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UI/UX DESIGN OF A GEOFENCING-BASED AND BYOD-BASED STUDENT ATTENDANCE INFORMATION SYSTEM USING THE DESIGN THINKING METHOD

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Abstract—*Inefficient manual attendance systems and the increasing use of personal mobile devices among students highlight the need for digital transformation in school attendance management. This study aimed to analyze user requirements and design a web-based student attendance information system integrating Bring Your Own Device (BYOD) and geofencing technology at SMK Ganesa Satria 1. The study applied the Design Thinking method through the Empathize, Define, Ideate, Prototype, and Test stages. User requirements were identified through direct observation, semi-structured interviews, and documentation involving students, teachers, administrative staff, and parents. An interactive prototype was developed using Figma and evaluated using the System Usability Scale (SUS) involving 30 respondents consisting of 15 students, 5 teachers, 2 administrative staff, and 8 parents. The analysis identified four main user groups and produced a mobile-responsive attendance system prototype incorporating geofencing-based location validation, attendance monitoring, recap dashboards, and parental supervision features. The usability evaluation resulted in an average SUS score of 76.25, corresponding to the Acceptable category, Grade B, and a Good adjective rating. These findings indicate that the proposed prototype has a satisfactory level of perceived usability and provides a potential framework for improving the efficiency, transparency, and accuracy of student attendance management. Further development and real-world implementation are required to evaluate its operational effectiveness.*

Keywords: *attendance system, BYOD, design thinking, geofencing, user interface.*

Abstrak—*Sistem absensi manual yang tidak efisien serta meningkatnya penggunaan perangkat pribadi oleh siswa menunjukkan perlunya transformasi digital dalam pengelolaan kehadiran di sekolah. Penelitian ini bertujuan untuk menganalisis kebutuhan pengguna dan merancang sistem informasi kehadiran siswa berbasis web yang mengintegrasikan konsep Bring Your Own Device (BYOD) dan teknologi geofencing di SMK Ganesa Satria 1. Penelitian menerapkan metode Design Thinking melalui tahapan Empathize, Define, Ideate, Prototype, dan Test. Kebutuhan pengguna diidentifikasi melalui observasi langsung, wawancara semi-terstruktur, dan studi dokumentasi yang melibatkan siswa, guru, staf tata usaha, serta orang tua. Prototipe interaktif dikembangkan menggunakan Figma dan dievaluasi menggunakan System Usability Scale (SUS) dengan melibatkan 30 responden yang terdiri atas 15 siswa, 5 guru, 2 staf tata usaha, dan 8 orang tua. Hasil analisis mengidentifikasi empat kelompok pengguna utama dan menghasilkan prototipe sistem absensi responsif berbasis perangkat seluler yang mencakup validasi lokasi berbasis geofencing, pemantauan kehadiran, dasbor rekapitulasi, serta fitur pengawasan orang tua. Evaluasi usability menghasilkan skor rata-rata SUS sebesar 76,25, yang termasuk dalam kategori Acceptable, memperoleh Grade B, dan berada pada kategori Good berdasarkan adjective rating. Hasil tersebut menunjukkan bahwa prototipe yang diusulkan memiliki tingkat persepsi kegunaan yang baik dan berpotensi menjadi kerangka untuk meningkatkan efisiensi, transparansi, serta akurasi pengelolaan kehadiran siswa. Pengembangan lebih lanjut dan implementasi pada lingkungan nyata masih diperlukan untuk mengevaluasi efektivitas operasional sistem.*

Kata Kunci: *antarmuka pengguna, BYOD, design thinking, geofencing, sistem informasi kehadiran.*

INTRODUCTION

The current development of information technology has driven massive digital transformation in various sectors of life, including the education sector (Sipayung, Wahyuni, & Hermansyah, 2025). One of the important pillars in school management that requires digitalization is the attendance recording system. A digital-based attendance recording system can improve the accuracy of student attendance records and minimize errors often associated with manual systems (Bahri & Setyawan, 2026). The discipline of student attendance is the main indicator of the success of the teaching and learning process as well as a reflection of the institution's commitment to maintaining academic quality. However, the practice of managing attendance at SMK Ganesa Satria 1 located in Depok City, West Java is currently still facing serious operational obstacles.

Based on initial observations, the daily attendance process at SMK Ganesa Satria 1 still relies on manual recording on paper by class teachers. This conventional method triggers inefficiency in teaching and learning time because teachers have to call out the names of students one by one. In addition to taking time, manual recording has a high level of vulnerability to potential fraud (such as attendance manipulation or "absenteeism"), the risk of physical damage to recapitulation documents at the Administration (TU) level, and weak data transparency for parents of students who are often late to find out about their children's absence (skipping school) until the end of the semester.

On the other hand, the development of gadget penetration is not limited to the general public but has also extended into the realm of education (Setiawati & Atmawati, 2022), specifically the use of smartphone by students. SMK Ganesa Satra 1, for instance, allows students to bring their devices to school. This phenomenon opens up opportunities for the implementation of the Bring Your Own Device (BYOD) concept, which is the active use of students' personal devices to carry out digital presence independently and instantly. The BYOD concept is considered efficient because schools do not need to invest in large-scale procurement of special hardware that is prone to physical damage (Djamarullah, 2024).

Several previous studies have tried to solve the problem of attendance in schools and agencies. Research by (Maulana & Purnama, 2025) designing a conventional web-based attendance system, but the system is not equipped with the validation of the user's physical location, so that the gap in fraud in the form of filling out attendance from outside the school area is still wide open. Another study proposed the use of fingerprint scanner hardware (Reski et al., 2024). While accurate in minimizing identity fraud, this solution requires high infrastructure investment costs for schools and is prone to long queue disruptions during school hours.

To overcome this gap, this study integrates Geofencing based technology to automatically lock the coordinates of the location of students' devices within the school's virtual radius. Geofencing technology is built upon geolocation technology to create a virtual fence around a specific location (Shevchenko & Reips, 2024). In student attendance systems, geofencing is used to ensure that attendance can only be recorded when students are within a designated school area, thereby enabling accurate attendance monitoring while preventing location-based fraud (Utomo, Sopingi, & Permatasari, 2026). This system will be implemented using the BYOD concept to minimize infrastructure investment costs. In addition, the system is combined with a real-time notification portal for students' parents to enhance transparency regarding student attendance.

In designing this system, the Design Thinking method was chosen as the main approach. In contrast to traditional software development methodologies such as Waterfall or Agile which focus heavily on the technical aspects of the system's functionality, the Design Thinking method works with the principle of human-centered design (Permadi, Aftaviani, & Muslim, 2024). This approach is crucial in the context of schools, where the system built must accommodate the needs of four actors with very contrasting characteristics and levels of digital literacy, namely Students, Teachers, TU Admins, and Parents. Students serve as the primary actors and data sources within the attendance information system; their data is monitored by teachers and parents, while TU admins manage the master data and overall system configuration. Through the stages of empathy to testing, the resulting interface design (UI/UX) is expected to be not only rich in technical features but also have a high level of usability.

Based on this background, this study aims to analyze the functional needs of users and design a comprehensive interface (UI/UX) of the Geofencing and BYOD-based student attendance information system. In addition, an evaluation was conducted to assess the users' perceived usability of the proposed prototype. Through the design of this prototype system, it is hoped that SMK Ganesa Satria 1 will have a strong foundation to implement a presence system that is transparent and efficient in order to support a more modern educational ecosystem.

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RESEARCH METHODS

This study uses a case study approach by applying qualitative descriptive methods to analyze needs, as well as interaction design engineering methods to design system interfaces. The research location focuses on SMK Ganesa Satria 1, Depok City, West Java.

Data Collection Techniques

Primary data collection was carried out intensively at SMK Ganesa Satria 1 to capture real problems (pain points) through three main instruments:

1. Direct Observation: Conducted for one week during school and school hours to observe the interaction of teachers and students during the process of recording manual attendance in the classroom as well as recapitulation of physical data by Administration (TU) staff.
2. Semi-Structured Interview: Involving stakeholder representatives consisting of 1 TU Chief of Staff, 2 class teachers, 3 parents and 5 students from different grade levels to gain a multi-actor perspective.
3. Documentation Study: Analyzing physical documents in the form of class journals, monthly attendance recapitulation sheets, and school accreditation report formats to map the needs of the system's output data structure.

Stages of Design Thinking

Design thinking is a user-focused problem-solving method that involves reframing problems in human-centric ways, generating numerous ideas through brainstorming, and adopting a hands-on approach to prototyping and testing (Aryansyah, Sokibi, & Fahrudin, 2023). The design thinking approach was introduced in 1990 by David Kelley and Tim Brown of IDEO, a design consultancy specializing in product design innovation (Alfirahmi, Kania, & Yusup, 2023).

To provide a systematic overview of the stages of problem solving, the research flow is designed by adopting the Design Thinking framework as shown in Figure 1.



Source : (Research Results, 2026)

Figure 1. Design Thinking-Based Research Flow

The Design Thinking method is applied as the main framework because of its human-centered nature to bridge the digital literacy gap between users (Anwar, Ratnasari, Wicaksono, & Dzakiyullah, 2024). The stages of operational work in this study are detailed as follows:

1. Empathize Stage

This stage aims to understand the user experience objectively without the researcher's subjective assumptions. The data from interviews and observations were processed and mapped into the Empathy Map to identify what feel, think, say, and do by each user actor related to the current school attendance system.

2. Definition Stage

The analysis stage is to synthesize findings from the empathy stage to formulate the core problem. The outputs of this stage include:

a. Functional Needs Matrix by Actor: Summarizes the characteristics of digital literacy, the main goals, and the main obstacles of each actor (Students, Teachers, TU Admins, and Parents).
b. How Might We (HMW): The process of formulating questions that trigger creative ideas (e.g., "How can we design a self-attendance system that is fast and avoids location fraud?").

3. Ideate Stage

The solution exploration phase is based on the agreed HMW formula. At this stage, it includes the formulation of the application menu for each actor. At this stage, Geofencing mathematical logic based on the coordinates of the earth coordinates (Latitude and Longitude) is formulated to lock the radius of presence.

4. Prototype Stage

Translating ideas into designs that can be tested interactively. The prototype manufacturing process is designed using the Figma design application. The end result is a high-fidelity user interface that is interconnected (clickable prototype) so that it resembles the original application to be simulated to the user. The calculation of the horizontal distance between two coordinate points on the earth's surface is solved mathematically using the Haversine Formula as in the following equation:

$$\Delta\emptyset = Lat_{user} - Lat_{center} \quad (1)$$

$$\Delta\emptyset = Lon_{user} - Lon_{center} \quad (2)$$

$$\alpha\ sin^2\left(\frac{\Delta\emptyset}{2}\right) + \cos(Lat_{center}) \cdot \cos(Lat_{center}) \cdot \sin^2\left(\frac{\Delta\lambda}{2}\right) \quad (3)$$

$$c = 2 \cdot \arctan 2\left(\sqrt{a}, \sqrt{1-a}\right) \quad (4)$$

$$d = R \cdot c \quad (5)$$

Where:
d = The distance between the student's position and the school's coordinate center (in meters).
R = Average radius of the earth (6,371,000 meters).
{Lat} and {Lon} have been converted into *radian units* before processing.

5. Test Stage
The evaluation of the resulting prototype uses the System Usability Scale (SUS) to quantitatively measure the usability of the user interface. SUS testing used a standard 10-item questionnaire with a Likert response scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) distributed to representatives of target users after prototype testing (Prastiyo & Sundari, 2023). 10 standard Indonesian SUS questions as described in Table 3.

Table 3. SUS Standard Questionnaire Question Instrument Matrix

Q	SUS Questionnaire Question Items
Q1	I think I will use this geofencing-based attendance system regularly if implemented.
Q2	I found the interface of this attendance system to be complicated and confusing to use.
Q3	I find this self-attendance system very easy for anyone to use.
Q4	I think I'll need the help of someone else or a technician to be able to use this system.
Q5	I found that the various functions and menus in this attendance system are already very well integrated.
Q6	I feel that there are a lot of things that are inconsistent (changing the layout) in this system.
Q7	I imagine most people (including the parents of students) will learn to use this system quickly.
Q8	I find this attendance system to be very exhausting and impractical when used.
Q9	I feel very confident and not afraid of making mistakes when operating this attendance system.
Q10	I feel like I have to learn a lot of things first before I can use this attendance system.

Source : (Research Results, 2026)

The final SUS score is converted into the system's eligibility criteria (Adjective Rating and Grade Scale). The final SUS score is calculated using the following conversion formula:

For odd-numbered questions (positive questions)

$$X_i = Respons\ Score - 1 \quad (6)$$

For even-numbered questions (negative questions)

$$Y_i = 5 - Respons\ Score \quad (7)$$

Cumulative respondent score:

$$Skor\ SUS = \left(\sum_i X_i + \sum_j Y_j\right) \times 2{,}5 \quad (8)$$

The results of this test will be used to evaluate and improve the next version of the prototype, such as enhancing the workflow, features, and user interface.

RESULTS AND DISCUSSION

The application of the Design Thinking method in this study focuses on aligning user needs (human-centered) with the limitations of Geofencing technology and the Bring Your Own Device (BYOD) policy at SMK Ganesa Satria 1. The elaboration of the research results is systematically divided based on five stages of Design Thinking work.

Empathize Stage

The initial stage is carried out to identify and understand the real obstacles (pain points) faced by Students, Teachers, Administrative Staff (TU), and Parents. Qualitative data collection was carried out through direct observation at SMK Ganesa Satria 1 for one week and semi-structured interviews with representatives of each actor (1 TU Chief of Staff, 2 class teachers, 3 parents and 5 students).

The results of the Empathy Map identified three main problem clusters:

1. Inefficiency of Teaching and Learning Activity Time: The process of manually calling attendance one by one by the teacher takes about 10 to 15 minutes at the beginning of the lesson.
2. Weak Transparency of Attendance Data: Parents of students do not get access to daily attendance information quickly. Information on absenteeism is generally only known when the school sends a physical summons letter at the end of the semester.
3. Risk of Data Corruption and Manipulation: Physical recapitulation at the TU level is prone to the risk of lost or damaged papers, as well as the existence of attendance manipulation gaps ("absenteeism") by fellow students on manual attendance sheets.

Define Stage

The Define stage aims to analyze the results of empathy in order to formulate specific functional needs of the system. The first step is the preparation of the User Persona to present the characteristics and expectations of the target user, as presented in Table 1.

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Table 1. Functional Needs Matrix Based on Actors

Actor/ User	Characteristics of Digital Literacy	Main Needs (Goals)	Major Obstacles (Pain Points)
Students	High (Familiar with smartphones)	Attend independently, instantly, without physical queues.	Limited device storage memory for new app installations.
Teacher	Medium	Monitor class attendance recaps in real-time without wasting teaching and learning time.	Administrative burden is excessive if the system is difficult to operate.
Admin TU	Medium - High	Automate monthly recaps and export reports to digital formats.	The process of manual data re-entry that triggers input errors (human error).
Parents	Low - Medium	Receive notifications or see your child's attendance status instantly.	Difficulty understanding application menus that are too complex.

Source : (Research Results, 2026)

After mapping needs, creative ideation triggering questions were formulated using the How Might We (HMW) method as the basis for designing solutions:
"How can we build a student personal device-based self-attendance system (BYOD) that is practical, but has a location validation system that is safe from fraud?"
"How to present a very simple attendance information portal so that it is easy for parents with various levels of digital literacy to understand?"

Ideate Stage

In the Ideate stage, the system architecture and location locking logic (Geofencing) were designed to answer the challenge of attendance manipulation. The system is designed to be web-based and mobile-friendly to overcome the memory constraints of students' devices (the concept of BYOD without the need to install additional .apk applications).

1. Application Menu

Based on the identified functional requirements, the system provides different menus and features for each user role. The distribution of application menus for Students, Teachers, Parents, and Administrative Staff is presented in Table 2.

Table 2. Actors and menus of each dashboard

Actors	Menu
Students	Login Page, Home Page, Attendance History Page, Student Profile Page
Teacher	Login Page, Main Page, Daily Journal Page, Student Monitoring and recapitulation Page, Teacher Profile Page
Parents	Login Page, Home Page, Student Attendance History Page, Guardian Profile Page
Admin TU	Login Page, Student Monitoring Page, Teacher Management Page, Curriculum Management Page, Recapitulation Page, Geofencing Settings Page

Source : (Research Results, 2026)

2. Mathematical Logic of Geofencing Radius

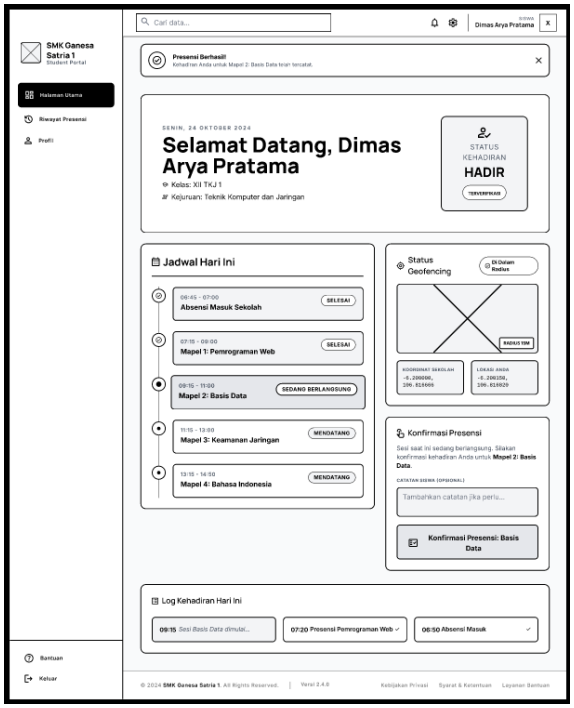
Location security is validated by comparing the GPS coordinates of the student's device (LatUSER, LonUser) with the coordinates of the school center that has been registered in the system (LatUSER, LonUser). The calculation of the horizontal distance between two coordinate points on the earth's surface is solved mathematically using the Haversine Formula. The system sets an attendance tolerance radius of d_limit < 50 meters. If the calculation results show that d > 50 meters, then the attendance module will be automatically locked (disabled) and the system will refuse to send attendance data.

Prototype Stage

The user interface design process is developed in stages from low to high precision to ensure optimal usability.

1. Low-Fidelity Design (Lo-Fi / Wireframe)

Low-fidelity design focuses on developing concepts and screen layouts (Irsan, Ismawan, & Fahrurozi, 2026), without implementing colors other than black, white, or gray (Wijayanto & Habibulloh, 2025). At this stage, button functionality, static radius mapping, and basic navigation structure are mapped to make it easier for users with low levels of digital literacy. Rough sketches are made on the student's home module that prioritizes the main attendance button, the teacher dashboard module that highlights the graphical summary, and the parent portal with a minimalist layout containing the child's attendance log. The resulting low-fidelity prototype of the student home page, which emphasizes the main attendance function and a simple navigation structure, is illustrated in Figure 2.



Source : (Research Results, 2026)

Figure 2. LoFi Student Home Page

2. High-Fidelity (Hi-Fi) Design

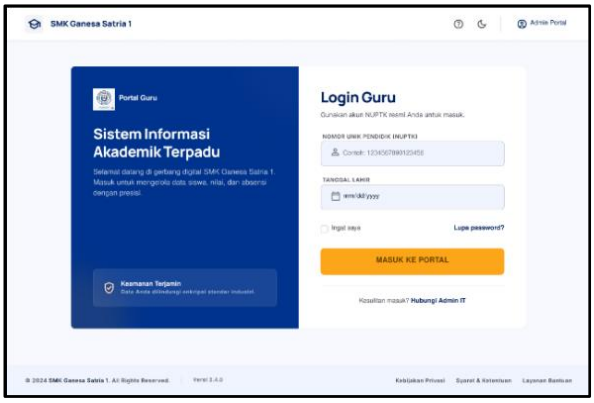
The high-precision (Hi-Fi) prototype is then designed in detail using the Figma application by applying consistent and interactive visual components. The design is focused on three main modules:

a. Mobile-Responsive Student Interface: Contains a compact, interactive embedded map visualization that marks the actual position of the students and the school's radius limits. The "Send Attendance" button will only be green (active) if the student's coordinates are verified within a radius of 50 meters.

b. Teacher and TU Monitoring Dashboard (Desktop): Equipped with a contrast metrics card widget to visually present daily attendance percentages, weekly fluctuation graphs, and a one-click button for direct data export to Excel/PDF format.

c. Parental Supervision Portal: Has a minimalist layout with a time-attendance log card system. This page uses large fonts (at least 14 pt) and bold color contrast (Green for attendance, Yellow for permission/illness, and Red for harp) to make it easy to monitor parents. This page only requires a simple login in the form of a Student Identification Number (NIS) to minimize the problem of forgetting passwords.

One of the high-fidelity interface designs developed in this study is the teacher login page, as shown in Figure 3.



Source : (Research Results, 2026)

Figure 3. Teacher Login Page

On the login page, each actor has a username and password that is adjusted. The login of teachers and admins uses the NUPTK number, which is the identity number of the teacher and admin, the student login uses the NIS number, which is the national identification number of a student, while the student's guardian only logs in using the NIS of his child who is a student at SMK Ganesa Satria 1 Depok.

3. ADMIN PORTAL (Admin Dashboard) - Full Administrative Management

Become the master data control center, total supervision of the school ecosystem, and geofencing system configuration.

a. Main Monitoring Page (Monitor)

Donut Chart Analytics: A large pie chart that maps the total attendance statistics of all students in real-time on the day (e.g.: 850/1000 Students, 85% Present, 10% Absent, 5% Late/Permit).

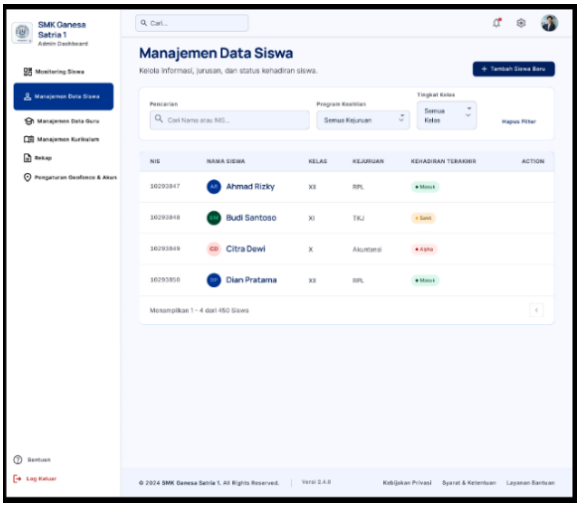
Radar Radius Limit Info: A visual panel confirming the active status of the geofence of the tight perimeter of the 50-meter radius.

Recent Attendance Logs: A log table of logs of incoming activity that runs automatically per second, monitoring the Name, Class, Major, and compliance status of the zone ("Valid (In Zone)" or "Invalid (Out of Zone)").

b. Student Data Management Page

CRUD (Create, Read, Update, Delete) menu complete with advanced search filters based on Skill Program (Vocational) and Grade Level to add, delete, or edit student data. The student data management interface enables administrators to manage student records through CRUD functions and filtering features, as illustrated in Figure 4.

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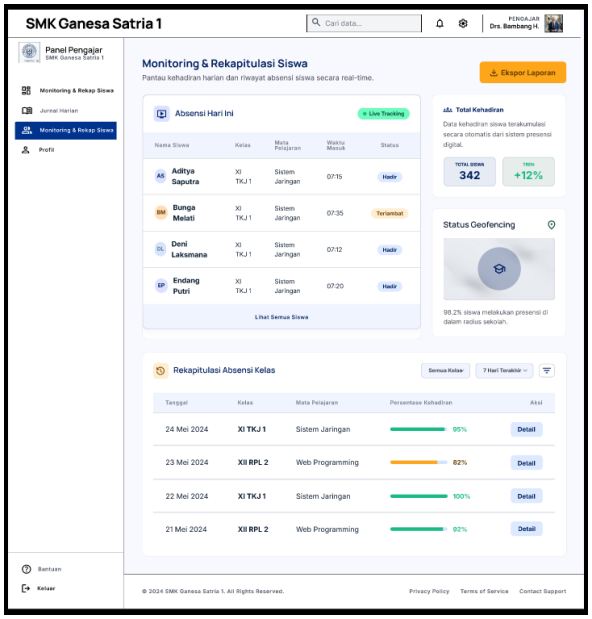


Source : (Research Results, 2026)

Figure 4. Student Data Management Page on the Admin Dashboard

c. Teacher Data Management Page

Manage a database of all teaching staff, track staffing status (Permanent/Honorary), map teacher classes, and monitor the status of teachers' work attendance (Active, Permit, Leave). The teacher monitoring and recapitulation dashboard was designed to provide teachers with centralized access to attendance information and related monitoring features, as shown in Figure 5.



Source : (Research Results, 2026)

Figure 5. Teacher Dashboard Page Monitoring & Recapitulation

d. Curriculum Management Page

Features of managing the school curriculum structure, subject code, division of subject groups (Vocational/General), and class level allocation.

e. Recapitulation & Statistics Page (Recap)

High-Level Cards: Displays the school's macro performance metrics: Total School Attendance (94%), Highest Attendance Class (XII RPL 1 - 98.5%), and Lowest Attendance Class (X TKJ 2 - 82.1%).

Insights Engine: An automated analysis box that gives early warning to the school, for example: "Attention in class X TKJ 2, 5 students have a high attendance rate in a row".

Report Documentation: One-click button to download a ready-to-use monthly report (Export Report / Export to CSV) for school accreditation needs.

f. Geofencing Settings Page (Core System Config)

This is the most crucial feature for administrators. Admins can accurately enter the school's geographic coordinates via the Center Point Latitude (-6.200000) and Center Point Longitude (106.816666) fields.

There is an interactive "Distance Slider" component to flexibly adjust the student's attendance tolerance radius from a minimum range of 10 meters to a maximum of 200 meters (on the screen is ideally set at 50m). This setting is immediately manifested in the visualization of the blue radius circle (School Zone Geofence Active) on the map.

4. TEACHER PORTAL (Teaching Panel) - Desktop Layout

Focus on the efficiency of teacher administration so that the attendance recording process no longer takes up 10-15 minutes of teaching and learning time.

a. Teacher Login Page

Use the educator's official identity number (NUPTK/NIP) and date of birth as a secure login credential.

b. Teacher Panel Home Page

Dashboard Overview: Greet the teacher (example: Drs. Bambang H.) and provide information on the number of teaching sessions that day.

Today's Teaching Schedule: Displays a timeline of classes that must be taught complete with Classroom/Lab information and indicators of teaching status.

Compact Analytics Widget: Displays two main metric cards, namely Average Attendance (a graph of the percentage of student attendance today compared to yesterday) and the ratio of Journals Filled in the current month.

Recent Activity & Shortcuts: A system activity log providing real-time document storage status updates or automated notifications regarding student absences (e.g., "Student Absent: Ahmad

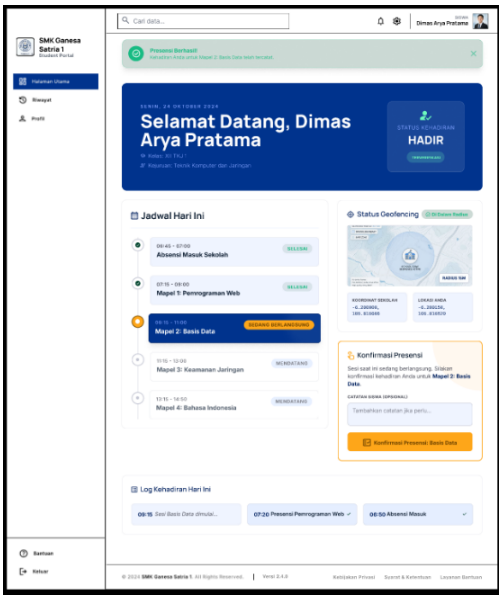
Zulfikar - Status: Permission (Doctor's Note Attached)"). Includes quick-access buttons for the Teacher Meetings, Download Reports, Student Counseling, and Student Achievements menus.

c. Pages of the Teaching Daily Journal
Teachers can document teaching materials through the "+ Create New Journal" button. The reporting history table contains Class and Subject filters, as well as tracks the verification status of documents ("VERIFIED" by curriculum or "PENDING").

d. Student Monitoring & Recapitulation Page
Live Attendance Tracking Today: Displays a walk-through list of students who attended in real-time complete with their exact entry time and automatic status (Present/Late).
Macro Geofencing Status: Displays the percentage of student location compliance ("98.2% of students are present within the school radius").
Class Attendance Recap: A summary table of attendance performance per class per date with percentage indicators and Detail buttons.

e. Teacher Profile Page
Contains personnel info, a list of main subjects, classes taught, teaching history for the current semester, and device login activity tracker for teacher account security.

5. STUDENT PORTAL - Mobile-Responsive Optimized
The mobile-responsive student portal was designed to support the BYOD concept and provide easy access to attendance, geofencing status, schedules, and attendance history, as presented in Figure 6.



Source : (Research Results, 2026)
Figure 6. Student Home Page

a. Student Login Page
Uses double security in the form of Student Identification Number (NIS) and Date of Birth (mm/dd/yyyy format) to ensure authentication, and is supported by End-to-End SSL encryption security.

b. Home Page (Home Presence)
Welcome Banner & Status Card: Personally welcome the student's name (example: Dimas Arya Pratama - XII TKJ 1) with a large status card "PRESENT - VERIFIED" if the attendance is successful.
Geofencing Status Widget: This is a core feature of the anti-cheating. The screen displays a dynamic mini-map (Geofence Active - Radius 15M) complete with transparency of coordinate data: School Coordinates (-6.200000, 106.816666) compared directly to Your/Student Location (-6.200150, 106.816820). The system automatically gives a green indicator if the student is in the "Safe Zone".
Today's Schedule Timeline: A sequential list of daily subjects featuring dynamically colored status labels such as "COMPLETED" "IN PROGRESS" or "UPCOMING".
Attendance Confirmation Module: Students can self-attend an active session, type "Student Notes (Optional)", and press the main action button "Attendance Confirmation: [Subject Name]".
Today's Attendance Log: A timestamp track record of student attendance activity for the day (e.g.: 06:50 Attendance Log, 07:20 Web Programming Attendance).

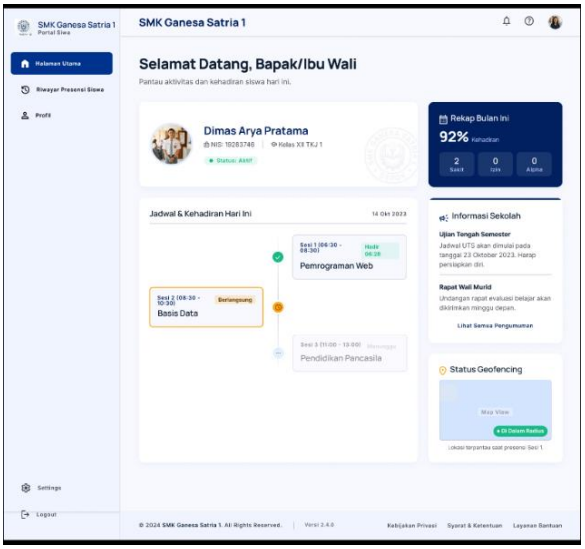
c. Attendance History Page
Displays a weekly cumulative summary card (example: 18/20 Sessions Met) and a Geofencing Accuracy index (example: 98% Valid, average distance of 15m).
Contains an in-depth history table that tracks student attendance distances in meters. Remarkably, this table is able to detect and mark "Invalid" data if the distance is too far (example: Distance 120m, note: In the library).

d. Student Profile & Telemetry Page
In addition to personal information management and password updates, this page has a Device Telemetry feature. This feature diagnoses the GPS signal strength of the student's device, the type of OS (Android/iOS), and the accuracy of the location estimate (e.g., < 5 meters) to ensure the feasibility of the student's BYOD device.

6. PARENT PORTAL - Minimalist & High Accessibility Layout
To facilitate attendance monitoring by parents, a simple and accessible guardian homepage was also

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developed, as illustrated in Figure 7. It is designed with a very clean interface, large texts, and simple navigation to accommodate the variation of students' parents' digital literacy levels.



Source : (Research Results, 2026)

Figure 7. Home Page of Guardians of Students

a. Parent Login Page

Only requires a 10-digit Student Identification Number (NIS) of the child. This design solves the main problem for parents who often struggle or forget passwords (pain points).

b. Portal Home Page

Child's Monthly Status & Recap: Directly displays a brief child's profile, activity status, as well as a summary box diagram of the child's monthly attendance which is divided into Attendance (Percentage), Sick, Allows, and Alpha.

Today's Schedule & Attendance: Parents can see what time their child taps in attendance at school (example: Session 1: Attendance at 6:28 a.m.) live.

Geofencing Status (Map View): Displays an "Within Radius" assurance label confirming that the child's position was actually detected inside the school when the attendance was sent.

School Information: Important school announcements (such as UTS info or meeting invitations) are presented directly on the homepage so that parents do not miss out on information.

c. Student Attendance History Page

Filter based on Day, Month, and Semester with a complete history table containing information on hours, subjects, and Geofencing location validation status.

d. Profile & Settings Page (Notification Preferences)

Display data on the alignment of family relationships (biological father/mother).

Notification Featured Features: Parents can enable the Real-time Notifications toggle via WhatsApp (send automatic messages to the parent's mobile phone number when their child is absent from school) as well as automatic automatic sending of weekly attendance PDF reports to the parent's email.

Test Stage

Evaluation of the system prototype is carried out empirically to validate the level of usability of the designed interface. The evaluation of perceived usability was quantitatively measured through the System Usability Scale (SUS) questionnaire instrument. This questionnaire was distributed to 30 respondents consisting of 15 Students, 5 Teachers, 2 TU Admins, and 8 Parents after they simulated an interactive prototype of Figma.

Table 4 below presents a summary of respondent answers and the results of the SUS score calculation.

Table 4. Summary of Respondent Answers

R	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	Q 8	Q 9	Q 10	SUS Score
R1	5	2	5	2	3	3	3	2	5	2	75
R2	5	2	5	2	3	2	3	3	4	1	75
R3	5	3	3	1	5	2	5	1	3	3	77,5
R4	4	2	5	2	5	2	5	3	4	3	77,5
R5	4	2	3	2	5	3	5	1	3	2	75
R6	3	1	4	1	4	1	3	3	4	1	77,5
R7	4	2	3	1	4	3	5	1	4	3	75
R8	3	2	5	3	3	1	4	3	5	1	75
R9	4	3	5	1	5	2	3	3	3	1	75
R10	5	3	4	2	5	2	3	1	5	3	77,5
R11	5	3	4	1	3	2	5	3	4	2	75
R12	4	2	5	1	4	3	3	1	3	1	77,5
R13	5	2	3	3	4	1	4	1	3	1	77,5
R14	5	1	5	3	3	2	3	2	4	1	77,5
R15	5	1	3	1	4	2	5	2	3	3	77,5
R16	4	3	4	3	5	1	4	1	5	3	77,5
R17	5	2	4	1	5	3	3	2	3	1	77,5
R18	4	1	3	1	5	2	5	3	3	2	77,5
R19	5	2	4	2	5	3	4	3	5	2	77,5
R20	5	3	4	2	3	3	4	2	5	1	75
R21	4	2	5	2	4	2	3	1	3	2	75
R22	4	2	3	1	4	2	3	1	4	1	77,5
R23	5	1	4	1	4	3	4	3	4	2	77,5
R24	3	1	5	1	4	2	3	1	3	3	75
R25	4	3	5	1	4	3	3	2	4	1	75
R26	5	2	4	1	5	2	4	3	3	3	75
R27	5	2	3	2	3	2	5	1	4	3	75
R28	3	2	5	3	4	2	4	2	4	1	75
R29	3	2	5	2	4	2	3	1	4	2	75
R30	4	2	3	3	5	1	4	2	4	1	77,5
									Average Score		76,25

Source : (Research Results, 2026)

Based on the results of the recapitulation of questionnaire data from 30 respondents, the cumulative average score of SUS was 76,25. Based on the SUS standard assessment scale, the score shows:

1. Acceptability Ranges: Is in the Acceptable category (Acceptable to all user groups).
2. Grade Scale: Obtained the title of Grade B.
3. Adjective Rating: Falls into the category of Good qualifications.

The results of this quantitative evaluation indicate that the perceived usability of the Geofencing and BYOD-based student attendance information system interface design is highly accepted by users and has a high level of usability to be implemented at SMK Ganesa Satria 1.

Limitations of the Study

While this study offers valuable insights, it has some limitations; notably, the case study was confined to a single school, SMK Ganesa Satria 1. Furthermore, the testing phases relied solely on a prototype or UI/UX design. As the system has not yet been deployed in a real-world environment, further research is expected to continue this interactive design prototype into the actual software development stage (coding/development) using stable responsive web frameworks with precise location API integration.

CONCLUSIONS AND LIMITATIONS

Based on the results of needs analysis, interface design, and testing that have been carried out throughout the stages of Design Thinking work, several main conclusions can be drawn as follows:

Alignment of Multi-Actor Needs: The application of the Design Thinking method has proven to be effective in mapping and bridging the contrasting digital literacy level gap among the four main actors (Students, Teachers, TU Admins, and Parents) at SMK Ganesa Satria 1.

System Efficiency and Transparency: The integration of the Bring Your Own Device (BYOD) concept combined with Geofencing location locking logic offers a solution to enhance student attendance system efficiency while minimizing infrastructure investment costs. In addition, the parent portal provides transparent collaborative supervision directly to the student's guardian's device.

Interface Perceived Usability: Quantitative evaluation using the System Usability Scale (SUS) questionnaire instrument resulted in a cumulative average score of 76.25. Based on the SUS standard standards, these results prove that the perceived usability of the prototype design is in the range of Acceptable, obtained the Grade B predicate, with a Good feasibility level to be implemented in real terms.

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