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Development of an Employee Attendance Management Information System Based on Web and Mobile with Location-Based Service

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Abstract:
Background. Attendance administration for non-civil servant employees at the Karanganyar Regency Education and Culture Office is still conducted manually, resulting in limited real-time monitoring, potential data integrity issues, and a lack of system integration.
Aims. This study aims to develop a mobile and web-based employee attendance management information system utilizing Location-Based Service (LBS) technology.
Methods. The system was developed using a client–server architecture, consisting of a Laravel-based web application for administrators and a Flutter-based mobile application for employees. GPS-based location validation and photo evidence were implemented to support attendance verification. System evaluation was conducted using black-box functional testing and specific LBS validation scenarios.
Result. System functionality was evaluated using black-box testing, which confirmed that all ten core system functions operated as intended. The Location-Based Service (LBS) module demonstrated high functional accuracy within the tested scenarios. LBS validation, conducted across five distinct coordinate scenarios, achieved a 100% success rate in determining and validating employee locations, including correctly restricting access when the employee was located outside the permitted radius at distances of up to 568.42 meters from the base location.
Conclusion. Within the scope of functional testing, the developed system demonstrates functional feasibility and provides a technological foundation for a more integrated digital attendance solution for non-civil servant employees.

Keywords: employee attendance; honorary employee; location-based service

INTRODUCTION

Non-State Civil Apparatus (Non-ASN) employees within the Karanganyar Regency Education and Culture Office are contract or honorary employees who play an essential role in assisting the official office's operations. Honorary employees themselves have the

meaning of a workforce that functions to help carry out the duties of permanent employees or civil servants both in technical and non-technical matters, because in reality not all tasks and responsibilities that civil servants and competencies can accommodate are not yet qualified, so additional personnel are needed to help do them (Pradana & Nugraheni, 2021). In terms of managing attendance recording and work scheduling for Non-ASN employees, it is entirely under the authority of the Education Office, and its implementation is still carried out manually. Each employee is obligated to sign the method on the attendance sheet managed by the personnel field. Attendance, also commonly known as attendance, is an activity or routine carried out by employees to prove that they are present or not in an organization or company (Hardyanto, 2022). The attendance sheet is used to monitor employees' attendance every weekday. The attendance sheet is also used as one of the indicators in work evaluation.

Monitoring or supervision is a process carried out to review the work that has been done to be assessed or corrected, with the intention that the implementation is in accordance with the plan.(Riyanto & Saragih, 2019). Another opinion says that monitoring is interpreted as the process of supervision and control of the organization. The process aims to assess the activities or performance of human resources and organizations so that all elements of the organization are expected to be encouraged to achieve common goals (Wahyuni & Rakhmawati, 2020).

Manual attendance systems with signatures used by Non-ASN employees risk lowering the integrity of attendance data. The existence of potential fraud, such as employees filling out the attendance list but not physically in the office, directly causes attendance data to be inaccurate and manipulative. Therefore, technology is needed *for Location Based Service (LBS),* which can be used to validate the location of employees for attendance purposes. *Location-based services are information services that can be accessed using a mobile device. It is equipped to determine the user's location and provide information about available services based on that* location. LBS is also capable of generating applications for location information with technology *Global Positioning System (GPS),* such as tourist attractions, restaurants, shops, hotels, offices, and cultural sites (Kasmawi et al., 2019).

Another problem with the system currently running is the presence method, which remains conventional, namely, using a physical sheet filled with signatures. The fundamental weakness of this method is its inability to monitor employee attendance in *real-time.* Currently, the majority of employees already have and are actively using mobile devices.

Likewise, the ASN employee environment at the Karanganyar Regency Education and Culture Office has implemented a mobile-based attendance application connected to the local government. So to overcome existing weaknesses and adjust to technological developments, it would be more effective if the attendance system for Non-ASN employees were also developed using *mobile devices.*

Based on the problems that have been described, this study aims to develop a mobile attendance application for non-civil servant (Non-ASN) employees by utilizing Location-Based Service (LBS) technology to improve the accuracy and validity of attendance data. The application is designed to be accessible via mobile devices and includes key features such as GPS-based location validation, photo evidence submission to mitigate attendance fraud, and an administrative dashboard for real-time attendance monitoring. This study contributes by developing an integrated mobile and web-based attendance system for non-civil servant employees, combining GPS-based validation, photo evidence, and real-time data synchronization through a RESTful API. The distinct contribution of this research lies in the unified integration of geo-fencing mechanisms, mandatory photo evidence, real-time administrative monitoring, and a one-account-per-device login restriction, specifically tailored to the operational context of contract personnel. Through this approach, the proposed system offers a more structured and reliable digital alternative to conventional manual attendance methods and addresses the technological gap in Non-ASN attendance administration.

LITERATURE REVIEW

Information system

An information system is a system used to collect, process, store, and disseminate information in an organization. Information Systems can help organizations to improve their operational efficiency and effectiveness, improve the quality of products and services, and improve communication and collaboration between managers and service users. Information Systems are an important tool used to achieve the goals of organizations and individuals in the digital age (Adham, 2024). In the context of this study, the Information System paradigm is applied to transition the manual attendance process into a unified digital platform. This shift ensures data centralization, enabling real-time processing and immediate dissemination of attendance records to the administration, thereby improving efficiency and data integrity for Non-ASN personnel.

Location-Based Services (LBS)

Location-based service (LBS) is an information service accessed through a mobile device using a mobile network, equipped to utilize location and mobile devices. Location-based service is an information service accessed through mobile devices via the internet and mobile networks, utilizing location markers (maps) on mobile devices. Location-based services will provide information services based on a location or position to users. (Budiman, 2016, in Aisyah et al., 2022). The implementation of Location-Based Service (LBS) serves as a fundamental approach to addressing the primary issue of attendance fraud. By utilizing the Global Positioning System (GPS) functionality inherent in LBS, the developed system implements a geo-fencing mechanism that validates employee coordinates against predefined work areas. This mechanism ensures that attendance records can only be successfully submitted when employees are physically present within the authorized location.

Application Programming Interface (API)

Application Programming Interface (API) provides the concept of application programming interface function, which is one of the ways that an application can be accessed and utilized by other parties and communicate between systems even though they are operated differently through *Hypertext Transfer Protocol* (HTTP), containing a *Java files* Script Object Notation (JSON). *File* that will be presented to users when accessing the API (Warsito et al., 2017). In recent years, API architectures have been developed to meet the needs of applications and developers in a variety of scenarios, such as REST, GraphQL, and gRPC. REST (Representational State Transfer) is an architectural style for distributed systems that separates client-side interfaces and server-side business logic to achieve scalability in line with the growth of the internet. GraphQL, which was developed by Facebook in 2012 and released publicly in 2015, is a query language with a single endpoint to interact with the API. While gRPC is an open-source framework for Remote Procedure Call, developed by Google (Chandra & Pharisees, 2025). The system developed in this research adopts the REST architectural style using APIs to facilitate robust communication between the client-side (mobile application used by employees) and the server-side (Laravel-based web application for administration). This client-server separation, enabled by the API, is crucial for ensuring real-time data exchange, scalability, and modular development.

Data Flow Diagram

A Data Flow Diagram is an abstract description of the logic of a system. This picture does not depend on software or hardware, data structure, or file organization. The advantage of using data flow diagrams is that they make it easier for users who do not understand computer science to grasp the system being developed. DFD describes the inputs, processes, and outputs of the system that relate to the general system model. Through this analysis of DFD, the processes that exist in the organization can be presented. The data flow approach provides an understanding of the logic that runs on the system. (Sanmorino & Isabella, 2017). DFD is utilized in this study as the primary modeling tool to visually represent the system's logic, specifically detailing the flow of attendance data, location verification checks, and feedback loops between the employee (input), the server processing (process), and the admin dashboard (output). This ensures transparent communication of the system's structure.

RESEARCH GAP

Existing digital attendance systems have been adopted to improve attendance recording efficiency. However, many current implementations are limited to basic attendance functions and do not fully integrate location validation, real-time administrative monitoring, and centralized data management within a unified platform. This research addresses these gaps by proposing and developing an integrated mobile and web-based attendance management system that leverages Location-Based Service (LBS) technology to support improved attendance accuracy and administrative oversight.

METHOD

This study adopts a model research design, Research and Development, to solve problems and achieve the set goals. Method *Research and Development* has 10 steps, among others, *Research and information collecting, Planning, Develop preliminary form of product, Preliminary field testing, Main product revision, Main field testing, Operational product revision, Operational field testing, Final product revision, Dissemination and implementation* (Borg and Gall in Sidik, 2019). However, the development of this research is limited to the 6th stage, because it does not reach the stage of product implementation in the field.

This research began with conducting direct observations and interviews. The interview was conducted with the relevant agency, namely the personnel staff responsible for managing attendance. This research was carried out at the Karanganyar Regency Education and Culture Office which is located at Jl. Lawu Office Complex, Cangakan, Karanganyar. The time for the implementation of the research takes place in the range of May to June 2025. The purpose of this interview is to obtain direct information about the ongoing attendance process, the obstacles that are often faced, and the need for the development of a digital-based attendance information system. The information obtained is used for the next stage, namely planning which aims to analyze the needs and become product conceptual in the form of system architecture, relationship diagrams, data flow diagrams and other conceptual requirements needed in the system. The system was developed using a client-server architecture with specific tools and frameworks to ensure robust functionality and future reproducibility. The web-based administration panel was built using the Laravel framework (PHP), while the mobile application for employee usage was developed using Flutter. The central data repository was managed via MySQL. To validate functionality and ensure reproducibility, system functionality was evaluated using the black-box testing method. The testing environment included simulating real-world usage on Android devices to specifically verify the accuracy and reliability of the Location-Based Service (LBS) and the mandatory one-account-per-device login restriction against the system's requirements. This entire development process is concluded with major functional testing to ensure that the system's functionality runs as set.

DISCUSSION

In this chapter, the results of designing and implementing a mobile- and web-based employee attendance management information system are presented. The system was developed as an integrated solution to address manual attendance and scheduling issues for non-civil servants at the Karanganyar Regency Education and Culture Office. It consists of a Laravel-based web application for administrators and a Flutter-based mobile application for employees. The system’s conceptual design is represented through system architecture, flowcharts, Entity Relationship Diagrams (ERD), and Data Flow Diagrams (DFD).

The system adopts a client-server architecture with a web service approach, separating the roles of clients and centralized data processing. The client side includes an admin web application for data management and monitoring, as well as a mobile application for employee attendance with location and photo validation. A RESTful API serves as the

communication bridge between clients and the server, enabling real-time data validation, centralized storage, and immediate monitoring of attendance records. The overall system architecture is illustrated in Figure 1.

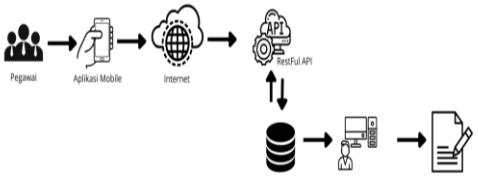

Figure 1. System Architecture

The flowchart in this design presents the system procedurally. Describe the procedural steps of each existing function, such as the login process, attendance flow, and data storage sequence. Flowcharts also illustrate how decision logic affects the direction of the system's workflow. The flowchart can be seen in Figure 2.

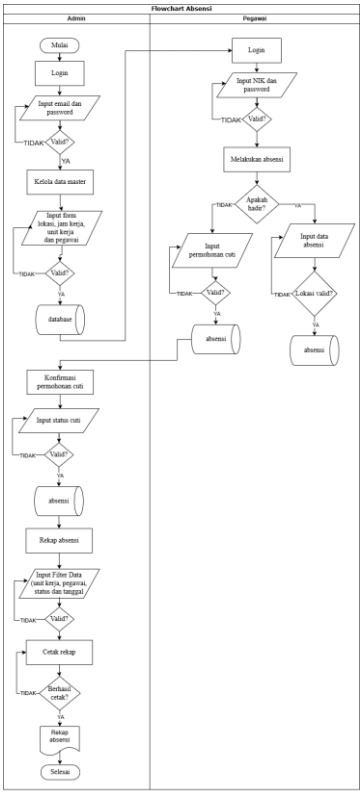

Figure 2. Flowchart

Context diagrams are part of Data Flow Diagrams (DFDs) that aim to establish system context and constraints. A context diagram can also be called a DFD Level 0. The following context diagram illustrates the process of the Employee Attendance Management Information System, using a Mobile-Based Service, as shown in Figure 3.

Figure 3. Context Diagram

This Data Flow Diagram Level 1 illustrates the primary data flows and core processes of the employee attendance management system, involving two external entities: Employees and Admins. It represents key system functions, including master data management, attendance recording, leave management, notifications, and attendance reporting, which support both administrative configuration and daily employee interactions. The DFD Level 1 is shown in Figure 4.

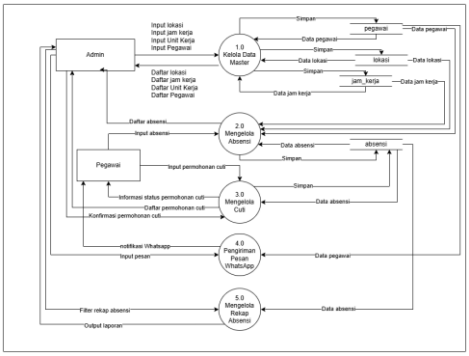

Figure 4. DFD Level 1

DFD Level 2 Process 1 describes the Managing Master Data process, which is fully handled by the Admin entity. This process covers the management of essential system data, including employee information, locations, work units, and working hours, which form the basis of the attendance system. The data flow design is illustrated in Figure 5.

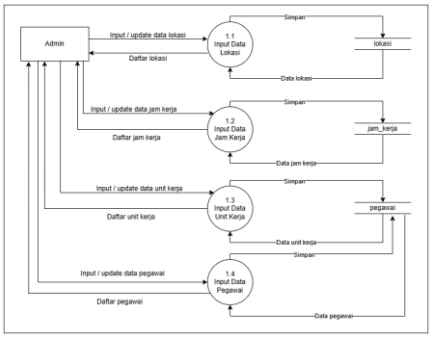

Figure 5. DFD Level 2 Process 1

DFD Level 2 Process 2 illustrates the Managing Attendance process, highlighting the interaction between employees and the system for submitting and validating attendance data.

This process ensures that attendance records are verified and stored accurately to support reliable attendance monitoring. The data flow design is shown in Figure 6.

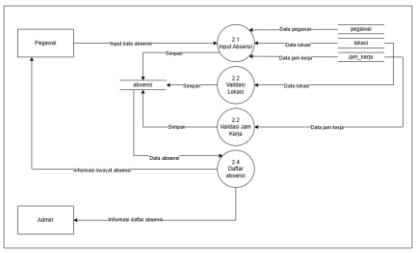

Figure 6. DFD Level 2 Process 2

DFD Level 2 Process 3 illustrates the data flow of the leave management process, which handles employee leave submissions and administrative approval within the system. The detailed process flow is shown in Figure 7.

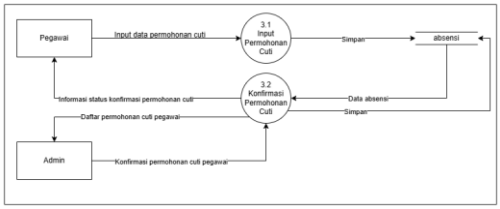

Figure 7. DFD Level 2 Process 3

DFD Level 2 Process 4 describes the notification management process, which supports the delivery of system notifications related to attendance and leave information. The data flow design is presented in Figure 8.

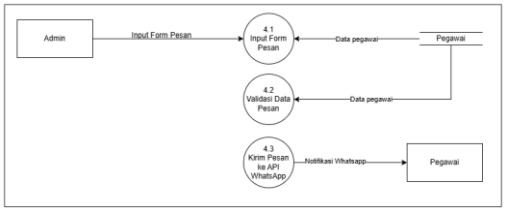

Figure 8. DFD Level 2 Process 4

DFD Level 2 Process 5 describes the Attendance Recap Report process, which focuses on processing recorded attendance data to generate structured recap reports. This process supports data filtering, recapitulation, and the presentation of attendance information for administrative monitoring. The data flow design is illustrated in Figure 9.

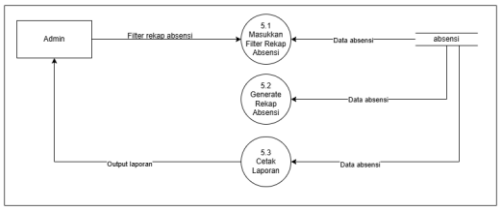

Figure 9. DFD Level 2 Process 5

The Entity Relationship Diagram (ERD) functions as a conceptual model for database design by illustrating the relationships among key data entities such as users, employees, attendance records, locations, and working hours (Akbar & Haryanti, 2023). This diagram forms the basis of the database structure used in the attendance information system and is presented in Figure 10.

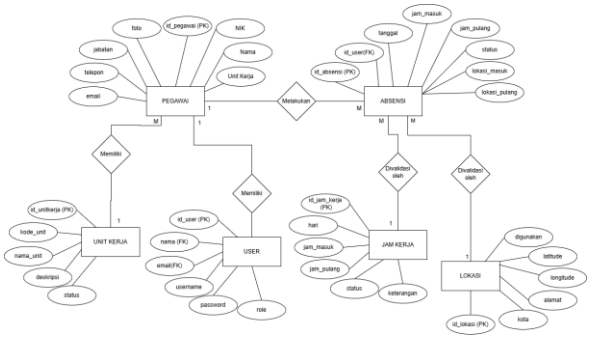

Figure 10. Entity Relationship Diagram

The discussion of the system interface begins with the login page, which functions as the main entrance for authentication into the application. Employees log in using an account that the admin has assigned. The appearance is shown in Figure 11.

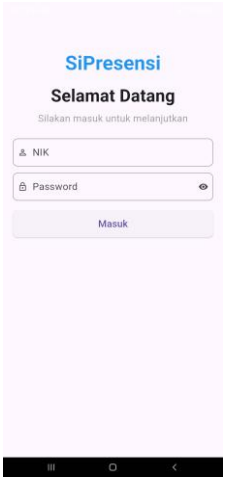

Figure 11. Login Page

The home page serves as the interface and the main navigation center. Several features are available in this view, such as work schedules, attendance recaps, and leave. A navigation

bar at the bottom connects to other menu views. The view of the Home page is shown in Figure 12.

Figure 12. Home Page

The Attendance page enables employees to record daily attendance through check-in and return functions, incorporating real-time GPS-based location validation to ensure presence within the designated office radius. Attendance submission is restricted when location requirements are not met, thereby preventing attendance manipulation. The interface is shown in Figure 13.

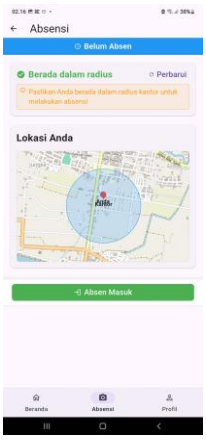

Figure 13. Attendance Page

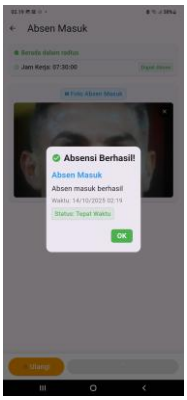

Figure 14. Attendance page

The Dashboard menu on the side of the website serves as a real-time monitoring center. It shows that the integration of data from mobile and website admin through APIs runs in real-time. This instantly updated data allows administrators to monitor the actual attendance status of employees without any delays. The view can be seen in Figure 15.

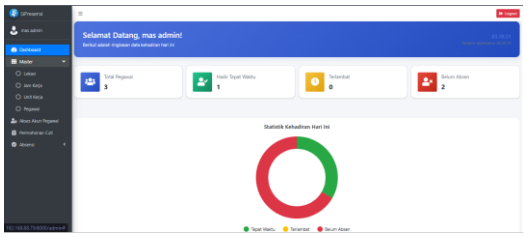

Figure 15. Admin Dashboard Page

On the admin side, there is also a location menu, which functions as an admin menu to set GPS coordinates and geofencing radius. Without this menu, location validation on the mobile side will not run. This view can be seen in Figure 16.

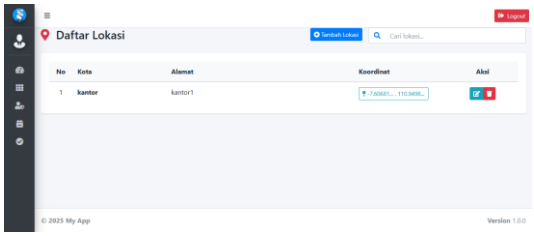

Figure 16. Location Menu Page

The attendance recap menu page shows the final result and solution of the problem at hand. This proves that the system can overcome the difficulties of manual recapitulation and generate integrated digital reports. The view can be seen in Figure 17

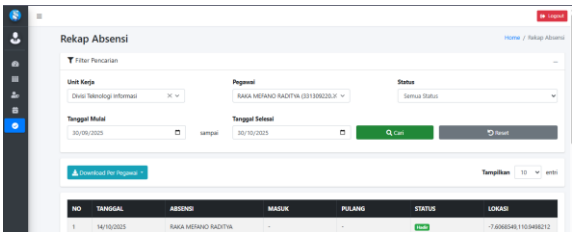

Figure 17. Attendance Recap Page

Figure 18. Attendance Recap View

System Testing

Table 1. Blackbox Testing

Yes	Testing	Test Case	Expected Results	Test results
1	Login	Employee enters Username and password	System successfully logged in and displays the dashboard page	Succeed
2	Login	Trying to sign in with the wrong password.	The system denies access and displays an authentication error message.	Succeed
3	Home Navigation	From the Homepage, access the Early Attendance Menu	The system successfully displays the Early Attendance Menu that shows the location status (within radius or not).	Succeed
4	Geo-fencing	Access attendance when the employee is within the specified radius of the work	The system displays the status "Within radius" and the Opt-Out Login button is on/clickable.	Succeed
5	Geo-fencing	Access attendance when the Employee is OUTSIDE the specified radius of the work location	The system displays an "Out of radius" warning and the Opt-in Absence button is off/unclickable.	Succeed
6	Attendance	Make an attendance with a valid location and take a selfie.	The attendance data (location, time, photo) is successfully sent and saved to the *backend*.	Succeed
7	Attendance	Trying to submit attendance without taking a selfie	The Submit Absence button is inactive (*error*) "Must take photos".	Succeed

8	Home Attendance	Be present at home with a valid location and take a selfie.	The home attendance data (location, time, photo) was successfully updated and saved to the	Succeed
9	Attendance recap	Access the Attendance Recap Menu after the daily attendance is recorded.	The system displays the latest attendance history and statistics.	Succeed
10	Permissions Menu	Input and apply for permission	The permit application data was successfully sent and recorded in the system for Admin processing.	Succeed

Table 2. Testing Against LBS

No.	Coordinates on which to base	Coordinate Point of employee location	Expected Results	Test Results
1	-7.6068140, 110.9498990	-7.6068549, 110.9498212 (9.77	Absence from the office area	Succeed
2	-7.6068140, 110.9498990	-7.603751, 110.954028 (568.42	Absences are denied outside	Succeed
3	-7.6068140, 110.9498990	-7.606220, 110.950021 (67.4	Absence from the office area	Succeed
4	-7.6068140, 110.9498990	- 7.605863, 110.950076 (107	Absences are denied outside	Succeed
5	-7.6068140, 110.9498990	-7.606150, 110.950029 (75.21	Absence from the office area	Succeed

SYSTEM LIMITATIONS, SCALABILITY, AND UX CONSIDERATIONS

Despite the successful validation of the system's functional requirements, this study acknowledges several limitations related to its scope and evaluation. The Research and Development (R&D) approach constrained the research to the product development phase, without progressing to full operational implementation or large-scale deployment. System evaluation was limited to black-box functional testing; consequently, non-functional assessments, including performance testing, stress testing, and formal user experience (UX) evaluation, were not conducted. Furthermore, although the mobile application was developed using Flutter, testing and deployment were restricted to the Android platform, thereby limiting accessibility for users on other operating systems.

From a scalability perspective, the system's client–server architecture and RESTful API provide a solid foundation for future expansion. This architectural design supports efficient data synchronization, increased user capacity, and potential integration with other enterprise systems, such as payroll and human resource management platforms. With respect to user experience, although no structured usability evaluation was performed, the interface

was intentionally designed to support straightforward task execution for attendance submission and administrative monitoring. Future studies are encouraged to conduct comprehensive UX and usability evaluations involving end users to assess system usability, user satisfaction, and interaction efficiency in real-world operational contexts.

CONCLUSION

Based on the results of the research on the Development of Employee Attendance Management Information Systems Using Mobile and Web-Based Location-Based Services, it can be concluded that the current manual attendance system has weaknesses, including difficulty in accessing real-time information, risks to data integrity, and a lack of integration with digital systems. In the software test built using location-based service technology, all functions have run as expected and met the primary purpose of this study: to provide an integrated digital solution to overcome the problem of recording employee attendance. The software has successfully executed key features, including daily attendance processes with GPS validation, sending photo evidence, and presenting attendance recapitulation data. The test results prove the functional feasibility of the system. This success is supported by real-time data synchronization between the employee mobile application and the web admin dashboard through the RESTful API, which can directly improve the process of monitoring attendance and managing personnel data. In addition to the functional testing of the system, specific testing of the implementation of Location Based Service (LBS) also shows that the system can verify and validate the location of employees with reasonable accuracy against the predetermined office radius. This is it. This confirms that the system developed has high functional feasibility and is efficacious in improving the accuracy and efficiency of employee attendance administration.

BIBLIOGRAPHY

Adham, M. F. (2024). Information Systems Implementation Analysis: A Literature Study. *Journal of Information Systems Technology*, *5*(1), 264–275. https://doi.org/10.35957/jtsi.v5i1.7815

Aisyah, A., Permata Sari, D., & Kusumanto, K. (2022). Design of Real Time Lecturer Attendance Application with Global Positioning System (GPS) and Location Based Service (LSB) Based Methods at the Department of Electronics Engineering, Sriwijaya State Polytechnic. *Journal of Locus Research and Service*, *1*(5), 341–347. https://doi.org/10.58344/locus.v1i5.73

Akbar, I. S., & Haryanti, T. (2023). Development of Entity Relationship Diagram Database of Ira Online Store Surabaya. *Computing Insight: Journal of Computer Science*, *3*(2), 28–35. https://doi.org/10.30651/comp_insight.v3i2.12002

Chandra, S., & Farisi, A. (2025). Comparative Analysis of RESTful, GraphQL, and gRPC APIs: Perfomance Insight from Load and Stress Testing. *Journal of Sisfokom*

(Information and Computer Systems), 14(1), 81–85. https://doi.org/10.32736/sisfokom.v14i1.2375

Hardyanto, C. (2022). The use of mobile technology in recording employee attendance when working from the office during the new normal of the Covid-19 pandemic. *Computing: Scientific Journal of Computer and Informatics*, *11*(1), 32–40. https://doi.org/10.34010/komputa.v11i1.7387

Kasmawi, K., Mansur, M., & Fitri, D. (2019). Location Based Service for locating local business locations using the Ionic Framework. *Matrix : Journal of Technology and Information Management* Technology, *9*, 27. https://doi.org/10.31940/matrix.v9i1.1258

Pradana, J., & Nugraheni, R. (2021). Diving into Hope in the Shadow of Work Unrest (Study at the Grobogan Regency Regional Secretariat Office). *Diponegoro Journal of Management, 10*(3), 65-79. Retrieved from https://ejournal3.undip.ac.id/index.php/djom/article/view/32439

Riyanto, N. P. (2019). Reminder System and Project Monitoring for Web-Based Employee Performance Appraisal. *Journal of Sisfokom (Information Systems and Computers), 8*(2), 172–183. https://doi.org/10.32736/sisfokom.v8i2.634

Sanmorino, A., & Isabella, I. (2017). Data flow diagram and broiler farm management information system database concept. *Global Scientific Journal of Informatics*, *8*(1). https://doi.org/10.36982/jiig.v8i1.217

Sidik, Muhammad. "E-commerce Design and Development with Research And Development Methods." *Journal of Informatics Engineering Unika Santo Thomas*, vol. 4, no. 1, 2019, pp. 99-107, https://doi.org/ 10.17605/jti.v4i1.516.

Subaeki, B. (2017). Information System Architecture Design Using the Enterprise Architecture Planning Method. *Journal of Information Technology Governance and Framework*, *3*(2), 94–101. https://doi.org/10.34010/jtk3ti.v3i2.466

Wahyuni, E. R. D., & Rakhmawati, R. (2020). The Impact of Internal Monitoring and Audit of the Asset Document Management Unit on the Quality of Asset Document Management: A Case Study of the Head Office of PT Kereta Api Indonesia (Persero). *Treasures: Journal of Archival Development*, *13*(2), 110. https://doi.org/10.22146/khazanah.55927

Warsito, A. B., Ananda, A., & Triyanjaya, D. (2017). The application of JSON data to support application development in universities with restfull techniques and web services. *Technomedia Journal*, *2*(1), 26–36. https://doi.org/10.33050/tmj.v2i1.313