Development of a Digital Attendance System Using the Appsheet Application with GPS and Biometric Verification

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Article Info	Abstract
	This study aims to develop a digital attendance application based on AppSheet at SMPN 2 Satu Atap Sluke, Sluke District, Rembang Regency, with a focus on measuring the validity, practicality, and excellence of the product. The application is designed as an innovative solution to replace the manual attendance system that has been used so far, which often poses challenges related to data accuracy and student discipline. The research method employed is Research and Development (R&D) using the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. Data collection was carried out through interviews, questionnaires, observations, and document analysis. The collected data were analyzed using descriptive techniques and hypothesis testing through expert validation, product practicality tests, one-sample t-tests, and simple linear regression tests. The results show that the digital attendance application based on AppSheet was declared highly valid with a score of 98% and an average of 92.31%, categorized as "Very Good." In addition, the application proved to be practical, superior compared to manual attendance, and effective in improving student attendance discipline, although statistically the effect was not significant. In conclusion, this application meets the quality criteria in terms of content, appearance, and functionality, making it feasible for use. The novelty of this study lies in the utilization of AppSheet with the integration of GPS and biometric technologies, which have not previously been applied in school attendance systems.

Artikel Info	Abstrak
	Penelitian ini bertujuan untuk mengembangkan aplikasi presensi digital berbasis AppSheet di SMPN 2 Satu Atap Sluke, Kecamatan Sluke, Kabupaten Rembang dengan fokus pada pengukuran validitas, kepraktisan, dan keunggulan produk. Aplikasi ini dirancang sebagai solusi inovatif untuk menggantikan sistem presensi manual yang selama ini digunakan dan sering menimbulkan kendala terkait akurasi data maupun kedisiplinan siswa. Metode penelitian yang digunakan adalah Research and Development (R&D) dengan model ADDIE yang meliputi tahapan analisis, desain, pengembangan, implementasi, dan evaluasi. Pengumpulan data dilakukan melalui wawancara, kuesioner, observasi, dan analisis dokumen. Data yang diperoleh kemudian dianalisis menggunakan teknik deskriptif serta pengujian hipotesis melalui validasi ahli, uji kepraktisan produk, uji t satu sampel, dan uji regresi linier sederhana. Hasil penelitian menunjukkan bahwa aplikasi presensi digital berbasis AppSheet dinyatakan sangat valid dengan skor 98% dan rata-rata 92,31% yang termasuk kategori "Sangat Baik". Selain itu, aplikasi terbukti praktis, unggul dibandingkan presensi manual, dan mampu meningkatkan kedisiplinan kehadiran siswa meskipun secara statistik pengaruhnya belum signifikan. Kesimpulannya, aplikasi ini memenuhi kriteria kualitas dari segi isi, tampilan, dan fungsionalitas sehingga layak untuk digunakan. Kebaruan penelitian terletak pada pemanfaatan AppSheet dengan integrasi teknologi GPS dan biometrik yang belum pernah diterapkan sebelumnya pada sistem presensi di sekolah.

I. INTRODUCTION

Education serves as one of the fundamental pillars in national development, with schools playing a crucial role in ensuring educational quality and success. At the forefront of this system is the principal, who bears the responsibility of managing all educational components to achieve institutional goals. The principal's leadership is highly strategic in ensuring learning success, and one of its concrete expressions lies in cultivating and enforcing a culture of student discipline.

A principal's performance in managing students can, in part, be evaluated through the

enforcement of discipline (Seyfarth, 2002). As the primary enforcer of discipline, school principals are tasked with implementing policies, including the development of digital attendance systems as a strategic effort to improve student discipline more effectively and efficiently. Rebore (2012: 139) supports this view, noting that computers and related software can assist principals in maintaining accurate records to address various school-related issues. In this study, the software in focus is a student attendance application designed to strengthen student discipline. Managing student discipline involves planning, monitoring, and evaluating student behavior to ensure compliance with school regulations. According to Matsuroh (2015), the aim of discipline is to guide children to act according to established rules, which can later be applied in the wider community. Attendance data serves as a primary indicator of discipline, as punctual and consistent attendance reflects responsibility and commitment to the learning process. Therefore, a precise and transparent attendance system can function as an effective managerial tool for monitoring, evaluating, and enhancing overall student discipline.

An attendance system functions as a management tool for individuals, institutions, or organizations, enabling the automatic recording of attendance data and its use in generating reports for administrative purposes (Sari, 2014). Attendance management systems, as described by Khoiriyah et al. (2018), allow organizations to document attendance systematically and use the data to support managerial needs. To enhance the efficiency and effectiveness of academic data management, particularly student attendance, an integrated, application-based system is necessary to simplify data processing. At SMPN 2 Satu Atap Sluke, addressing attendance issues requires a specialized solution. One practical response is the adoption of an Android-based student attendance information system, which enables more efficient monitoring of attendance. Kurniawan et al. (2019) note that digitalization in discipline management promotes data-driven decision-making and fosters greater involvement from all stakeholders. Similarly, Nurhadi (2023) highlights that a digital system with real-time monitoring and automated reporting features facilitates the evaluation and follow-up of disciplinary issues.

Several studies have shown that the use of digital attendance systems can enhance efficiency and effectiveness in managing student attendance. Rao's (2022) research examined the *Atten Face System*, a real-time attendance system based on facial recognition. This system operates by analyzing, tracking, and recording student attendance automatically through live classroom camera snapshots. The method has proven effective in reducing attendance manipulation while improving the accuracy of attendance records. Meanwhile, Chukwude's (2023) study revealed that the *Roll Call System* provides a more efficient, accurate, and modern solution for attendance management. Findings from Aigbokhan et al. (2023) on the development of a mobile-based attendance system also demonstrated improvements in accuracy and efficiency in recording student attendance at educational institutions. Furthermore, Rizki et al. (2024) investigated the implementation of a student attendance information system using the Android-based *AppSheet* application, aimed at minimizing the time spent on manual attendance so as not to reduce teaching time in the classroom. The results indicated an increase in efficiency in the attendance process. Similarly, research conducted by Pramesti and Febrianto (2024) on designing a teacher attendance system using the *AppSheet* application proved effective in improving the efficiency of teacher attendance recording in elementary schools.

School principals hold a significant responsibility to drive innovation, manage resources, and ensure the implementation of policies that support discipline improvement. In addition, principals play a role in determining the direction of educational technology development in alignment with school needs and the organizational culture being built. Through visionary and participatory leadership, principals can act as key drivers in implementing digital attendance systems as part of efforts to cultivate student discipline. This is consistent with the study by Mansor et al. (2022), which developed a web-based attendance and temperature recording system integrated with the *Virtual Learning Environment* in Malaysian schools. The system was designed not only to monitor student attendance but also to track their health conditions, thereby contributing to improved discipline.

From these findings, it can be concluded that student attendance systems, when carried out manually, often face challenges such as recording errors, limited accessibility, and time inefficiency. Therefore, schools require a digital attendance system that is practical, capable of recording in

real-time, and able to send notifications to parents, thereby fostering student discipline through more transparent and accurate attendance monitoring.

The novelty of this study compared to previous research lies in measuring the effectiveness and practicality of the *AppSheet*-based digital attendance system on student discipline. Furthermore, this study introduces innovation through the use of the *AppSheet* application with a combined verification system involving two technologies GPS and biometrics which has never been developed before. According to Aigbokhan et al. (2023:133), GPS is a device that utilizes the *Global Positioning System* to accurately determine the location of vehicles, individuals, or other attached objects. On the other hand, the use of biometrics as a validation medium is considered an appropriate choice, as biometric technology offers a high level of security for personal identification and verification (Kalyani, 2017:05).

AppSheet is a no-code application development platform that enables users to design data-driven applications without requiring programming expertise. The platform supports integration with multiple data sources, including Google Sheets, Excel, and other cloud-based databases. As noted by Kurniawan and Fauzan (2022:120), AppSheet provides an intuitive interface and flexible customization options, making it particularly suitable for educators without a technological background. In the education sector, Google Sheets is frequently utilized to store and manage data related to student attendance, academic performance, and learning reports (Wibowo, 2023:70).

The present study seeks to develop a digital attendance system using AppSheet to enhance student discipline at SMPN 2 Satu Atap Sluke. Specifically, this research focuses on the development of a student digital attendance application through AppSheet, incorporating GPS and biometric verification. The integration of GPS ensures that students register attendance only when located on school premises, while biometric verification such as fingerprint or facial recognition confirms the student's identity. By combining these two technologies, the system is expected to generate more accurate and reliable attendance data.

II. METHOD

This study employs a Research and Development (R&D) approach using the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. Putra (2015:67) defines R&D as a systematic and intentional method of research aimed at discovering, improving, developing, producing, and testing the effectiveness of new, superior, efficient, productive, and meaningful products, models, and strategies. According to Sugiyono (2022), the ADDIE model includes: (1) the analysis stage, where problems are identified to determine the most appropriate solutions; (2) the design stage, which focuses on planning and creating the product to be developed; (3) the development stage, where the product is constructed and refined; (4) the implementation stage, which involves product testing; and (5) the evaluation stage, where improvements are made based on identified weaknesses. The stages of development research using the ADDIE framework are illustrated as follows.

The respondents in this study were students from grades VII, VIII, and IX at SMPN 2 Satu Atap Sluke, Sluke District, Rembang Regency. A total of 15 students participated, consisting of 5 students from each grade level. These respondents were involved in both limited and large-scale trials: the limited trial was conducted with 5 participants, while the large-scale trial involved all 15. This procedure aligns with Arikunto's (2013:254) recommendation that small-group trials may include 4–14 respondents, whereas large-group trials may involve 15–50 respondents.
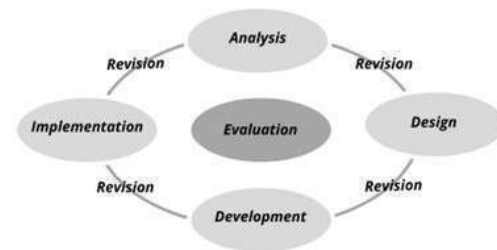
Figure 1. Stages of ADDIE Model Development Research

The following outlines the stages of research and development using the ADDIE model as applied in this study. The first stage involves analyzing the needs and problems related to student attendance, both from the perspective of teachers and students. This analysis includes: (a) examining the existing use of attendance systems and prior experiences with attendance processes, and (b) identifying the need for a digital attendance application.

The second stage is the design phase, where a product is planned to address the problems identified in the analysis. At this point, the researcher designs the product using the AppSheet application. The third stage is product development, in which the digital attendance application for students is built through AppSheet with GPS and biometric verification. The product is then validated by media experts to identify any weaknesses and areas for improvement.

The fourth stage is implementation, which involves testing the developed application on the target group of students. This trial, conducted with students in grades VII, VIII, and IX of SMPN 2 Satu Atap Sluke, Sluke District, Rembang Regency, incorporates revisions based on expert feedback. The purpose of this stage is to evaluate the feasibility of the developed product. The fifth stage is evaluation, conducted after the product trials. This stage aims to assess weaknesses and the overall impact of using the application. Evaluation is not limited to the final stage but occurs throughout each prior stage of development. It is carried out based on expert validation results and student response questionnaires, which help measure the practicality and effectiveness of the product in improving student discipline.

Data collection is a crucial part of this research. According to Sugiyono (2022), the primary purpose of research is to gather field data. The techniques used in this study include interviews, questionnaires, observations, and document analysis. For data analysis, the methods employed consist of expert validation tests, product practicality tests, one-sample t-tests, simple linear regression tests, paired t-tests, and N-Gain tests.

III. RESULT AND DISCUSSION

A. Result

1. Analysis

At this stage, the researcher examined the need for a digital attendance system by conducting observations and interviews with several teachers to assess the school's readiness in adopting digital attendance. The indicators reviewed included the current state of the student attendance system, needs and expectations for a digital solution, available facilities and technical support, as well as recommendations and suggestions.

The findings revealed that the existing manual attendance system still presents several challenges, such as potential recording errors, limited accessibility for data analysis, and the additional time and effort required for data recapitulation. Although attendance is a vital component in monitoring student discipline, the limitations of manual systems hinder learning effectiveness. Most respondents emphasized the importance of adopting a digital attendance system. The desired features include real-time recording, user-friendly operation, automated data recaps, and the ability to send notifications to parents. A digital system is expected to enhance student discipline by making attendance monitoring more transparent and accurate.

Regarding resources, most students already own smartphones, but unstable internet connections in some school areas remain a challenge. Schools are therefore encouraged to support system implementation by providing training and technical assistance. For optimal effectiveness, the application must be simple, easy to operate, and functional even in offline mode. The development process should involve stakeholders such as teachers, technical staff, principals, parents, and IT teams to ensure the system meets practical needs.

The needs analysis confirmed that the current manual attendance system frequently encounters problems, including inaccuracies, accessibility issues, and time inefficiencies. Hence, schools require a digital attendance system that is user-friendly, real-time, and capable of notifying parents ultimately improving student discipline through clearer and more accurate monitoring.

2. Design

After completing the analysis, the researcher proceeded to design a solution based on the identified needs. The concept of the Student Digital Attendance application emphasizes automation through the AppSheet platform, accessible via smartphones and computers to support both students and administrators.

The main features include:
a) Student data input covering NIS (Student Identification Number), student name, and class.
b) Daily attendance system with options for present, excused/absent, sick, or late.
c) Automated report generation attendance summaries accessible to principals, teachers, homeroom teachers, and parents.

3. Application Structure and Workflow

The application features a simple interface with user-friendly navigation. The workflow includes: (1) students logging in, selecting their NIS (with name and class auto-filled), then confirming attendance via photo and signature; (2) attendance data being automatically stored in the system, generating both digital and periodic printed reports for parents/guardians during semester report distribution.

4. Integration with Google Sheets

AppSheet was selected for its seamless integration with Google Sheets, which serves as the database for storing student profiles, attendance records, and reports. This integration allows continuous data access and updates for authorized users.

5. Expert Validation

The application design underwent validation by IT experts to ensure technical feasibility. Expert feedback guided revisions to improve system quality and functionality.

6. Prototyping

An initial prototype was created to test basic functions, including attendance recording and simple report generation. Students, as end-users, tested the prototype and provided feedback for further development.

7. Data Security and Privacy

Data protection was a priority in the design. Schools established strict access controls, limiting sensitive information to authorized personnel such as principals and administrators. Through Google Sheets, student data was safeguarded with layered security measures to prevent breaches. The design stage ultimately produced a comprehensive, user-friendly digital attendance application aligned with the needs of student discipline management.

This design served as a critical foundation for subsequent development stages.
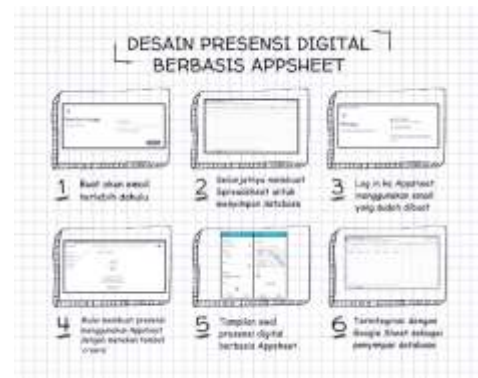
Figure 2. AppSheet Attendance Creation Flow Storyboard

8. Development

Several stages were carried out in the development phase of this study. Spreadsheet Creation Stage. The first step in developing an AppSheet-based digital attendance system was creating a Google account (Gmail) to enable the use of Google Spreadsheets for generating data files and attendance sheets. Within Google Spreadsheets, two files were prepared: "Attendance" and "Student List." The "Attendance" sheet contained key data fields, including Date, Time, Student ID (NIS), Name, Class, Attendance Status, Remarks, Photo, Location (GPS), and Signature. Additional fields could be added as needed, and the information recorded in this sheet would later be displayed in the AppSheet application. The second file, "Student List," stored student data consisting of Student ID (NIS), class, and name, serving as the reference database for the attendance system.
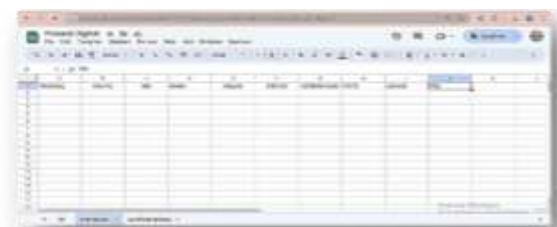
Figure 3. Google Spreadsheet Initial View

The default interface of Google Sheets generally appears as a grid composed of rows and columns. At the top, the title bar displays the sheet name along with the main menu, while at the bottom, several

worksheets or "sheets" are available to help organize data. The platform also provides a range of formatting tools and features to support data editing and analysis.

When applied for attendance purposes, the spreadsheet view is customized to simplify the recording and visualization of student attendance. The display typically presents a table or list containing essential details such as student names, check-in and check-out times, along with additional information like location and notes. This layout also facilitates the generation of reports, analysis of attendance patterns, and more effective monitoring and management of attendance data.

Figure 5. Google Drive Photo and Signature View

9. Stage of Creating the AppSheet Application

After completing the file setup, the next step is to open the AppSheet platform. At this stage, the development of the AppSheet-based digital attendance appli-cation begins by utilizing the data already prepared in the Google Spreadsheet. By selecting the "Create" button, the application is generated, and the display appears as illustrated in the figure above.
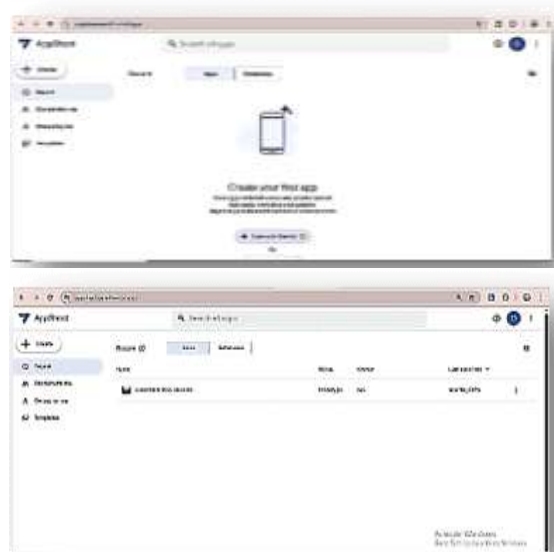
Figure 6. Initial View of AppSheet

In this stage, the attendance option displayed on the main screen is selected to configure the application according to the intended design. On the far left, a navigation panel provides access to various sections of the app, including data, workflows, settings, and more. Next to it are the two spreadsheet files previously created Attendance and Student List. When one of these files is selected, the corresponding data (such as date, time, student ID/NIS, name, etc.) appears for adjustment. On the right side, there is a visual design preview of the application, showing the layout of user interface elements such as forms, attendance records, and detailed attendance displays, as illustrated in the figure.

Figure 7. Attendance Data Display Utilization of the Digital Attendance System

Figure 8. Initial Attendance Data Entry Page

On the initial attendance page, a "+" button is available to begin recording presence. Once selected, it directs the user to the attendance data entry page, which includes fields such as date and time (automatically set to "today" and not editable), NIS, status, photo, location, and signature. When the NIS is clicked, the student's name and class are automatically displayed. In cases where the status indicates illness or absence, an additional "description" field also appears automatically, as illustrated in the figure.

Figure 9. Display of Name, Class, and Description

Following this, students are required to complete the status menu. If attendance is recorded after the designated entry time of 07:05, the system will automatically assign the status "Attendance Declined." The photo menu must also be filled by tapping the icon, which activates the camera to capture the student's face. If the captured image is correct, students may press *save* or choose *cancel* to retake the photo.

Next is the location menu, preset to "here," which automatically records the student's location at the time of attendance. This field is locked and cannot be edited, preventing students from altering their attendance location. Additionally, the signature menu functions as an added layer of verification, ensuring that the attendance is genuinely completed by the student.

Attendance Results Display. This section presents the attendance record in detail, including date, time, NIS, name, class, status, photo, location, and signature. All recorded data are automatically synchronized with the spreadsheet, serving as a reliable tool for monitoring student attendance while also supporting reporting and analysis for discipline management.

Figure 10. Page After Successful Attendance

The development of the AppSheet-based digital attendance system with GPS and biometric verification followed several systematic stages. The process began with setting up a Gmail or Google account, which was required as the application relies on a Google-based database for storing data. After logging into Google Drive, a spreadsheet file was created as the main data repository. This file, initially blank, was then named and organized to include the necessary data fields such as date, time, student name, photo, GPS, and signature.

Once the spreadsheet was prepared, the AppSheet platform was accessed using the same Google account. The application was then developed by configuring features step by step through the available menus, while the right-hand panel was used to verify that the layout and functionality aligned with the intended design. After the application was fully set up, it was deployed by sharing the access link or distributing the downloaded version to students through a WhatsApp group for direct use.

To ensure its quality, the product underwent two stages of testing: validity and practicality. The validity test, conducted by three IT experts, produced a score of 0.98 (98%), indicating a high level of validity. Meanwhile, the practicality test involved 15 student respondents evaluating 13 statements, resulting in a total score of 1384.62 out of 1500, with an average percentage of 92.31%, categorized as "Excellent." These findings demonstrate that the digital attendance system meets the standards of content quality, appearance, and functionality, making it suitable for further implementation and research.

10. Implementation

The subsequent stage involved implementing the product by conducting trials of the developed application. At this stage, several statistical tests were performed, including a one-sample t-test, and simple linear regression test.

The outcome of the one-sample t-test is presented in Table 1.

Table 1. Results of One-Sample T-Test Calculation

Average (Mean)	Standard Deviation	Number of Respon-dents (n)	t-count	t-table	df	α
37.6	2.47	15	15.05	2.145	14	0.05

Since the calculated t-value is greater than the t-table value, it can be inferred that there is a significant difference between the students' average digital attendance and the comparison value of 28.

The results of the simple linear regression analysis are presented in Table 2. Regression Test Coefficients.

Table 2. Regression Test Coefficients

Variable	Coefficient	Std. Error	t	p-value	95% CI
Intercept (Const)	25.75	8.31	3.10	0.008	[7.79, 43.71]
Digital Presence	0.33	0.23	1.43	0.176	[-0.17, 0.83]

The analysis of the digital attendance system shows that the regression test produced an R-squared value of 0.136, meaning that 13.6% of discipline variation can be explained by digital presence. The coefficient of 0.33 indicates that every one-point increase in digital presence is expected to improve discipline by 0.33 points. However, with a p-value of 0.176 (> 0.05), this relationship is not statistically significant at the 95% confidence level. On the other hand, the paired T-test results ($t \approx$ 23.13, df = 14, p < 0.0001) confirm a significant difference between digital and manual attendance, suggesting that the digital system is more effective in enhancing student discipline.

At the evaluation stage, feedback was collected from both students and IT experts. Students highlighted the need for an offline mode to overcome unstable internet access. Meanwhile, IT experts provided several suggestions: the first expert recommended adding multi-device admin access, integrating QR code-based student IDs, and applying class-based data filters. The second expert advised revising the "Attendance Declined" column into clearer categories and improving the main page layout for a more intuitive and professional design. The third expert emphasized enhancing the user interface with better navigation, adding automatic reminders, and ensuring photos are captured directly through the app's camera feature to prevent misuse.

B. Discussion

Based on the findings of this study, it can be concluded that an AppSheet-based digital attendance system has the potential to enhance student discipline. The use of this technology helps address the limitations of manual attendance systems, which are often prone to recording errors, data delays, and time-consuming processes. By providing a more accurate, real-time, and automated platform, this system allows principals, teachers, and parents to monitor student attendance quickly and effectively.

The results also demonstrate that the digital attendance system streamlines administrative tasks and plays a strategic role in fostering a culture of discipline among students. With features such as automatic notifications and instant reporting, teachers and parents can respond immediately to cases of absence or tardiness, thereby supporting continuous discipline improvement. Although most students own smartphones and are capable of using the application, its effectiveness also depends on the availability of adequate school infrastructure and internet access. Challenges in the field include unstable network connections and the need for technical training to ensure smooth implementation.

The integration of GPS and biometric verification within the AppSheet-based attendance system is designed to resolve common issues in attendance tracking and management. Unlike manual systems that are less efficient and susceptible to data manipulation, this digital solution ensures higher accuracy and reliability. The GPS feature verifies student location in real time, while biometric tools such as selfies and digital signatures guarantee that attendance data genuinely represents the student, thereby strengthening data validity.

The application's design supports automated attendance recording through QR codes, GPS, and an integrated database containing student information such as ID number (NIS), name, class, and attendance

history. It is user-friendly, accessible across multiple devices (smartphones, tablets, and computers), and ensures secure storage of student data in Google Sheets, accessible only by authorized administrators and teachers. In summary, by offering an integrated, user-friendly, and secure system, the AppSheet-based digital attendance application not only facilitates attendance recording but also provides useful analytics and reporting tools, making it an effective solution for improving the management of student discipline.

The expert validation test covered eight assessment aspects: functionality, GPS accuracy, data security, user interface, system performance, compatibility, data integration, and biometric reliability. All three experts awarded a score of 4 for each aspect, except for the user interface, where two experts gave a score of 3. The total score reached 23.50 or 98%, indicating that the product is classified as "valid." The practicality test included four indicators: ease of use, efficiency of time and energy, reliability and accuracy, as well as technical support and readiness. Consisting of 15 question items, this assessment achieved a score of 1384.62 or 92.31%, placing it in the "very good" category.

The one-sample t-test showed that the average student digital attendance score (37.6) was significantly higher than the comparative benchmark value (28). This finding suggests that the digital attendance system contributes to improved student discipline. Several factors may explain this improvement: greater accessibility and transparency of digital systems, reduced opportunities for data manipulation, faster and more accurate record-keeping due to real-time automation, and increased student motivation driven by parental monitoring features.

However, results from the simple linear regression test indicated that digital presence did not have a statistically significant effect on discipline at the 95% confidence level. The regression coefficient (0.33) suggested a positive but weak effect, with a p-value (0.176) greater than 0.05. The R-squared value of 0.136 revealed that only 13.6% of the variation in student discipline could be explained by digital presence, meaning that other factors play a more dominant role. The superiority test confirmed that digital presence outperformed manual systems, while efficiency and effectiveness tests found digital presence to be effective in improving discipline, with most students achieving maximum scores after its implementation.

Overall, the study demonstrates that an AppSheet-based digital attendance system with GPS and biometric verification can significantly enhance student attendance management and discipline. This aligns with research by Mansor et al. (2022), who developed a web-based attendance and temperature recording system in Malaysian schools, and Haugom (2022), who reported that digital teaching improved student attendance rates in Norway. Both studies support the notion that technology enhances efficiency, accuracy, and oversight in attendance management. However, while Mansor emphasized web integration and health monitoring, the current study focuses on an AppSheet-based application with GPS and biometric verification tailored for junior high schools. Similarly, Haugom's results confirm that student engagement increases with digital learning, reinforcing the benefits of digital systems in overcoming conventional attendance challenges.

In addition, Salome (2018) designed a classroom attendance management system using biometric identification (facial recognition and fingerprints) to minimize manipulation and ensure accuracy. Likewise, Rao (2022) examined the Atten Face system, which utilizes real-time classroom camera snapshots for automatic attendance detection, reducing errors and enhancing accuracy. Both studies emphasize biometrics and automation as critical components for improving reliability in attendance tracking, which directly relates to the findings of this study.

Research by Aigbokhan et al. (2023) highlights the use of automated platforms and systems to support administrative activities in education, specifically by developing a mobile attendance application that enhances the accuracy and efficiency of recording student attendance. Similarly, this study also utilizes an AppSheet-based mobile application equipped with GPS and biometric verification, both aimed at improving efficiency and accuracy in managing attendance data. In line with this, Chukwude (2023) developed a modern Roll Call system to monitor student presence, further demonstrating how digital tools are designed to reduce the limitations of

manual recording and strengthen discipline through technology.

Overall, this research and prior international studies confirm that adopting digital technologies such as mobile apps, facial recognition, and biometrics significantly increases accuracy, efficiency, and reduces data manipulation in student attendance. By implementing a no-code platform like AppSheet suitable for schools seeking fast, practical solutions without advanced programming knowledge this study also expands upon earlier findings.

Similarly, the research of Rizki et al. (2024) titled *"The Application of Student Attendance Information Systems Using Android-Based AppSheet Applications"* shares many parallels with this study. Both apply AppSheet, GPS verification, and biometric features to ensure accuracy and practicality. However, the key difference lies in scope: Rizki et al. focused on Android-based school applications, while the present study emphasizes developing a digital attendance system as a discipline management tool and testing its effectiveness specifically at SMPN 2 Satu Atap Sluke. Rizki et al. also placed greater emphasis on direct application and field testing.

Meanwhile, the study by Zulhidayati et al. (2024) entitled *"Planning a Mobile-Based Online Attendance System for Teachers and Employees Using AppSheet"* also shares similarities but differs in scope and methodology. Unlike this research, which incorporates GPS and biometric verification for students and focuses on system development, implementation, and evaluation, Zulhidayati et al. concentrated on designing and planning an online attendance system for a broader context involving teachers and employees across institutions. Their emphasis was primarily on planning and procedural organization, rather than testing its effectiveness. Both studies, however, support the trend that AppSheet platforms, along with GPS and biometric verification, are effective tools for managing attendance in both educational and governmental settings.

The research of Ariyanti and Gisni (2021) entitled *"Student Attendance System Planning Using the AppSheet Application at MDTA Attawakkal"* also presents similarities and distinctions. Like the present study, it proposed an AppSheet-based system with GPS and biometric verification features. However, Ariyanti and Gisni's work remained focused on the planning stage at MDTA Attawakkal and did not extend to implementation or evaluation of its effectiveness in improving student discipline.

In conclusion, this study reinforces existing evidence that digital attendance systems improve student discipline and attendance because integrated, automated, and user-friendly systems motivate students to be more responsible. Thus, implementing AppSheet-based digital attendance solutions represents not only an effective approach to discipline management in schools but also a step toward advancing digitalization in education, ultimately contributing to enhanced learning quality and broader improvements in the education system.

IV. CONCLUSION AND SUGGESTION

A. Conclusion

The study shows that the AppSheet-based digital attendance system with GPS and biometric verification is effective and efficient in managing student attendance at SMPN 2 Satu Atap Sluke. It streamlines recording, monitoring, and reporting, improves discipline, reduces errors, and prevents manipulation found in manual systems. The application is valid in terms of content, interface, and functionality. Findings from the one-sample t-test revealed a significant improvement in discipline, although regression analysis indicated no direct statistical relationship, suggesting other influencing factors. The N-Gain test confirmed practical improvement in student discipline after implementation. Overall, the system enhances discipline indirectly and meaningfully. Future improvements should emphasize user-friendliness, real-time notifications, stronger data security, and continuous training for educators and staff.

B. Suggestion

Future development of the digital attendance system using Appsheet should focus on enhancing user-friendliness, integrating real-time notifications for students and teachers, and ensuring data security to prevent manipulation. Schools are also encouraged to provide continuous training for educators and administrative staff so the system can be effectively implemented to support student discipline management.

REFERENCES

Aigbokhan, E. E., Adigun, J. O., Lawal, O. N., Okikiola, F. M., Onadokun, I. O., & Oladiboye. (2023). Mobile attendance system using GPS and facial authentication. *Anchor University Journal of Science and Technology (AUJST)*, 3, 132–145.

Chukwude, O. M. (2023). Development of face recognition-based attendance system. *SLU Journal of Science and Technology*, 6, 214–224. https://doi.org/10.56471/slujst.v6i.362

Hamzah, H. (2018). *Discipline-based character education in schools*. Yogyakarta: Deepublish.

Haugom, E. (2022). The effect of changing from campus-based to digital teaching on student attendance: A case study of Norwegian business students. *Heliyon*, 8(11), e11307. https://doi.org/10.1016/j.heliyon.2022.e11307

Kalyani, C. H. (2017). Various biometric authentication techniques: A review. *Journal of Biometrics & Biostatistics*, 8(5), 371.

Khoiriyah, N. L., Marisa, F., & Wijaya, I. D. (2018). Design and build an online attendance system based on granted data validity. *JIMP - Independent Informatics Journal of Pasuruan*, 3(1), 53–61. https://doi.org/10.37438/jimp.v3i1.89

Kurniawan, D., & Fauzan, A. (2022). Utilization of Appsheet in educational application development. *Journal of Technology and Education*, 10(3), 120–135.

Mansor, N. S., Awang, H., Ndanusa, A. B., Idris, R., & Al-Mashhadani, A. F. S. (2022). Design and development of attendance and temperature recording system: A smart companion for the current VLE implementation in Malaysian schools. *Proceedings*, 111. https://doi.org/10.3390/proceedings2022082111

Matsuroh, I. (2015). Character education through discipline habituation. *Journal of Character Education*, 5(3), 321–330.

Nurhadi, H. (2023). Digital transformation in education management: Challenges and strategies. *Journal of Indonesian Education Management*, 10(1), 45–56. https://doi.org/10.21009/jmpi.101.05

Pramesti, S., & Febrianto, P. T. (2024). Implementation of a digital attendance system to improve the efficiency of recording teacher attendance in elementary schools. *JATI (Journal of Informatics Engineering Students)*, 8(2), 2429–2434.

Putra, N. (2015). *Research and development: An introduction*. Jakarta: PT Raja Grafindo Persada.

Rao, A. (2022). AttenFace: A real time attendance system using face recognition. *2022 IEEE 6th Conference on Information and Communication Technology (CICT 2022)*. https://doi.org/10.1109/CICT56698.2022.9998001

Rebore, R. W. (2012). *The essentials of human resources administration in education*. Boston: Pearson Education.

Rizki, M. A., & Setiawan, D. L. (2024). Using the Android-based Appsheet app. *Technology Education, University of Muhammadiyah Kuningan*, 8(5), 107041.

Salome, W. (2018). *University of Nairobi School of Computing and Informatics biometrics class attendance management system.*

Sari, Y. (2014). *Automated attendance management system*. Jakarta: Information Technology Publisher.

Sugiyono. (2022). *Quantitative, qualitative and R&D research methods*. Bandung: Alfabeta.

Wibowo, B. (2023). Utilization of Google Sheets for school data management. *Journal of Modern Educational Technology*, 16(1), 70–85.

Yours Truly, G. (2021). Design of student attendance system using Appsheet application at MDTA Attawakkal. *Journal of Informatics Engineering UNIKA Santo Thomas*, 6, 367–372. https://doi.org/10.54367/jtiust.v6i2.1553

Yulianti, N., & Prasetyo, R. (2021). The relationship between student attendance and discipline level and learning achievement. *Journal of Educational Psychology and Counseling*, 7(1), 34–40. https://doi.org/10.26858/jppk.v7i1.12456

Zulhidayati, Z., Okra, R., Musril, H. A., & Derta, S. (2024). Design of a mobile-based online attendance system for teachers and employees using Appsheet. *Juwara Journal of Insight and Script*, 4(1), 23–32. https://doi.org/10.58740/juwara.v4i1