

Innovation of Web-Based Digital Attendance System with Double Validation for Student Attendance Authentication via QR Code, Selfie, and Geolocation (Case Study: SMK Negeri 1 Bojonegoro)

Muhammad Rinov Cuhanazriansyah^{1✉}, Ahmad Kholiqul Amin², Aprilia Eka Widiana³

^{1,2,3}Pendidikan Teknologi Informasi, IKIP PGRI Bojonegoro, Jawa Timur, Indonesia

muhrirov15@gmail.com¹, ahmad.kholiqul@ikippgribojonegoro.ac.id², aprielaekawdn19@gmail.com³

Abstract

This study aims to develop a web-based digital attendance system with dual validation using QR Code, selfie verification, and geolocation to improve the accuracy, efficiency, and transparency of student attendance recording at SMK Negeri 1 Bojonegoro. The study employed a Research and Development (R&D) method using the ADDIE model, which consists of the stages of analysis, design, development, implementation, and evaluation. The trial subjects included 35 students, 1 teacher, and 1 school operator. Data were collected through observation, interviews, documentation, and questionnaires. The system quality was evaluated using the ISO/IEC 9126 standard, which includes functionality, reliability, usability, efficiency, and maintainability, while user satisfaction was measured using a Likert scale. The results showed that the system was successfully developed and could be used according to the school's needs. The system quality test obtained an average score of 4.1 (good category), while the user satisfaction level achieved an average score of 3.9 (good category). The system is considered capable of simplifying the attendance process, accelerating access to attendance data, reducing the potential for attendance fraud, and supporting real-time attendance monitoring. Therefore, this web-based digital attendance system is feasible to be used as a more effective attendance solution in the school environment.

Keywords: digital attendance system, web-based, QR Code, selfie verification, geolocation, ISO/IEC 9126.

JPTI Journal is licensed under a Creative Commons Attribution-Share Alike 4.0 International License.



1. Introduction

The advancement of information technology in the digital era has brought about significant changes across various aspects of life, including education. Within the school context, technology no longer serves merely as a medium for communication and information dissemination, but has also become an essential instrument for enhancing administrative effectiveness and efficiency. One administrative aspect closely linked to this need is the management of student attendance data. Attendance does not function solely as routine data; rather, it also serves as an indicator of discipline, a basis for evaluating students' behaviour, and a reference for administrative decision-making in schools. Therefore, the need for an attendance system that is fast, accurate, and integrated has become increasingly important in line with the growing demands of technology-based educational data management [1], [2], [3], [4], [21], and [24].

In practice, many schools still rely on manual attendance systems through attendance lists or register sheets completed directly in the classroom [17], [18]. Although this method is relatively simple, it has several

limitations, such as vulnerability to recording errors, the lengthy time required for recapitulation, and difficulties in monitoring attendance data in real time [19], [23]. Similar issues were also identified at SMK Negeri 1 Bojonegoro. Based on preliminary observations and interviews with the duty teacher and homeroom teachers, student attendance is still recorded manually by the class secretary and then submitted to the subject teacher or administrative staff for recapitulation. This process results in recapitulation delays of approximately 15–20 minutes in each lesson, a recording error rate of around $\pm 12\%$, and a waiting period of 1–2 days before the attendance data can be submitted to the school administration. These conditions indicate a discrepancy between the school's need for an efficient system and the reality of administrative practices that remain conventional [16].

Previous studies have demonstrated that the digitalisation of attendance systems can provide a solution to the shortcomings of manual methods. Styefani and Utomo (2025) [2] explain that a QR code-based attendance system can accelerate attendance recording, reduce administrative burdens, and support more efficient data integration. In line with this,

Nurfansyah and Utami [1] found that a web-mobile attendance system integrating QR codes and geolocation can improve recording accuracy and facilitate attendance data management. Research by Tajul et al. [6] also shows that the integration of QR codes and geolocation in attendance systems can strengthen the verification process, as the system not only records user identity but also confirms the user's presence at a predetermined location [5], [8]. These findings affirm that the use of digital technology in school attendance systems has considerable potential to improve the efficiency, accuracy, and transparency of attendance management [20], [22].

Nevertheless, previous studies have generally focused on only one or two validation methods. In fact, the use of QR codes as the sole verification tool still has weaknesses, particularly the possibility of proxy attendance or code scanning by unauthorised individuals. In this context, layered validation becomes important in order to enhance the authenticity of attendance data. Hooi et al. [9] demonstrates that combining several authentication technologies, such as QR codes, fingerprints, and GPS, can strengthen attendance systems in educational institutions [10], [11]. By the same logic, the integration of QR codes, selfies, and geolocation in a student attendance system has the potential to provide more comprehensive verification: QR codes as an initial means of identification, selfies as visual evidence of attendance, and geolocation as confirmation that attendance has been recorded within an authorised area [25]. Therefore, the development of a web-based digital attendance system with dual validation is relevant both to address the existing research gap and to meet the practical needs of the school environment.

In addition to functionality, software quality is also an important factor in the development of a digital attendance system. A good system must not only function properly, but must also meet certain quality criteria in order to be used optimally by both teachers and students. In this study, system quality is evaluated using ISO/IEC 9126, which encompasses the aspects of functionality, reliability, usability, efficiency, maintainability, and portability. This framework is relevant for assessing whether the system developed genuinely meets users' needs, remains stable during use, is easy to understand, operates efficiently, and can be maintained and further developed [12], [13], [14], [15].

Based on the foregoing discussion, this study focuses on the development of a web-based digital attendance system with dual validation through QR codes, selfies, and geolocation at SMK Negeri 1 Bojonegoro. This system is expected to improve the accuracy and authenticity of attendance data, accelerate the recapitulation process, support real-time attendance monitoring, and minimise the potential for manipulation of student attendance records. Accordingly, this study has strong urgency, both in practical terms as a solution

to the problems associated with manual attendance systems in schools and in academic terms as a contribution to the development of educational information systems that are more secure, efficient, and measurable [1]; [6]; [2]; [9]; and [21].

2. Methods

This study employed a Research and Development (R&D) approach using the ADDIE model, which comprises five stages: analysis, design, development, implementation, and evaluation. This model was selected because it provides a systematic framework for developing technology-based products while allowing continuous refinement at each stage. In this study, the product developed was a web-based digital attendance system with dual validation, designed to support student attendance recording in a manner that is faster, more accurate, secure, and real-time at SMK Negeri 1 Bojonegoro. The system was evaluated in terms of software quality using the ISO/IEC 9126 standard, as well as user satisfaction following its implementation.

2.1 Problem Analysis

The initial stage of the study focused on analysing the problems associated with the conventional attendance system. Based on preliminary observations and interviews with the duty teacher and homeroom teachers, it was found that student attendance was still recorded manually using attendance sheets and subsequently recapitulated by teachers or administrative staff. This process gave rise to several issues, namely delays in recapitulation, a high risk of recording errors, the absence of real-time data availability, and continued opportunities for attendance manipulation, such as proxy attendance. These conditions indicate that the school requires an attendance system that is not only capable of expediting administrative processes, but also of strengthening the validity of student attendance data. In response to these issues, the solution proposed in this study was the development of a web-based digital attendance system with dual validation. The system was designed by integrating three principal components: QR Code as the initial means of user identification, selfies as visual evidence of attendance, and geolocation as verification that attendance was recorded within the school premises. The integration of these three methods was chosen because previous studies have shown that most attendance systems still rely on only one or two validation methods, thereby leaving room for manipulation. Accordingly, the system design in this study was directed towards addressing the needs for efficiency, accuracy, security, and transparency in student attendance management.

2.2 Design of the Problem-Solving Method

The design of the research method illustrates the process of problem-solving from the identification of issues to the evaluation of the results of system implementation. Conceptually, this method links four main components: the problem of manual attendance, the development of a digital attendance system, the implementation of dual validation, and the evaluation of

system quality and user satisfaction. This framework emphasises that the study did not end with the creation of an application, but also examined whether the developed system was genuinely effective in addressing the initial problem.

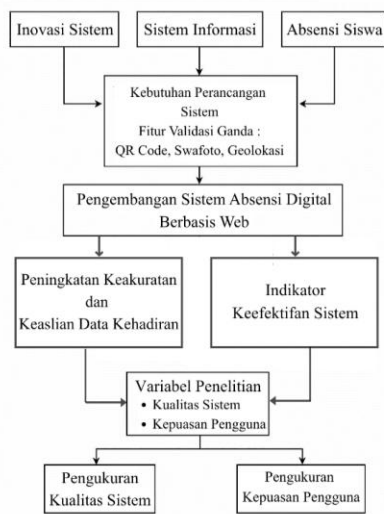


Figure 1. Research Method Flowchart

Based on the diagram, the problem-solving process was carried out in stages. The issue of manual attendance was first analysed in order to identify user needs and the weaknesses of the previous system. The results of this analysis then served as the basis for designing a web-based system that could be accessed flexibly from various devices without requiring additional installation. At the next stage, the system was developed with a dual-validation mechanism so that attendance data would not only be recorded automatically, but also validated in terms of both identity and location. Once the system had been fully developed, a limited implementation was conducted within the school environment, after which it was evaluated in terms of system quality and user acceptance.

2.3 System Architecture

The system architecture employed in this study adopted a web-based client-server concept. On the user side (client), students accessed the system through devices equipped with a browser, camera, and active GPS. On the server side, the application managed authentication, validation, data storage, and the presentation of attendance reports. Teachers and administrators were granted access rights to monitor, verify, and recapitulate attendance data stored in a centralised database. A web-based approach was chosen because it offers flexibility of access, facilitates system maintenance, and supports real-time data updates.

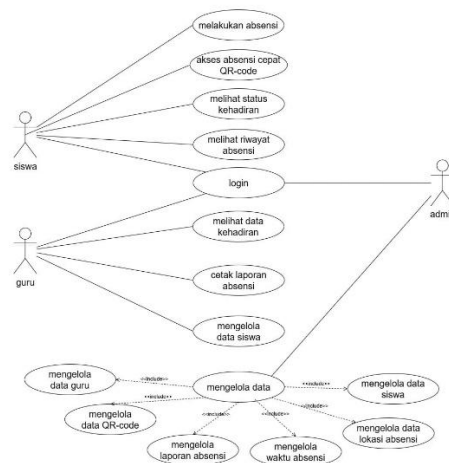


Figure 2. Architecture of the Digital Attendance System

The architecture shows that the attendance process began on the student side as the primary user. Students scanned the QR Code, took a selfie directly, and the system then captured the device’s location coordinates. These three forms of data were sent to the web application for validation and subsequently stored in the database. On the other side, teachers and administrators accessed the dashboard to monitor attendance status, view recapitulations, and use the data as a basis for attendance administration. With this model, the entire attendance process was conducted in a centralised manner, properly documented, and capable of being monitored at any time.

2.4 Data Processing Diagram

Data processing in this system began with the raw data obtained when students recorded their attendance, followed by validation and storage processes, ultimately producing attendance reports as output. This sequence is important in demonstrating how attendance data were processed from the initial input stage until they became information ready for use by the school.

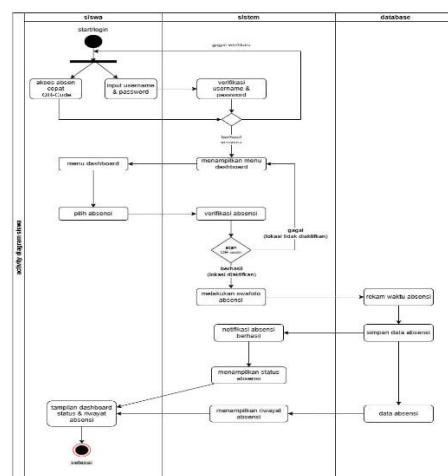


Figure 3. Data Processing Diagram

The diagram above shows that the system received several types of raw data simultaneously, namely student identity, QR Code scanning results, selfies, and location coordinates. These data were not stored immediately, but first had to pass through a validation stage. If all components were valid, the system recorded the attendance time, assigned the attendance status, and stored the results in the database. Subsequently, the data could be processed into attendance reports per student, per class, as well as administrative reports for teachers and the school. Through this design, the system was able to ensure that the data produced were not only rapidly available, but also possessed a higher degree of authenticity.

2.5 Stages of System Development Using ADDIE

The stages of system development in this study followed the ADDIE model. At the analysis stage, the problems associated with manual attendance, user needs, and the characteristics of the school environment were identified. At the design stage, the researcher designed the system architecture, the dual-validation process flow, the interface design, and the database structure. The development stage involved building the web-based application by integrating the QR Code, selfie, and geolocation modules. At the implementation stage, the system was piloted within the school environment to determine its operational feasibility. Finally, the evaluation stage was carried out to assess system quality and the level of user satisfaction based on the outcomes of system use.

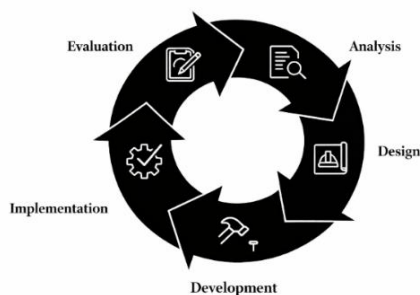


Figure 4. ADDIE Stages in the Study

2.6 Data Collection Techniques

The data in this study were collected through several techniques, namely observation, interviews, documentation, and questionnaires. Observation and interviews were employed at the initial stage to identify problems and system requirements. Documentation was used to complement information related to the attendance process within the school. After the system had been developed and implemented, questionnaires were used to assess system quality and user satisfaction. The assessment of system quality referred to the aspects of functionality, reliability, usability, efficiency, and maintainability under ISO/IEC 9126, while user satisfaction was measured in terms of ease of use, speed, appearance, and the perceived benefits of the system for both teachers and students.

2.7 Data Analysis Techniques

Data analysis was conducted in two forms, namely qualitative analysis and descriptive quantitative analysis. Qualitative analysis was used to interpret the results of observations, interviews, and user feedback during the system development process. Meanwhile, descriptive quantitative analysis was used to process data obtained from questionnaires evaluating system quality and user satisfaction. The results of the assessment were then interpreted to determine the feasibility level of the system developed. Through this analysis, the study was able to demonstrate whether the web-based digital attendance system with dual validation had effectively addressed the problems of manual attendance, both from the technical perspective and from the perspective of user acceptance.

2.8 Indicators of System Success

The success of the system in this study was measured using several key indicators, namely the success of dual authentication, the speed of the attendance process from initiation to data storage, the accuracy of location validation, system stability during use, and the level of user satisfaction with the ease and benefits of the system. These indicators were used to ensure that the system produced not only functioned operationally, but also met the school's needs in establishing attendance administration that is more efficient, accurate, secure, and transparent.

3. Results and Discussions

3.1 Results of System Development and Implementation

This study produced a web-based digital attendance system with dual validation integrating QR Code, selfies, and geolocation. The system was developed through the ADDIE stages, beginning with needs analysis, followed by system model design, core feature development, school-based implementation, and evaluation. The main features successfully realised included a login page, QR Code scanning, selfie capture, location detection, attendance history, and a data management dashboard for teachers and administrators. Beta testing was conducted in one Year 10 Computer and Network Engineering class involving 35 students and 2 teachers, while alpha testing involved 2 expert validators.

During the implementation stage, the system operated in accordance with the workflow that had been designed, beginning with login, followed by QR Code scanning, selfie capture, and attendance data storage. The attendance data were successfully stored and subsequently displayed through both the attendance history feature and the administrative dashboard. These findings indicate that the system was able to perform its basic function as a centralised digital attendance recording medium.

The results of expert validation showed that the system fell within the good category and was considered suitable for use. This was reinforced by the media

expert’s assessment, which stated that the system was “good and can be implemented”. In addition, performance testing using Locust showed that the system was capable of handling increased loads of up to approximately 200 users while maintaining a low failure rate. The median response time ranged from approximately 30–45 ms, while the 95th percentile ranged from around 45–70 ms, indicating that the system performance remained relatively stable under access load.

Table 1. Results of system implementation and technical evaluation

No.	Aspect	Description of Results
1	System Implementation	The web-based digital attendance system was successfully implemented at SMK Negeri 1 Bojonegoro, involving 36 students, teachers, and administrators as users.
2	Testing Environment	The system was operated using laptop devices within a local network environment and had not yet been deployed through online hosting.
3	Usage Process	All features operated according to the intended workflow, including login, QR Code scanning, selfie capture, and attendance data storage.
4	Implementation Results	The system could be used properly, attendance data were stored and could be accessed again, and the attendance process became faster than with the manual method.
5	Expert Validation	Based on ISO/IEC 9126 standards, the system was classified as good and suitable for use.
6	Performance Testing	Testing using the Locust tool showed that the system was able to handle up to approximately 200 simultaneous users without significant failure.
7	Response Time	System responses remained stable, with a median of approximately 30–45 ms and a 95th percentile of approximately 45–70 ms.

8	Failure Rate	The failures-per-second value was low, indicating that the system remained stable as the load increased.
9	User Evaluation	Questionnaire results showed that the system met user needs and made the attendance process more effective.
10	Technical Conclusion	The system was suitable for use, demonstrated good performance, and supported effective and real-time attendance recording.

The table shows that the development outcomes did not stop at the design stage, but progressed to implementation and technical evaluation. From a software engineering perspective, the successful operation of the core functions and the stability of system performance serve as initial indicators that the system has operational feasibility for use in a school environment. However, because the implementation was still limited and conducted only within a local network, these results should be understood as evidence of initial feasibility rather than full-scale testing.

3.2 Results of the System Quality Test

System quality was assessed using a questionnaire based on ISO/IEC 9126. The aspects evaluated included functionality, reliability, usability, efficiency, and maintainability. The processed data showed that all aspects obtained an average score above 4.0, with an overall score of 4.1. These findings indicate that, in general, the system received a positive response from users.

Table 2. Results of the system quality test based on ISO/IEC 9126

Aspect	Mean	Category
Functionality	4.2	Strongly Agree
Reliability	4.1	Agree
Usability	4.2	Strongly Agree
Efficiency	4.0	Agree
Maintainability	4.1	Agree
Total	4.1	Agree

In the functionality aspect, the score of 4.2 indicates that the main features, such as QR Code scanning, selfie capture, and geolocation, were considered to operate in accordance with user needs. This score is important because the core function of the system lies in the successful implementation of layered validation to ensure attendance authenticity. In other words, the system functions not only as a tool for recording

attendance, but also as a mechanism for verifying both identity and location.

The usability aspect also obtained a score of 4.2, indicating that the system interface was relatively easy for students to understand and use. This result is consistent with the system design, which emphasised simplicity of appearance, readability, and a concise usage flow. In the school context, a high usability score is particularly important because the main users of the system are students and teachers who require a practical application without complicated technical training.

Meanwhile, the reliability and maintainability aspects each obtained a score of 4.1. This indicates that the system was considered sufficiently stable during use and relatively easy to manage further. From a development perspective, these results suggest that the system structure is adequate to support routine operation and further development, although there is still room for improvement, particularly if the system is to be implemented more widely.

The efficiency aspect obtained a score of 4.0, which was the lowest among the assessed aspects, although it still remained within a positive category. This finding may be interpreted as indicating that the system was sufficiently fast, but that efficiency was not yet its strongest aspect. Logically, this may be associated with the layered validation process, which requires the system to handle scanning, image capture, and location detection sequentially. Therefore, the stronger the validation applied, the greater the demand placed on process efficiency. This is a reasonable consequence of a system that prioritises security and the accuracy of attendance data.

3.3 Results of User Satisfaction

In addition to system quality, this study also measured user satisfaction after the system had been used during the trial stage. The aspects assessed included ease of use, system speed, interface appearance, usefulness, and overall satisfaction. The processed data showed that the overall average user satisfaction score was 3.9, indicating that users tended to respond positively to the developed system.

Table 3. Results of the user satisfaction test

Aspect	Mean	Category
Ease of Use	3.8	Agree
Speed	3.9	Agree
Appearance	4.1	Agree
Usefulness	4.1	Agree
Overall Satisfaction	4.0	Agree
Total	3.9	Agree

The appearance and usefulness aspects obtained the highest scores, each at 4.1. These results indicate that users considered the system to have a sufficiently clear and well-organised appearance that supported attendance activities in school. In addition, the system was regarded as providing tangible benefits by making

the attendance process more practical and structured. From an implementation perspective, this finding is important because it indicates that the system was accepted not only because it could be used, but also because it was considered beneficial in school administrative practice.

The overall satisfaction aspect obtained a score of 4.0, while speed obtained a score of 3.9. These values indicate that users were generally satisfied with the system, although they still perceived room for improvement in relation to processing speed. This is consistent with the results of the system quality test, in which efficiency also emerged as the aspect with the lowest score compared with the others. Thus, from both the system quality perspective and the user satisfaction perspective, processing speed appears to be the area most open to improvement in future development.

The lowest score was found in the ease-of-use aspect, namely 3.8. Although this still reflects a positive response, the score suggests that some users may still require adaptation to the digital attendance procedure, which consists of several steps. This is understandable because the system employs dual validation, meaning that the attendance process is not as simple as marking a manual attendance register. In other words, improvements in security and data validity bring the consequence of additional usage steps, although these remain within acceptable limits for users.

3.4 Analysis of Research Findings

Overall, the findings of this study show that the web-based digital attendance system with dual validation was successfully developed and could be implemented within a school environment. The system was not only capable of carrying out the attendance recording function, but also strengthened authentication through the combination of QR Code, selfie, and geolocation. This success is reflected in the positive expert validation results, stable performance during testing, high system quality scores, and good levels of user satisfaction.

When analysed further, the main strengths of the system lie in functionality and usability, both of which obtained the highest scores in the system quality test. This means that the system performed well in two important respects: its main features operated in line with their intended purpose, and users were able to operate it relatively easily. At the same time, the highest satisfaction scores in the appearance and usefulness aspects indicate that users perceived clear practical value in the implementation of the system. Taken together, these results demonstrate that the system is not only technically sound, but also sufficiently accepted operationally by school users.

On the other hand, the findings also show that efficiency, speed, and ease of use remain aspects that can still be improved. From a development perspective, this may serve as a basis for further refinement, for example through simplifying the attendance workflow, optimising the selfie upload process, accelerating location detection, or improving performance when the

system is accessed simultaneously. Therefore, the findings of this study not only demonstrate the success of the product, but also provide a direction for further development so that the system may become increasingly responsive and convenient to use on a wider scale.

3.5 Suggestions for the Presentation of Graphs in the Article

To strengthen the results section visually, the data presented in Table 2 and Table 3 should also be displayed in bar charts. The first chart may present a comparison of the scores for each system quality aspect, while the second chart may display the user satisfaction scores. Presenting the data in this way would make it easier for readers to see that the highest aspects of system quality were functionality and usability, while the highest user satisfaction scores were found in the appearance and usefulness of the system.

4. Conclusions

Based on the results of the research and development conducted, it can be concluded that this study successfully developed a web-based digital attendance system with dual validation through QR Code, selfies, and geolocation to support the student attendance recording process at SMK Negeri 1 Bojonegoro. The system was developed using the ADDIE model, which includes the stages of analysis, design, development, implementation, and evaluation. Through these stages, a system was produced that was designed to address the problems associated with manual attendance, such as delays in recapitulation, the potential for recording errors, and the possibility of proxy attendance.

From the implementation perspective, the system developed was able to perform its main functions effectively, beginning with login, followed by QR Code scanning, selfie capture, location validation, and the storage of attendance data in the database. The system also provided faster and more structured access to attendance data for users, including students, teachers, and school operators. Thus, the development of this system has proven to be a more effective solution than the manual attendance method previously used at the school.

The evaluation results showed that system quality fell within the good category, indicating that the system is suitable for use as a digital attendance medium in the school environment. The assessment of system quality was based on the aspects of functionality, reliability, usability, efficiency, and maintainability in accordance with the ISO/IEC 9126 framework. This indicates that the system was not only able to function technically, but was also sufficiently stable, easy to use, and supportive of attendance administration needs in a more efficient manner.

In addition, the results of the beta test showed that users gave a positive response to the developed system. Most users felt that the system made the attendance process easier, particularly because the QR Code feature

was considered more practical than manual recording. Users also found the attendance history feature helpful, as it allowed attendance data to be viewed directly without waiting for recapitulation by the school. In terms of appearance, the system was considered sufficiently clear, neat, and easy to understand, enabling users to adapt quickly when operating it. It can therefore be concluded that this web-based digital attendance system not only fulfilled the technical quality requirements, but also provided a positive user experience and supported the efficiency of the attendance process within the school environment.


Overall, this study addressed three main research focuses: (1) the development process of a web-based digital attendance system with dual validation could be carried out systematically through the ADDIE model; (2) the quality of the system developed was feasible and good based on software quality evaluation; and (3) the level of user satisfaction with the system indicated positive acceptance, particularly in the aspects of ease of use, usefulness, and practical value. Therefore, the system developed may be regarded as a relevant alternative for improving the accuracy, security, and efficiency of student attendance management in schools.

References

- [1] L. O. M. Nurfansyah and W. S. Utami, "Development of a Web-Mobile Based Attendance Information System For Teachers and Students Using QR Code Integrated With Geolocation," *Jurnal Teknologi dan Open Source*, vol. 8, no. 2, pp. 973–983, 2025, <https://doi.org/10.36378/jtos.v8i2.5145>.
- [2] A. Styefani and P. Utomo, "Development Of Student Attendance System Application Using Qr Code At MAN 1 Kota Gorontalo," *International Journal of Social Service and Research*, vol. 5, no. 11, 2025, <https://doi.org/10.46799/ijssr.v5i11.1340>.
- [3] I. D. Perwitasari, J. Hendrawan, N. A. Putri, and Y. T. Bilqis, "QR Code Based Attendance System as an Innovation for High School Management," *Journal of Informatics Management and Information Technology*, vol. 4, no. 4, pp. 158–163, Oct. 2024, <https://doi.org/10.47065/jimat.v4i4.417>.
- [4] D. Hamdani, A. P. W. Wibowo, and H. Heryono, "Perancangan Sistem Presensi Online dengan QR Code Menggunakan Metode Prototyping," *Jurnal Teknologi dan Informatika*, vol. 14, no. 1, pp. 62–73, Mar. 2024, <https://doi.org/10.34010/jati.v14i1.11844>.
- [5] M. R. Nasution and A. Fauzi, "Perekaman Kehadiran Karyawan dengan Akses Geolokasi: Inovasi Sistem Absensi Berbasis Web," *Rabit: Jurnal Teknologi dan Sistem Informatika Univrab*, vol. 9, no. 1, pp. 91–102, 2024, <https://doi.org/10.36341/rabit.v9i1.4037>.
- [6] S. W. Taju, Y. P. Mamahit, and J. A. Pongantung, "Implementing QR Code and Geolocation Technologies for the Student Attendance System," *CogITO Smart Journal*, vol. 10, no. 1, pp. 221–232, Jun. 2024, <https://doi.org/10.31154/cogito.v10i1.636.642-653>.
- [7] I. Amirulloh, I. D. Iskandar, Y. Apriyani, A. I. Warnilah, D. S. Purnia, and M. Surahman, "Teacher Attendance Monitoring System Teaching with QR-Code and Geo Location Using Android Platform," *Journal of Physics: Conference Series*, vol. 1641, Art. no. 012030, 2020, <https://doi.org/10.1088/1742-6596/1641/1/012030>.
- [8] R. Gunawan, A. M. Yusuf, and L. Nopitasari, "Rancang Bangun Sistem Presensi Mahasiswa dengan Menggunakan QR Code Berbasis Android," *ELKOM: Jurnal Elektronika dan*

- Komputer*, vol. 14, no. 1, pp. 47–58, Jun. 2021, <https://doi.org/10.51903/elkom.v14i1.369>.
- [9] Y. K. Hooi, K. S. Kalid, and S. Tachmammedov, “Multi-Factor Attendance Authentication System,” *International Journal of Software Engineering and Computer Systems*, vol. 4, no. 2, pp. 62–79, 2018, <https://doi.org/10.15282/ijsecs.4.2.2018.5.0049>.
- [10] T.-V. Dang, “Smart Attendance System Based on Improved Facial Recognition,” *Journal of Robotics and Control*, vol. 4, no. 1, pp. 46–53, 2023, <https://doi.org/10.18196/jrc.v4i1.16808>.
- [11] V. D. Nguyen, H. V. Khoa, T. N. Kieu, and E.-N. Huh, “Internet of Things-Based Intelligent Attendance System: Framework, Practice Implementation, and Application,” *Electronics*, vol. 11, no. 19, Art. no. 3151, Sep. 2022, <https://doi.org/10.3390/electronics11193151>.
- [12] N. Nofiyati, A. K. Nugroho, and B. Wijayanto, “Evaluation of the Quality of Academic Information System UNSOED Using ISO 9126 and Mean Opinion Score (MOS),” *Jurnal Teknik Informatika (JUTIF)*, vol. 3, no. 3, pp. 771–779, Jun. 2022, <https://doi.org/10.20884/1.jutif.2022.3.3.366>.
- [13] M. Jamil, S. F. Saputra, M. I. Wahid, and D. Riana, “Evaluasi Metode ISO/IEC 9126 Pada Kinerja Website Sistem Informasi Akademik Perguruan Tinggi,” *Informatika Mulawarman: Jurnal Ilmiah Ilmu Komputer*, vol. 16, no. 1, pp. 27–33, 2021, <https://doi.org/10.30872/jim.v16i1.5209>.
- [14] N. N. U. Januhari, P. A. P. Ronda, and I. G. G. P. Wijaya, “Software Quality Evaluation Using ISO/IEC 9126 on the ITB STIKOM Bali Online Academic Information System (SION),” *International Journal of Engineering Technologies and Management Research*, vol. 11, no. 5, pp. 76–83, 2024, <https://doi.org/10.29121/ijetmr.v11.i5.2024.1454>.
- [15] Sholiq, R. A. Auda, A. P. Subriadi, A. Tjahyanto, and A. D. Wulandari, “Measuring Software Quality with Usability, Efficiency, and Portability Characteristics,” *IOP Conference Series: Earth and Environmental Science*, vol. 704, no. 1, Art. no. 012039, 2021, <https://doi.org/10.1088/1755-1315/704/1/012039>.
- [16] O. H. Lengkong, D. H. Fiden, and A. Masrikat, “Sistem Informasi Absensi Real-Time di Universitas Klabat,” *CogITo Smart Journal*, vol. 2, no. 2, pp. 216–228, 2016, <https://doi.org/10.31154/cogito.v2i2.31.216-228>.
- [17] A. R. Patta and S. Suhartono, “Pengembangan Sistem Informasi Absensi Guru dan Siswa Berbasis Web di SMA Negeri 1 Tellulimpoe Kabupaten Sinjai,” *Jurnal Teknologi Elektroika*, vol. 14, no. 1, pp. 1–11, 2017, <https://doi.org/10.31963/elektroika.v14i1.1216>.
- [18] H. Rhomadhona, “Penerapan Teknologi QR Code Berbasis Web untuk Absensi Pegawai pada BKPSDM Kabupaten Tanah Laut,” *Jurnal Humaniora Teknologi*, vol. 4, no. 1, 2018, <https://doi.org/10.34128/jht.v4i1.38>.
- [19] D. Prasetyo, I. Fitri, and A. Rubhasy, “Sistem Absensi Online Berbasis Web Dengan QR Code Secara Real Time Menggunakan Algoritma Vigenere Cipher,” *INTECOMS: Journal of Information Technology and Computer Science*, vol. 4, no. 1, pp. 88–96, Jun. 2021, <https://doi.org/10.31539/intecom.v4i1.2411>.
- [20] B. Munthe, Herman, A. Arifin, B. S. Nugroho, and E. Fitriani, “Online Student Attendance System Using Android,” *Journal of Physics: Conference Series*, vol. 1933, Art. no. 012048, 2021, <https://doi.org/10.1088/1742-6596/1933/1/012048>.
- [21] M. A. Rosid and S. Sumarno, “Rancangan Sistem Presensi Mahasiswa Menggunakan QR Code dengan Fitur Geolocation dan Enkripsi AES,” *JIKA: Jurnal Informatika*, vol. 5, no. 2, pp. 167–173, 2021, <https://doi.org/10.31000/jika.v5i2.4052>.
- [22] A. F. A. Fatah, R. Mohamad, F. Y. A. Rahman, and N. I. Shuhaimi, “Student Attendance System Using an Android Based Mobile Application,” in *Proc. 2021 IEEE 11th IEEE Symposium on Computer Applications & Industrial Electronics (ISCAIE)*, 2021, pp. 224–227, <https://doi.org/10.1109/ISCAIE51753.2021.9431771>.
- [23] M. S. Mohammed and K. A. Zidan, “Enhancing Attendance Tracking Using Animated QR Codes: A Case Study,” *Indonesian Journal of Electrical Engineering and Computer Science*, vol. 31, no. 3, pp. 1716–1723, Sep. 2023, <https://doi.org/10.11591/ijeecs.v31.i3.pp1716-1723>.
- [24] A. Patel, A. Joseph, S. Survase, and R. R. Nair, “Smart Student Attendance System Using QR Code,” *SSRN Electronic Journal*, 2019, <https://doi.org/10.2139/ssrn.3370769>.
- [25] S. P. Kosa and N. Saurina, “Digital Attendance System with Location Tracking and Selfie Verification for Employee Presence Monitoring at PT Fazana Berkah Mulia,” *ICoBITS*, 2025, <https://doi.org/10.32664/icobits.v1.78>.

Biographies of Authors

	<p>Muhammad Rinov Cuhanazriansyah, S.T., M.Pd.T., is a distinguished academic and lecturer currently affiliated with the Department of Information Technology Education at IKIP PGRI Bojonegoro. With a robust educational background that bridges technical engineering and pedagogical technology, he has established himself as a prominent figure in the field of educational innovation. His scholarly contributions are widely recognised, particularly in the areas of gamification in education, interactive learning media, and web-based programming. According to official records from SINTA and Google Scholar, his research has achieved significant impact, featuring publications in reputable international journals such as the <i>International Journal of Interactive Mobile Technologies (iJIM)</i>. Beyond his teaching responsibilities, Mr Cuhanazriansyah is deeply involved in the academic publishing ecosystem, serving as a meticulous editor and peer reviewer for various scientific journals and textbooks. His expertise in research methodology and 'Research and Development' (R&D) is evidenced by his Intellectual Property Rights (IPR) for works focusing on classroom action research and innovative learning models. As a dedicated researcher with a notable SINTA Score and H-index, he continues to drive the</p>
--	---

	<p>advancement of digital literacy and educational technology in Indonesia, fostering a modern learning environment that aligns with the demands of the 4.0 era. For academic inquiries, collaborations, or editorial matters, Muhammad Rinov Cuhanazriansyah can be reached via email at muhrinov15@gmail.com</p>		<p><i>Edutama</i> and <i>J-ABDIPAMAS</i> (Jurnal Pengabdian Kepada Masyarakat), ensuring the rigorous peer-review of emerging educational research. His commitment to academic literature is further evidenced by his role as a prolific author and editor of scholarly books, notably his works on statistics with computer programming and contextual teaching approaches. Through his multifaceted roles as an educator, reviewer, and editorial leader, Dr. Amin continues to shape the future of instructional strategies and educational innovation within the 4.0 era. For academic inquiries, collaborations, or editorial matters, Dr. Amin can be reached via email at ahmadkholiqulamin@ikipgribojonegoro.ac.id.</p>
	<p>Dr. Ahmad Kholiqul Amin, M.Pd., is a highly regarded academic and senior lecturer based at IKIP PGRI Bojonegoro, where he serves within the Department of Information Technology Education. With a doctoral degree and a profound expertise in educational technology and mathematics education, Dr. Amin has become a pivotal figure in advancing digital pedagogy in Indonesia. His scholarly profile is notably strong; according to the Science and Technology Index (SINTA), he maintains a high impact within the research community, boasting an H-index that reflects a consistently cited body of work on Google Scholar. His research often explores the intersection of mobile blended learning and mathematical problem-solving, with significant publications in esteemed platforms such as the <i>International Journal of Interactive Mobile Technologies (IJIM)</i>. In addition to his teaching and research, Dr. Amin is a cornerstone of the academic publishing landscape. He serves as the Editor-in-Chief for several influential journals, including <i>Jurnal Pendidikan</i></p>		<p>Aprilia Eka Widiana is an undergraduate student in the Information Technology Education Program at IKIP PGRI Bojonegoro. She was born in Bojonegoro on April 19, 2003 and is currently in her eighth semester. Her research focuses on information systems, especially web-based applications for education. Her undergraduate thesis is entitled “<i>Innovation of a Web-Based Digital Attendance System with Dual Validation for Student Attendance Authentication Using QR Code, Selfie, and Geolocation.</i>” She is actively involved in PMII IKIP PGRI Bojonegoro and can be contacted at apriliekawdn19@gmail.com.</p>