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Implementation Of Geolocation Method Using Haversine Model on Internship Presence System (Case Study in One of The State-Owned Enterprises)

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ABSTRACT

Attendance is a critical metric in assessing internship participants, impacting their total evaluation during the internship duration. A state-owned firm presently employs a manual attendance system utilizing a logbook, susceptible to recording inaccuracies and data tampering. This study seeks to develop a web-based attendance system that employs geolocation techniques, enabling interns to check in without completing a logbook. This system uses the Haversine model to compute a maximum distance of 500 meters from a specified work site to guarantee the precision of attendance data.

This research also examines absence resulting from illness or authorized leave. Rapid Application Development (RAD), utilizing Unified Modeling Language (UML) for system design, is the methodology employed in creating this attendance system. The system is coded utilizing the PHP programming language and the MySQL database. This research culminates in developing a web-based attendance system that allows interns to check in at their work sites efficiently and correctly, thereby diminishing reliance on the manual logbook system.

This research entails improved precision in attendance documentation, heightened efficiency in overseeing intern assessments, and augmented accountability among interns. By applying this method, the state-owned firm can more effectively evaluate intern performance and make informed decisions concerning its organizational development and contributions.

Keywords: *Attendance, Geolocation, Haversine Formula, Web-Based System, GPS, Rapid Application Development (RAD), Unified Modeling Language (UML)*

INTRODUCTION

The advancement of information technology has revolutionized the employment environment across multiple industrial sectors, including human resource management. A crucial element of human resource management is employee or intern attendance oversight, generally known as absenteeism or attendance tracking (Marcheta et al., 2022). Technological developments enable the optimization of the data collection method by utilizing contemporary technologies. Data can be collected through specific methods to be transformed into comprehensible information.

Despite technological advancements, numerous organizations in diverse sectors continue to depend on manual techniques for gathering employee or intern data, especially in attendance tracking. Manual data collecting may result in inaccuracies in decision-making. I Gusti Ngurah asserts that manual attendance using paper and ink is highly precarious, as it is prone to loss or damage and vulnerable to alterations by unauthorized individuals. This can be exceedingly harmful when attendance data is required (Diyasa et al., 2022).

A state-owned firm operates in the technology and electronics sector and offers an internship program for vocational and college students. This program gives students the chance to acquire practical work experience in business. Managing intern attendance frequently poses difficulties owing to the substantial number of interns distributed across multiple departments or locations within the organization.

Technology provides logical approaches to tackle these difficulties. The intern attendance process is executed manually through attendance sheets, susceptible to mistakes and inefficiencies. This may result in inaccurate absenteeism data, which can influence decision-making on human resource management within the organization. Summarizing attendance data demands considerable time, diminishing overall efficiency (Muhammad Dawamul Mughni & Putri Aisyiyah Rakhma Devi, 2023).

Applying geolocation techniques utilizing the Haversine model offers a viable option to address these difficulties. The Haversine model enables the precise determination of interns' geographical placements by GPS (Global Positioning System) on smartphones and similar devices facilitated by the progression of smartphone technology. By incorporating geolocation into the attendance system, the employer can guarantee that interns can only check in if they are within a defined proximity to the designated work site. The Haversine model acknowledges that the Earth is a spherical body rather than a flat surface, exhibiting a specific degree of curvature. Using their longitude and latitude data, the Haversine formula calculates the great-circle distance between two sites on the Earth's surface. The Haversine model is utilized because it accurately computes the distance between two points utilizing latitude and longitude as input variables (Abdurrasyid et al., 2024).

Definition of Information Systems

An information system is a structured method for collecting, inputting, processing, and storing data, as well as managing, controlling, and reporting information, to enable an organization to attain its defined objectives (Fatimah et al., 2022).

Attendance System Attendance refers to gathering data to ascertain an individual's presence within a group, institution, or organization. Attendance is a significant factor as it is essential to an individual's presence. (Saragadam et al., 2024)

Location-Based Service (LBS)

Location-Based Service (LBS) refers to the technology utilized to ascertain the location of the device in use. Location-Based Services (LBS) is an information service accessible through mobile devices connected to a mobile network that can utilize the device's location. (Agramanisti Azdy & Darnis, 2020)

Geographic Information System (GIS)

Geography is employed since GIS is founded on geographical or spatial data. This geographical or spatial aspect pertains to delineating positions within a space. Geographic Information System (GIS) is a computer-based information system used to represent and study the Earth's geographical surface digitally. (Sudiatmika et al., 2021)

Google Maps Application Programming Interface

Svennerberg observes that the Google Maps API is the most extensively utilized online API. Observations from May 2010 indicate that the Google Maps API is employed in 43% of mashups (applications and websites that integrate several data sources) KANAGARAJ & SURESH (2019) as cited in The Google Maps API serves various functions, including location visualization, address lookup, driving direction acquisition, and other related aims.

Haversine Equation

The Haversine formula calculates the distance between places on the Earth's surface based on latitude and longitude coordinates. The Haversine formula is a crucial equation in navigation that calculates the great-circle distance between two sites on the Earth's surface using their longitude and latitude coordinates. Assuming the Earth is a perfect sphere with a radius ($R = 6.371 \times 10^3$ km), and the coordinates of two places in spherical coordinates are $(\text{lon1}, \text{lat1})$ and $(\text{lon2}, \text{lat2})$, the Haversine formula may be articulated using the following equation (Liu et al., 2020).

$$D=2R * \arcsin \sqrt{(\sin^2(\Delta\text{lat}/2) + \cos(\text{lat2}). \cos(\text{lat1}). \sin^2(\Delta\text{long}/2))}$$

A website is a compilation of interlinked pages that house diverse elements, including papers and photos, hosted on a web server.

Accelerated Application Development (RAD) Procedure

Rapid Application Development (RAD) is a lifecycle methodology aimed at facilitating expedited development and attaining superior quality outcomes relative to established methodologies (Hao et al., 2021). RAD integrates multiple structured methodologies with prototyping and collaborative application development techniques.

System Usability Scale (SUS) Evaluation Method

The System Usability Scale (SUS) is an evaluative instrument employed to test the usability of a product, application, or system (Elgui et al., 2020). The SUS possesses several distinctive properties that differentiate it from other questionnaires, including:

The SUS comprises 10 questions, making responses reasonably swift and straightforward.

SUS utilizes technology-agnostic principles, allowing it to assess practically all interface types.

The questionnaire is evaluated on a scale from 1 to 100, yielding a singular value facilitating comprehension across diverse fields for individuals and groups.

In light of the aforementioned dilemma, the author will undertake this research to develop a web-based attendance system that employs geolocation techniques. This system would enable interns to check in without completing an attendance log.

METHOD

This study employs a quantitative research approach to systematically evaluate the efficacy of a web-based attendance system incorporating geolocation methods. The study will utilize a Rapid Application Development (RAD) methodology, emphasizing iterative development and user feedback to enhance the system. Approximately 50 interns from a state-owned enterprise utilizing a manual attendance system will participate. Data collecting approaches will include pre-implementation surveys to provide insights on current practices and obstacles, alongside post-implementation surveys to assess user satisfaction. The system will be constructed with Unified Modeling Language (UML) for design, PHP for programming, and MySQL for database management, incorporating the Haversine model to compute distances and verify check-ins within a certain radius.

The analysis will utilize statistical approaches to compare survey responses before and after deployment, evaluating improvements in attendance accuracy and user experience. The anticipated results encompass enhanced attendance record accuracy, better efficiency in overseeing intern assessments, and augmented accountability among interns. This methodology seeks to resolve the issues associated with the existing manual logbook system, thereby improving the internship experience and offering significant insights for the firm's organizational advancement.

DISCUSSION

Examination of the Existing System Workflow

The evaluation of the existing intern attendance system is still performed manually through a logbook. This approach leads to inefficiencies in documenting and consolidating attendance reports. A new system is essential to resolve these challenges and establish a digital solution, guaranteeing that the attendance process functions successfully and efficiently.

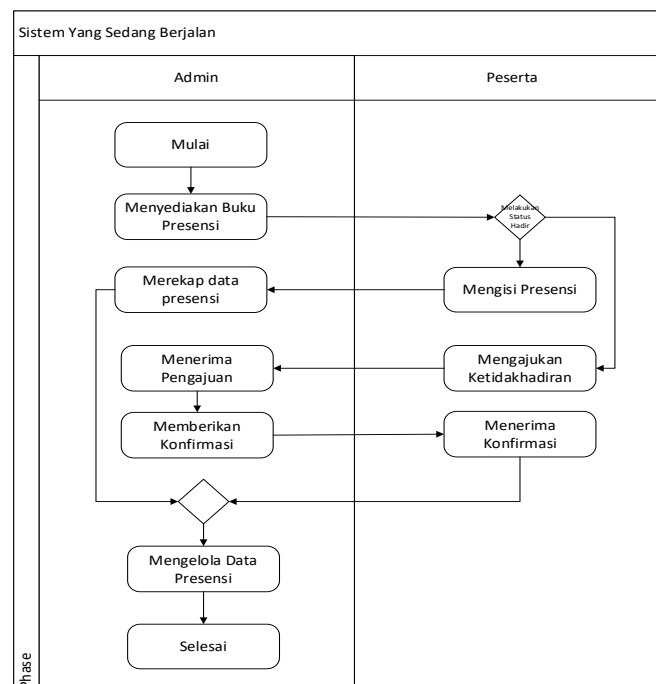


Figure 1. Examination of the Existing System Workflow

The graphic above depicts the subsequent points:

1. Interns complete the attendance log available at the gazebo.
2. The administrator verifies that the interns accurately complete the attendance log.
3. Interns who are tardy, unwell, or telecommuting must submit requests for authorization to the administrator via WhatsApp conversation.
4. Participants desiring to go early must obtain permission from the administrator and furnish a justification.
5. The administrator either approves or denies the authorization requests.
6. The administrator oversees the attendance records.

The deficiencies of the existing system encompass:

1. Interns are required to line up at the gazebo, resulting in inefficiencies and prolonged wait times.
2. Utilizing physical attendance log and manual procedures is laborious and inefficient, particularly during summarization and reporting.
3. Requesting authorization using WhatsApp and maintaining manual records complicates effectively tracking and managing permissions.
4. The manual procedure is opaque and difficult to audit, possibly resulting in data accuracy concerns.

System Architecture

System design aims to delineate the technological elements that function as solutions within the design process. At this juncture, the design will be meticulously delineated to tackle more technical concerns pertinent to implementation tasks, including Use Case Diagrams, Activity Diagrams, Sequence Diagrams, Class Diagrams, and interface design.

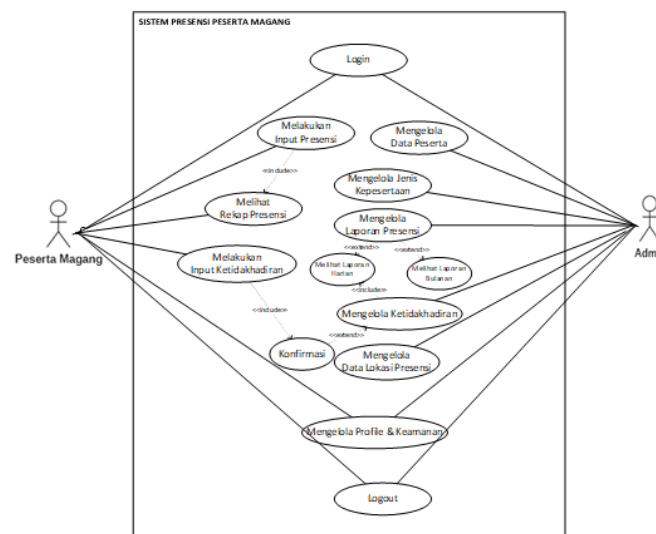


Figure 2. Use Case Diagram

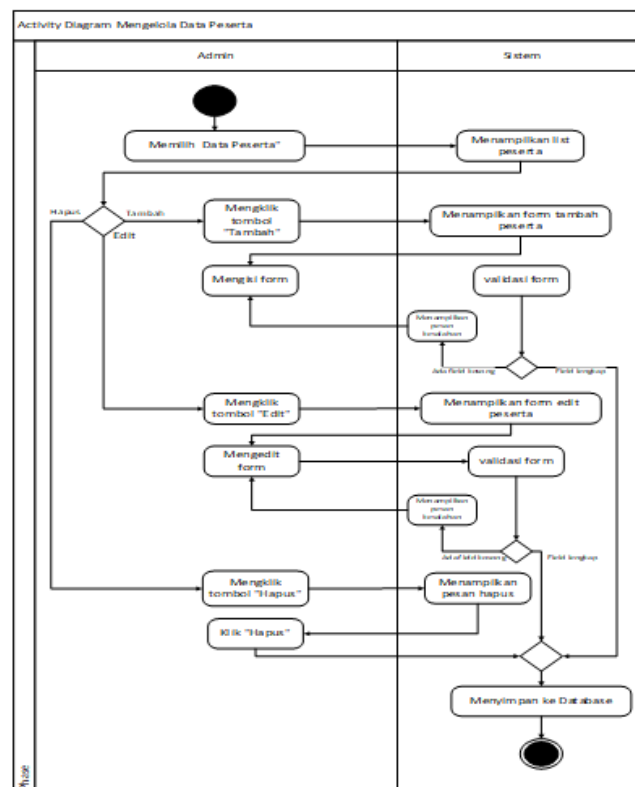


Figure 3. Activity Diagram

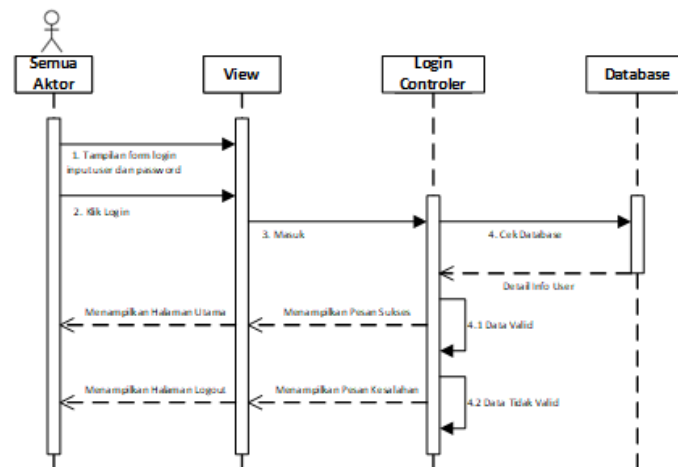


Figure 4. Sequence Diagram

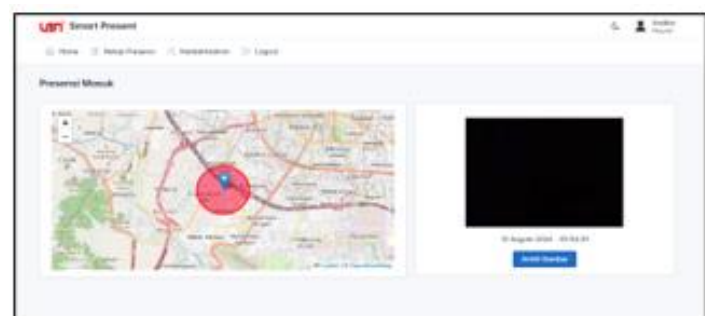
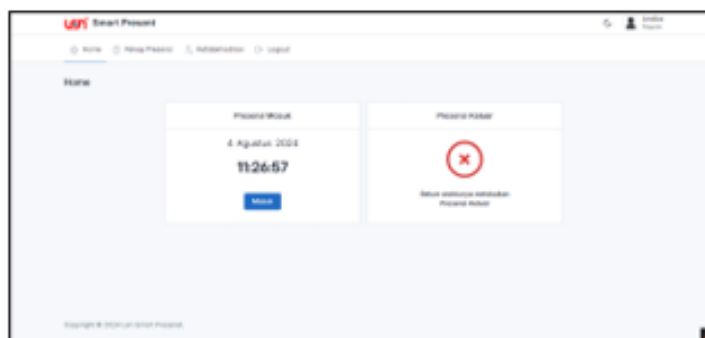
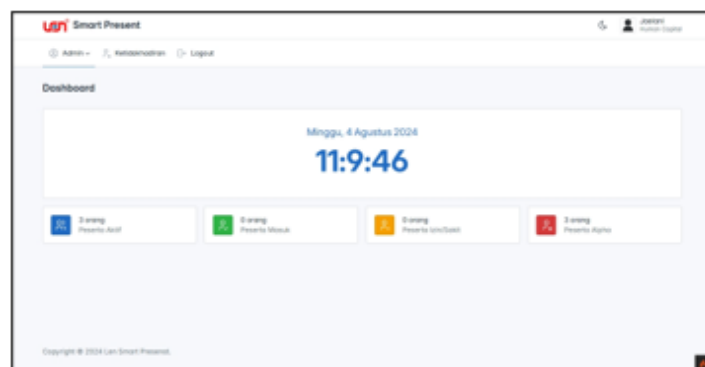


Figure 6. Admin Menu Structure



System Execution

Implementation is the process of ensuring that a program or policy is executed efficiently and that its objectives are fulfilled.



CONCLUSION

The research findings indicate the application of geolocation technology via the Haversine model in the attendance system for interns at One of The State-Owned Enterprises has resulted in notable enhancements in the precision and security of attendance data, concurrently diminishing the potential for data manipulation. This solution improves efficiency in tracking intern placements, reinforcing the concept of digital attendance management that highlights the essential role of technology in maintaining operational precision and security. This implementation enhances in One of The State-Owned Enterprises standing as a pioneer in technology and electronics.

Several proposals can be proposed for the advancement of this research. Subsequent studies may concentrate on developing a mobile Android iteration of the system to enhance accessibility. Furthermore, incorporating new features, such as a link to the evaluation system, would augment its functionality. Integrating attendance monitoring for activities such as Dhuha prayers, Zumba classes, and meal distribution could yield a more holistic attendance management system.

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