Web-Based Attendance System Using Gps: A Solution For Attendance Accuracy In The Digital Era

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Abstract : This study aims to design an online attendance system based on GPS for universities to improve the accuracy and efficiency of attendance records. The system allows students to mark their attendance via mobile devices with location verification through GPS. The methods used include requirements analysis, interface design, and implementation based on web and mobile platforms. The results of the testing show that the system functions well, improves attendance accuracy, and simplifies the attendance administration. This system is expected to become a modern and effective solution for universities.

INTRODUCTION

In today's digital era, information technology has become an integral part of various aspects of life, including the education sector. One of the technologies that is increasingly being implemented is the attendance system. Attendance is an essential part of administrative processes in educational institutions, especially in universities (Khairul et al., 2023). Traditional attendance systems, which still rely on manual methods, often require more time and effort, and are prone to human errors and data manipulation.

To address these issues, a more efficient and accurate attendance information system is needed. One solution that can be implemented is the use of Global Positioning System (GPS)-based technology. A GPS-based online attendance information system can provide convenience in monitoring student attendance in real-time using mobile devices. By utilizing GPS, student attendance locations can be detected automatically, ensuring that attendance can only be recorded at designated locations, such as classrooms or campus areas(Ikhwanudin et al., 2024).

Additionally, this system can offer various benefits, such as reducing the potential for fraud in the attendance process, simplifying attendance data processing, and improving the efficiency of attendance administration. Therefore, the design of this GPS-based online attendance system is crucial in optimizing administrative processes at the

university (Sari & Alfarisi, 2024).

In university administration, the accuracy and speed of recording student attendance are vital to support academic and administrative activities. A GPS-based attendance system allows for more timely and accurate attendance recording, preventing potential fraud, such as false attendance or attendance that does not reflect reality. On the other hand, students will benefit from the convenience of marking their attendance using the devices they already own, namely smartphones (Putra et al., 2023).

It is expected that with the implementation of this GPS-based online attendance information system, the attendance process at the university will become more efficient, effective, and minimize errors in attendance recording (Perwitasari et al., n.d.). This system will also provide more comprehensive and detailed data that can be used by faculty and administrative staff for academic evaluations and overall student data management. Furthermore, by using a web-based platform, this system is expected to be accessible anytime and anywhere, offering flexibility for both students and campus administrative staff (Khoirul et al., 2024).

RESEARCH METHODS

The research method used in designing the online GPS-based attendance information system at the University follows a structured software engineering methodology. This research will go through several stages aimed at producing a system that meets user needs and functions properly. Below are the steps in the proposed research method :

Research and Development (R&D) Approach

This research uses the Research and Development (R&D) approach to develop the information system. The R&D approach aims to produce a new and innovative product or system that can be used to solve real-world problems. This process includes several stages, from problem identification to system evaluation after implementation. The main steps in the R&D approach include :

1. **Preliminary Research and Problem Analysis**

The initial stage involves identifying the existing problems in the traditional attendance system at the University. Research is conducted to identify the weaknesses of the manual attendance system and the reasons for implementing a GPS-based system. At

this stage, surveys and interviews with relevant parties, such as administrative staff, lecturers, and students, are carried out to understand challenges like time inefficiency, attendance fraud, and difficulties in manually managing attendance data (Alfith et al., 2024).

2. System Development Planning

Based on the problem analysis, system development planning is conducted to determine system requirements, both functional and non-functional. This stage includes designing the system architecture, process flow (flowchart), and specifying the hardware and software needed to support the GPS-based online attendance system. Efficient database design is also a crucial part of this stage (Angelia et al., n.d.).

3. System Prototype Development

After planning, a prototype of the system is developed. This prototype is an initial model of the system to be developed. Prototyping allows developers to test concepts, user interfaces, and basic system functionality. (Faizal, 2024)The prototype will be tested and refined based on feedback from early adopters, such as students and administrative staff.

4. System Validation and Testing

At this stage, the GPS-based attendance system is validated and tested. Validation is carried out by testing the prototype in a real environment to ensure that the system meets the specified needs. Testing is conducted through pilot testing involving users from student and lecturer groups to monitor whether the system accurately detects user location and records attendance (Putra & Putri, n.d.).

The testing process includes several aspects, such as :

a. Accuracy testing : Testing the accuracy of GPS location detection during attendance.

b. Usability testing : Testing the ease of use of the system for users.

c. Performance testing : Testing the system's speed and response in processing attendance data.

d. Security testing : Testing the system's security in protecting user data.

5. Revision and Refinement

Based on the test results and user feedback, revisions and improvements are made to the system. Corrections are made to features or functions that are not working as

expected or to areas that need enhancement. This stage ensures that the system is ready to be implemented across the university with optimal results (Januartika, 2023).

6. **System Implementation**

After the system has been fully developed and tested, the next stage is implementation. The system will be integrated with the existing campus infrastructure. Students and lecturers will begin using this system for their daily attendance. During the implementation phase, a short training session will be held for users (user training) to ensure that they understand how to use the GPS-based attendance system (Putri & Putra, n.d.).

7. **Evaluation and Maintenance**

System evaluation is conducted after implementation to measure the effectiveness of the GPS-based online attendance system. This evaluation is carried out by collecting data from users through questionnaires or interviews to assess whether the system meets their needs. If any problems or negative feedback are found, maintenance and updates will be carried out periodically (Penelitian et al., n.d.).

Additionally, system maintenance includes :

    a. Bug fixing : Resolving any errors or bugs that arise during use.

    b. System updates : Updating to add new features or improve system performance based on evaluations and user feedback.

RESULTS AND DISCUSSION

1. **System Requirements, Hardware and Software Requirements**

The web-based employee attendance system with GPS must meet several key requirements to function optimally. First, the system must provide secure login access, protected from unauthorized access. Second, the system must be able to process attendance data from each session and convert it into useful information. Third, integration with GPS technology is required to determine the geographical location of employees during attendance, minimizing fraud. Additionally, the system must have a database that stores complete employee information and be capable of generating periodic attendance reports for monitoring and evaluation. Lastly, the system's interface must be user-friendly, making it easy for employees to record attendance and view related information.

The hardware and software requirements for designing a web-based GPS employee attendance system at Universitas Pembangunan Panca Budi include a computer with an Intel Core i3 CPU, 4GB of RAM, 500GB of storage, and wifi that supports GPS location. On the software side, the system requires Windows 10, Visual Studio Code, PHP version 7 or higher, as well as XAMPP Web Server and MySQL. These specifications are tailored to ensure optimal system performance, though they may vary depending on the system's complexity and the number of users accessing it.

2. Research Design

The following is the UML (Unified Modeling Language) design of "Designing Employee Attendance at the Besilam Bukit Lembasa Village Office, Wampu District Using Web-Based GPS":

1. Use Case Diagram: shows the main functions of the attendance system, such as login, incoming attendance, outgoing attendance, and display of attendance data.

2. Activity Diagram: shows the workflow of the attendance system, from using GPS to determine the location of attendance to processing attendance data by the system.

3. Sequence Diagram: shows the sequence of activities that occur in the attendance process, from using GPS to storing attendance data.

4. Class Diagram: shows the classes in the attendance system, such as Employee, Attendance, GPS, and Website.

By using UML, researchers can create an attendance system design that is easier for the development team to understand and implement. UML design can also help in identifying system requirements and resolving potential problems before development occurs.

a. *Use Case Diagram*

The use case diagram in this research has levels as admin and employee. Figure 1 is a use case diagram for designing an attendance system.
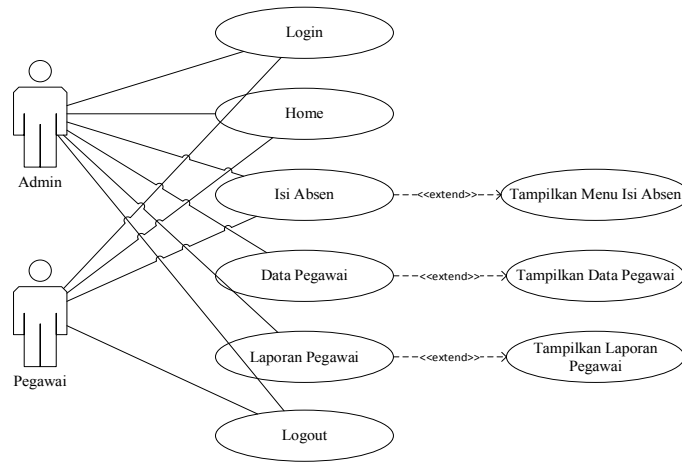
Figure 1. Use case diagram attendance system

b. Activity Diagram

Activity diagrams in the attendance system have the function of showing admin and employee workflow in detail. This activity diagram is used to describe activities or actions in the attendance system, such as retrieving data from GPS, validating logins, and processing attendance data. The Activity Diagram also shows the login branches in the system. Figure 2 is an activity diagram of the designed system.
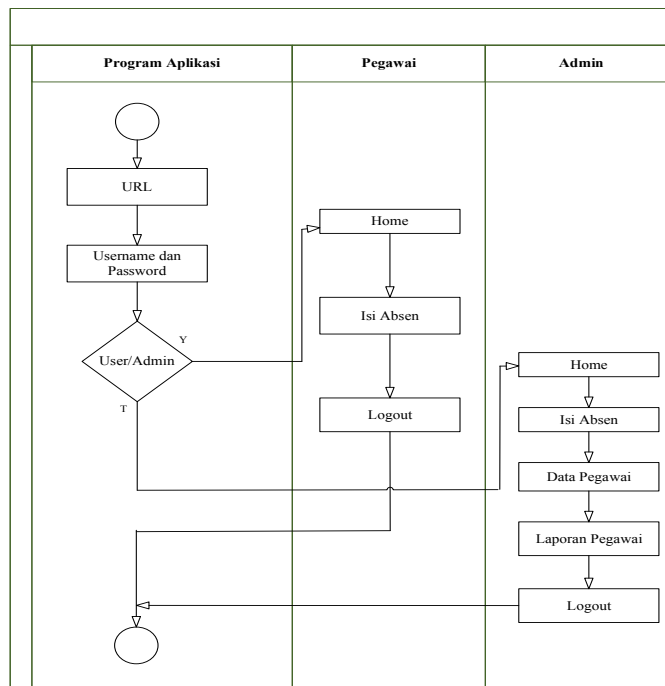
Gambar 3.1 *Activity diagram* penelitian

c. Sequence Diagram

The sequence diagram in this system has the function of showing the sequence of interactions between admin and employees in the attendance system. Sequence diagrams can provide a clear picture of how admins and employees carry out their functions in the attendance system.

Sequence diagrams are used to describe the sequence of work carried out by each menu in the attendance system. In "Designing employee attendance at the Besilam Bukit Lembasa Village Office, Wampu District using Web-based GPS", sequence diagrams can be used to show how attendance data is taken from GPS, how login is carried out, and how attendance data is processed and stored in the system. Figure 3 is a sequence diagram of the attendance system for the admin section and figure 4 is a sequence diagram of the attendance system for the employee section.
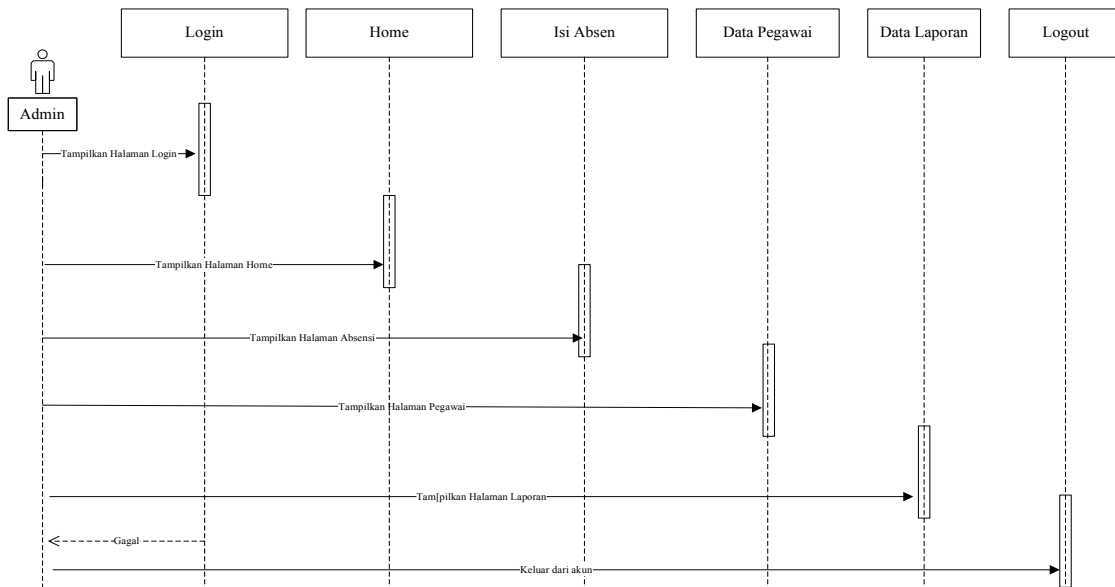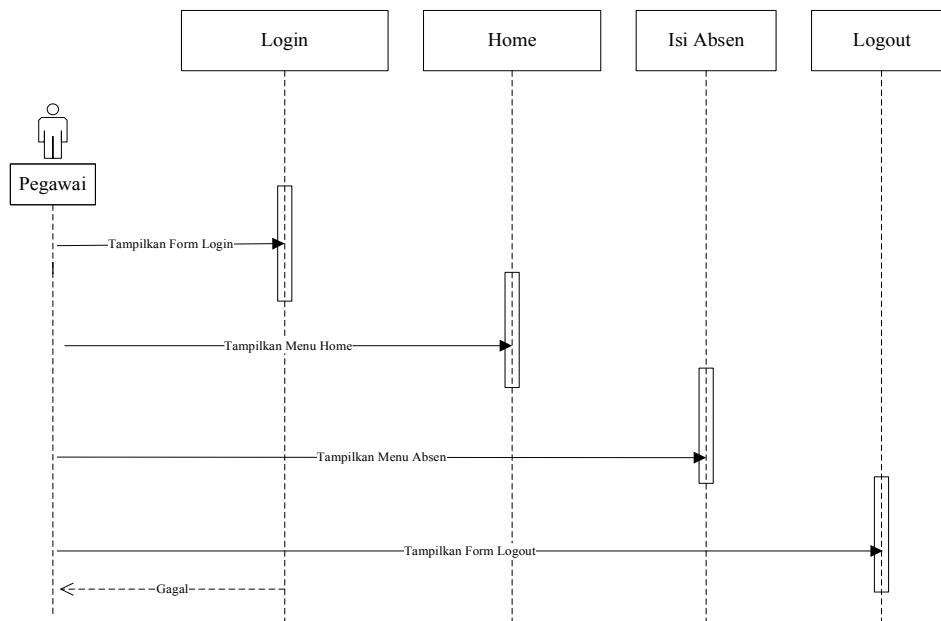

**Figure 3.** *Sequence diagram* **(admin)**

Figure 4. Sequence diagram (employee)

d. *Class Diagram*

The class diagram in this system has the function of showing classes and the relationships between classes in the attendance system. Class diagrams are used to describe attributes, operations, and relationships between classes in the attendance system.

Class diagrams can be used to describe classes in an attendance system such as GPS class, employee class, attendance class, and admin class. The class diagram in the attendance system allows admin users or employees to take attendance only once, namely to enter and leave each day. Figure 5 is a design of the attendance system class diagram.
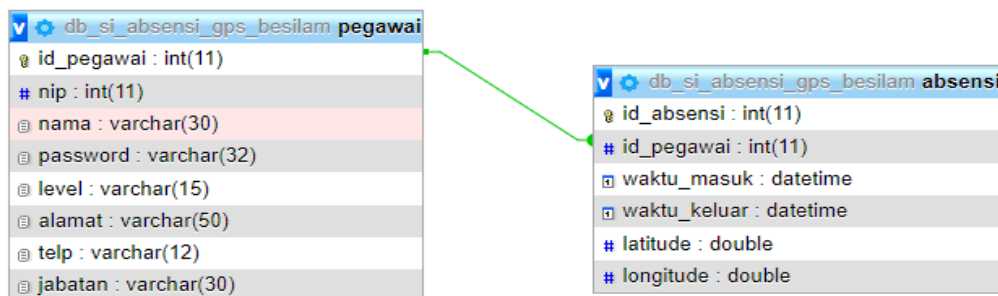
Figure 5. *Class diagram* sistem absensi

CONCLUSION

After conducting the research, the author concludes that the design and development of a web-based employee attendance system can improve the efficiency and accuracy of attendance management at the university. This system was designed using Balsamiq and developed with PHP programming language. GPS technology enables the accurate and automatic capture of employee coordinates, allowing for real-time attendance, which helps administrators monitor employee attendance more effectively. The implementation of the attendance system at Universitas Pembangunan Panca Budi can be done by building a website that can be accessed anytime and anywhere, making it easier for employees to record their attendance.

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