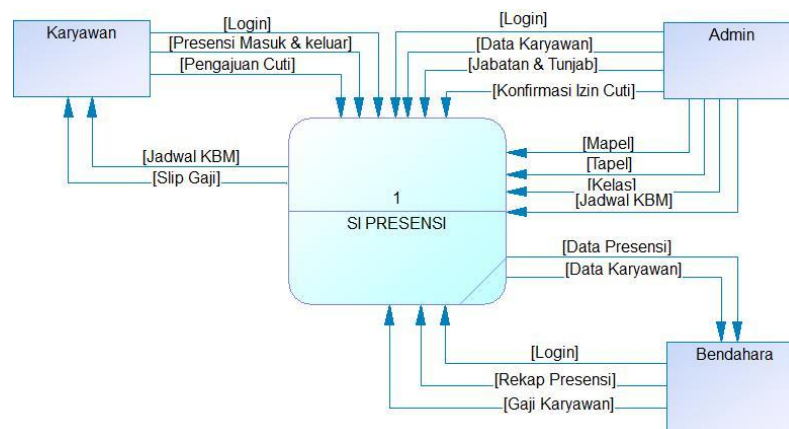

Figure 1: Context Diagram

2. Conceptual Data Model (CDM)

CDM, or Conceptual Data Model, is a model that describes entities and relationships between entities. This conceptual data model represents how users view the data stored in the database (Irwanda et al., 2022). CDM is organized in the form of tables without specifying the data type, which describes the relationship between tables in preparation for implementation into the database..

The CDM of the attendance and payroll information system for teachers and employees at Madrasah Aliyah As'adiyah Meneng Ketapang can be seen in the following figure:

Figure 2: Conceptual Data Model

3. Phisycal Data Model (PDM)

Physical Data Model (PDM) is a data model that represents the relationship between tables in physical form (Diaz et al., 2016). PDM is the result of the generate process derived from the Conceptual Data Model (CDM). PDM clearly displays the tables that make up the database and the columns in each table.

The following PDM is the result of the previous Conceptual Data Model (CDM) generation:
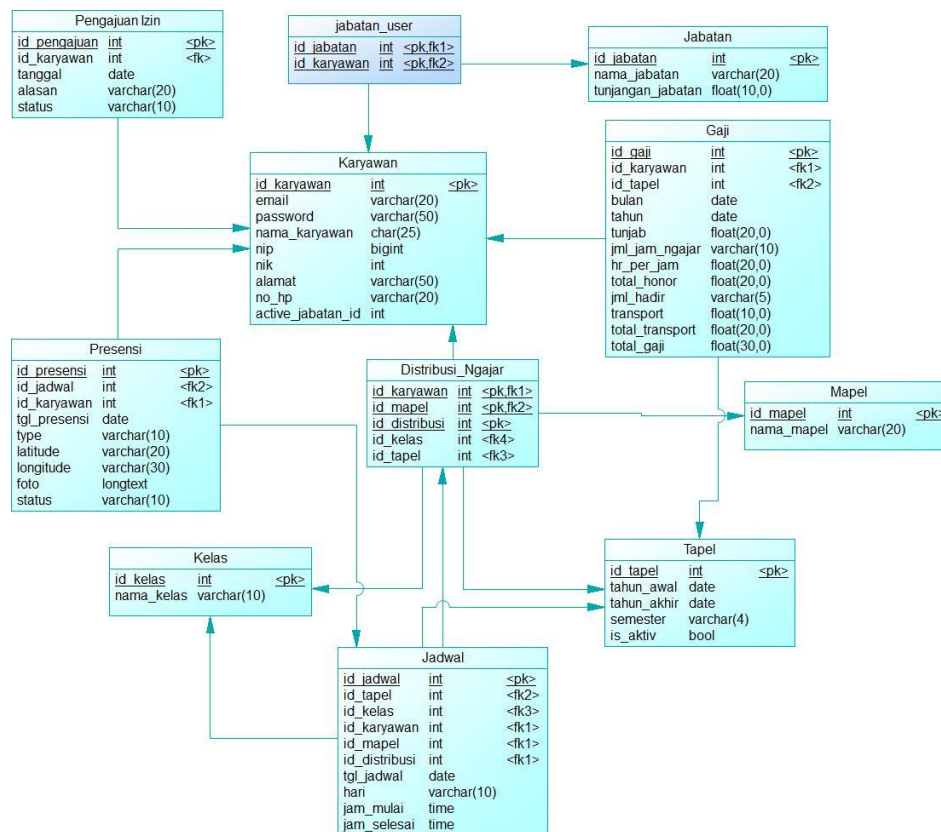
Figure 3: Phisycal Data Model (PDM)

System Implementation

The implementation stage is carried out to translate the results of system analysis and design into a real form in the form of a program that can be run. The system is built with two main interfaces, namely Flutter-based mobile applications for attendance features, and Laravel 11-based web applications for data management and payroll. The implementation of this system aims to replace the manual attendance and payroll process that has been used at Madrasah Aliyah As'adiyah Meneng Ketapang.
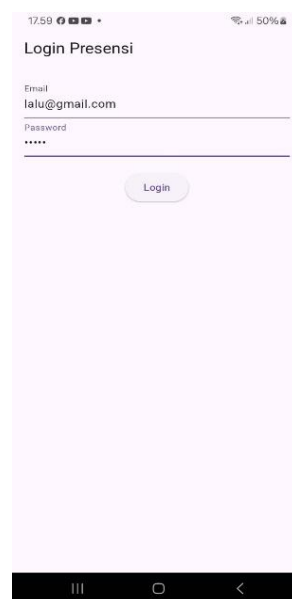

Figure 4: Android App Login Screen

The initial display of the mobile application is the login page as shown in Figure 4 above, users such as teachers or employees can access the system by entering their email and password. This page serves as an initial authentication before users can perform attendance. Login validation is done against user data stored in the database.
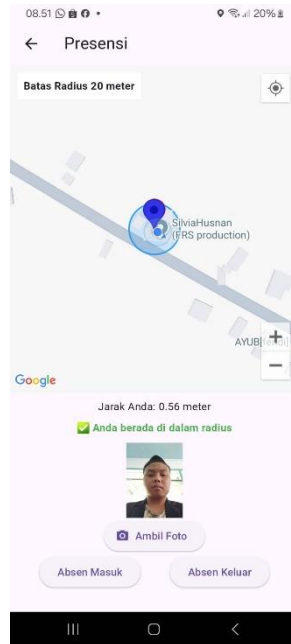

Figure 5: Attendance with Location Validation Feature

After successful login, users are directed to the attendance page page as shown in Figure 5 above. On this page, the system will match the user's current location with the location point that has been determined by the institution. The system utilizes GPS and a validation radius (in this

Figure 6: Presence Data Display

case 20 meters) to determine whether attendance can be done. Users are also asked to take a selfie as physical evidence of attendance. If the coordinates and photo match, the attendance will be saved into the database automatically.

This view is part of the admin dashboard in the web application page as shown in Figure 6 above, admins can view all attendance data from teachers and employees in real-time. The data

Figure 7: Automated Payroll Recap Interface

displayed includes: name, attendance time, in/out status, and location information. This display makes it easy for the admin to monitor employee attendance every day.

This page allows the treasurer to view all teacher/employee salary calculations taken from attendance data and the number of teaching hours page as shown in Figure 7 above. Salaries are calculated automatically based on the hourly honorarium, attendance, and position allowances. In addition, the treasurer can also export this data into Excel format for recording or financial reporting purposes.

On this page, teachers and employees can view and print their monthly pay slips page as shown in Figure 8 above. The payslip displays details of income based on attendance, teaching hours, and allowances received. This feature makes it easier for employees to verify their salaries without having to contact the treasurer directly.

User Feedback and Perceived Usefulness

Post-implementation feedback was collected from three users, including teachers, administrators, and treasurers. Overall, the system received positive responses. In terms of transparency, users appreciated the automatic salary breakdown, which allowed them to easily verify their income without manual calculations. Regarding reliability, the implementation of GPS

Figure 8: Teacher's Pay Slip Page

validation was considered effective in reducing the possibility of attendance fraud, especially through location spoofing.

System Strengths

The developed system offers several important advantages. First, attendance recording accuracy has improved significantly, as the system documents time, location, and photo evidence simultaneously. Second, real-time access allows administrators to monitor attendance instantly via a web dashboard. Finally, the integrated payroll feature enables automatic payroll calculation based on attendance data, thereby reducing human error in payroll processing.

System Limitations

Despite its strengths, the system also has some limitations. It relies on modern smartphones with stable GPS capabilities, which means users with older devices may experience slower or less accurate location detection. In addition, while the fake GPS detection mechanism was effective during testing, it requires continuous updates to remain resistant to newer spoofing techniques. These issues highlight the need for ongoing maintenance and scalability improvements in future system iterations.

Testing

System testing is carried out to ensure that all features in the attendance and payroll information system run according to the needs and specifications that have been designed. This test uses the Blackbox Testing method, where each function is tested based on input and output without looking at the internal code structure of the system.

The main focus of testing is to ensure that each user role can run features in accordance with their duties and responsibilities. In addition, security features such as fake GPS detection are also tested to ensure the integrity of the attendance system. This testing involved six core scenarios representing the main modules of the system. Each scenario is tested by actual users from the madrasah, including administrators, treasurers, and teachers.

The following are the results of system testing based on the scenarios that have been designed:

Tabel 1. System Testing Results for the Attendance and Payroll Information System

No	Test Scenario	Expected Result	Test Result	Tested By
1	Login testing for attendance in the android application	Teachers and employees can access the attendance page using their respective accounts	Success	Teacher
2	Testing attendance in and out as well as validation of location and tolerance radius	Teachers and employees can take attendance according to a predetermined location and a 20 meter radius limit.	Success	Teacher
3	Testing fake GPS when taking attendance	The system successfully detected users when they used fake GPS apps to falsify their location.	Success	Teacher
4	Feature testing on the admin page (user input, employee data,	Admin can use all	Success	Admin

	position, attendance, school year, class, subject, teaching distribution, leave permission)	features according to job description		
5	Feature testing on the treasurer page (automatic salary calculation, Excel export, viewing attendance data)	The treasurer can calculate monthly salary based on attendance, position, and teaching hours, and export data to Excel.	Success	Treasurer
6	Feature testing on the teacher/employee page (print pay slips, leave applications)	Teachers/employees can print pay slips and apply for leave independently.	Success	Teacher

CONCLUSION

Based on the results of research and testing that has been carried out, it can be concluded that this web and Android-based attendance and payroll information system has been successfully built according to the needs that have been analyzed. This system is designed to replace the manual process that has been used so far, which tends to create obstacles such as potential manipulation of attendance data, recapitulation errors, and delays in salary calculations. The system successfully provides attendance features based on location validation and selfie photos that are integrated with the detection of fake GPS usage. In addition, the system is also able to recap attendance and calculate salaries automatically based on the number of attendances, positions, and teaching hours. All main features tested, both on the Android and web platforms, showed test results that were in line with expectations and no functional errors were found during the testing process. Thus, this system is considered feasible for further use in supporting the attendance and payroll process in educational institutions.

This study is limited to small-scale madrasahs, so it cannot be generalized widely. Further development should include more sophisticated cheating detection technology and integration with a more comprehensive academic system.

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