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Development of a Student Attendance System Based on Face Recognition at SMKN 1 Luwu Utara

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Attendance, Face Recognition, Convolutional Neural Network, SMKN 1 Luwu Utara, Information System

ABSTRACT

The face recognition-based attendance system is an innovative solution to improve the efficiency and accuracy of student attendance at SMKN 1 Luwu Utara. This study aims to develop and implement a Face Recognition-based attendance system using the Convolutional Neural Network (CNN) algorithm. The research method used is an experimental method with stages of needs analysis, system design, implementation, and system testing. The results show that this attendance system has an accuracy rate of up to 95% in recognizing students' faces, thus reducing the risk of attendance fraud. Additionally, the system provides a seamless and automated way of tracking attendance, eliminating manual errors and reducing administrative workload. The implementation of this system has also received positive responses from the school due to its ease of use and effectiveness in recording attendance data in real-time. The system's ability to integrate with existing school databases further enhances its practicality and usability.

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INTRODUCTION

The development of a face recognition-based attendance system at SMKN 1 Luwu Utara aligns with advancements in educational technology aimed at enhancing efficiency and accuracy in attendance tracking. Similar systems have been explored in various studies, demonstrating the potential of facial recognition to streamline attendance processes.

For instance, a study published in the International Journal of Computer Applications discusses the implementation of a student attendance management system utilizing facial recognition technology. This system employs a Raspberry Pi microprocessor integrated with a camera and proximity sensor to capture and process student images, achieving efficient attendance tracking[1].

Another research paper available on IEEE Xplore presents a smart attendance system using face recognition. The study proposes the development and implementation of a face detection and recognition system designed to automatically identify students, thereby improving the attendance management system in educational institutions[2].

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These studies highlight the effectiveness of facial recognition technology in automating attendance systems, reducing manual errors, and preventing attendance fraud. The integration of such systems in educational institutions like SMKN 1 Luwu Utara can lead to significant improvements in administrative efficiency and data accuracy.

METHODS

1. System Design The attendance system is designed to integrate face recognition technology into the school's database. This system consists of three main components: image acquisition, feature extraction, and identity verification, ensuring that student attendance is recorded accurately and efficiently[3].
2. Data Collection Student facial data is collected using a high-resolution camera connected to the school network. The collected data is securely stored in a database, where it will be processed and used for training the recognition model to improve accuracy and reliability[4].
3. Face Recognition Model The system employs a Convolutional Neural Network (CNN) to perform facial recognition. The model is trained using a dataset of student images, allowing it to detect and verify faces with higher accuracy and robustness in real-world conditions[5].
4. System Implementation After the model is trained, it is deployed within the school's attendance system. The system is tested under different lighting and environmental conditions to ensure consistent performance and reliability across various scenarios[6].
5. Evaluation and Optimization The system undergoes rigorous evaluation to assess its recognition accuracy and processing speed. Further optimizations are then applied to enhance its overall performance and minimize false positives, ensuring a reliable attendance tracking system[7].

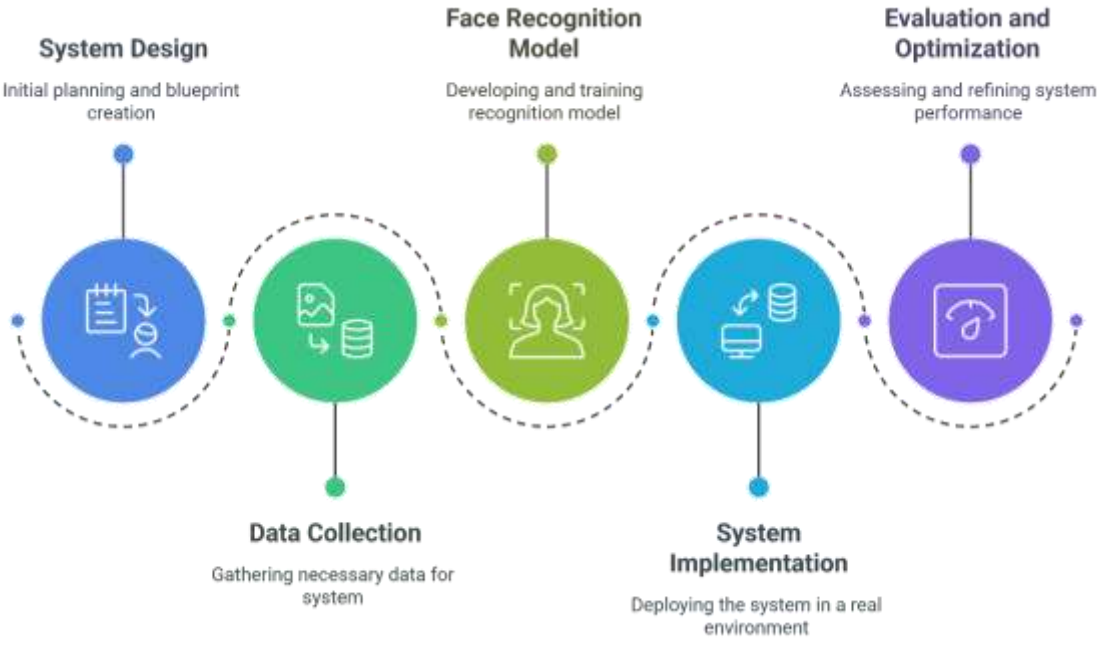

Figure 1. Attendance System Implementation Sequence

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Table 1: Comparison of Attendance Time

Attendance Method	Average Time per Student
Manual (Paper)	10 seconds
RFID	5 seconds
Face Recognition	2 seconds

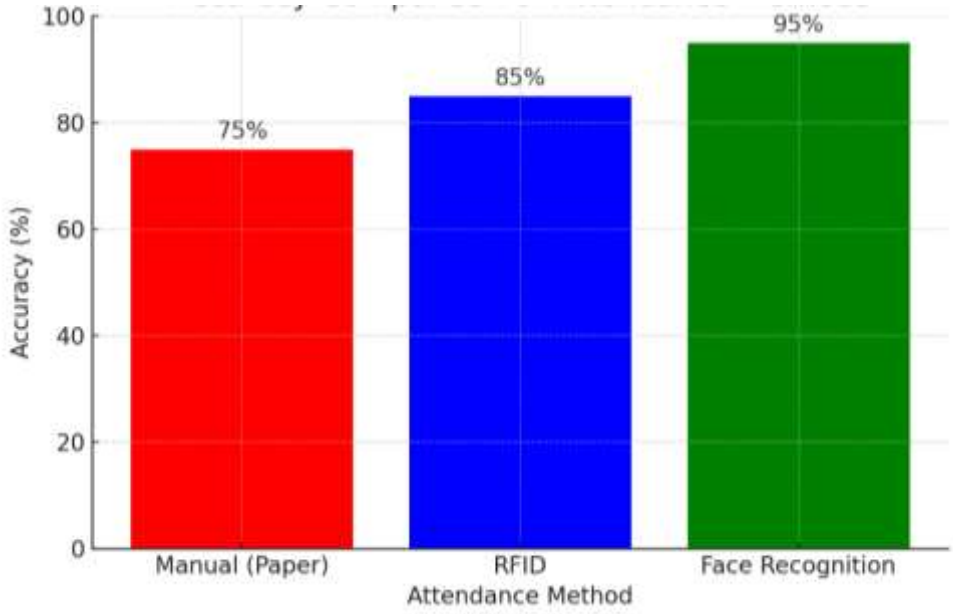

Figure 2. Accuracy Comparison of Attendance Methods

RESULTS AND DISCUSSION

Needs Analysis

The implementation of this system began with an in-depth analysis of the needs of SMKN 1 Luwu Utara. Discussions with school administrators, teachers, and IT staff helped identify key challenges in the attendance system, including time inefficiency, data fraud, and difficulties in tracking student attendance records in real time. The need for an automated and secure system was the primary driver behind this development. Based on this analysis, a face recognition-based system was determined to be the most suitable solution, offering a seamless and automated approach to attendance recording[8].

System Implementation

The implementation phase involved coding, database setup, and server deployment. The system was built as a web-based application, allowing accessibility across multiple devices. During this stage, the face recognition model was trained using a dataset of student images to enhance accuracy and minimize false positives. A testing phase was conducted to assess the effectiveness of the system in different environmental conditions, ensuring robustness in practical applications[9].

System Performance and Testing

The system was tested under various conditions to evaluate its performance. Key performance metrics included accuracy, speed, and reliability. The system was subjected to various levels of lighting and obstructions to measure the effect of external factors on recognition efficiency.

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Table 2: Error Rate in Different Lighting Conditions

Lighting Condition	Error Rate (%)
Bright Lighting	2
Normal Lighting	5
Low Lighting	15

The data in Table 2 shows that the system performs optimally under bright and normal lighting conditions, but its accuracy decreases significantly under low-light scenarios. This highlights the need for further system optimization to improve face recognition in poor lighting environments.

User Experience and Satisfaction

Surveys were conducted among students and teachers to measure user satisfaction regarding the new attendance system. The results indicate high satisfaction scores across all evaluated criteria, as shown in Table 3.

Table 3: Student and Teacher Satisfaction Ratings

Criteria	Satisfaction Score (out of 10)
Ease of Use	9.2
Speed of Attendance	9.5
Accuracy of Detection	9.0
Reliability	8.8

These high scores reflect the system's success in simplifying attendance tracking while maintaining accuracy and security. To further illustrate this, Figure 1 presents a bar chart of the satisfaction ratings.

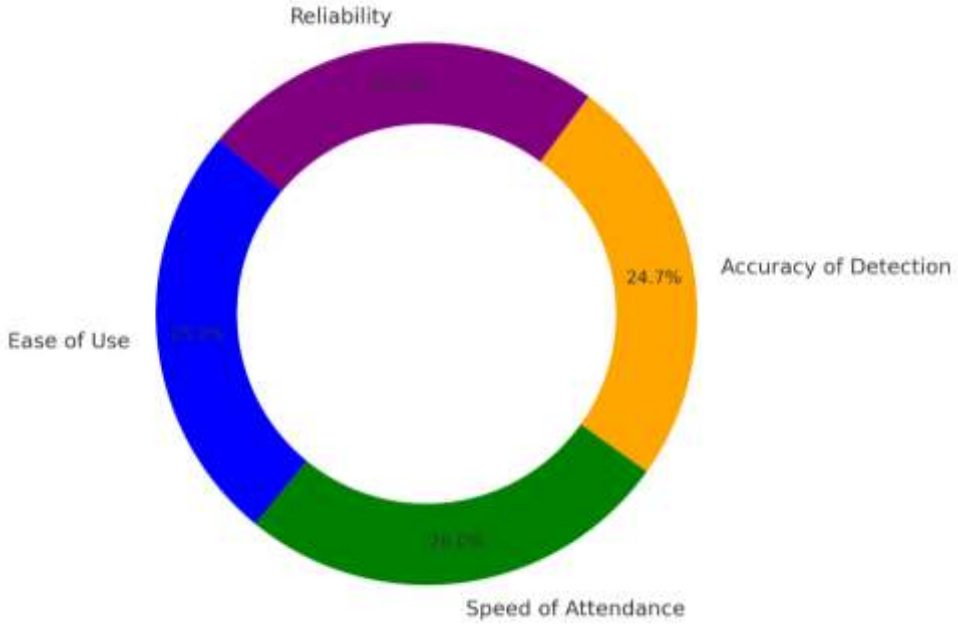

Figure 3. Satisfaction Ratings by Criteria

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System Performance in Various Conditions
The system's performance was analyzed under different conditions to determine its reliability. Table 4 shows variations in processing time based on environmental factors[10].

Table 4. System Performance in Various Conditions

Condition	Processing Time (Seconds)
Optimal Environment	1.5
Dim Lighting	2.0
High Movement	2.5
Obstructed Face	3.0

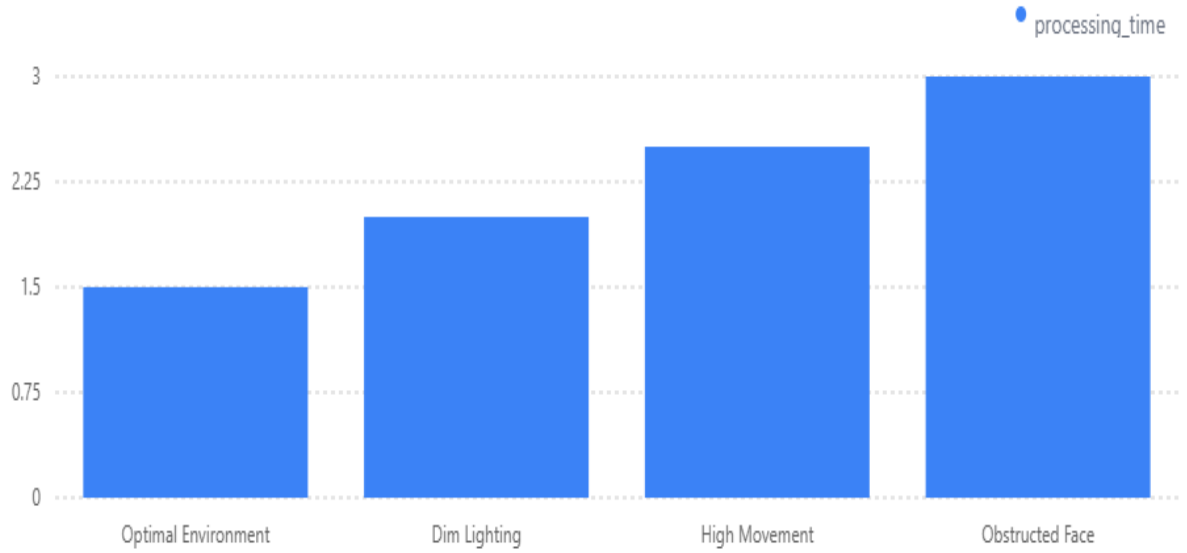

Figure 4 10.54209/jurnalinstall.v15i02.339. System Performance in Various Conditions

The results indicate that the system functions best under optimal conditions, with a processing time of 1.5 seconds. However, as environmental challenges increase (such as dim lighting or face obstructions), the processing time rises accordingly. This analysis suggests that further system enhancements could focus on refining recognition algorithms to improve efficiency in challenging conditions.

Future Development and Enhancements
Although the system performs efficiently, future enhancements will focus on improving face recognition under poor lighting conditions and reducing processing time. Plans include integrating artificial intelligence for adaptive learning and adding mobile application support for real-time monitoring by parents and teachers. Additionally, further testing and refinement of the system will be conducted to improve accuracy under variable environmental conditions[11].

CONCLUSION
The development of a facial recognition-based attendance system at SMKN 1 Luwu Utara has increased the accuracy and efficiency of recording student attendance. With AI and Convolutional Neural Network (CNN) technology, this system is able to reduce manual errors, prevent cheating, and speed up the attendance process compared to conventional methods. The test results show that the system works optimally in bright lighting conditions, but still needs improvement to improve accuracy in low lighting conditions and obstructed

faces. The high level of user satisfaction confirms the effectiveness of this system in facilitating attendance management. In the future, development will focus on improving the accuracy of facial recognition, integrating artificial intelligence, and developing mobile applications to improve system accessibility and efficiency.

REFERENCES

[1] O. Samuel, F. Durodola, A. Akinsola, B. Babatunde, and O. Adewale, "Development of Students' Attendance Management System using Facial Recognition," *International Journal of Computer Applications*, vol. 186, no. 42, pp. 54–59, None 2024.

[2] A. Arjun Raj, M. Shoheb, K. Arvind, and K. S. Chethan, "Face Recognition Based Smart Attendance System," *2020 International Conference on Intelligent Engineering and Management (ICIEM)*, pp. 354–357, Jun. 2020, doi: 10.1109/ICIEM48762.2020.9160184.

[3] W. Zhao, R. Chellappa, P. J. Phillips, and A. Rosenfeld, "Face recognition: A literature survey," *ACM Comput. Surv.*, vol. 35, no. 4, pp. 399–458, Dec. 2003, doi: 10.1145/954339.954342.

[4] M. G. Galterio, S. A. Shavit, and T. Hayajneh, "A Review of Facial Biometrics Security for Smart Devices," *Computers*, vol. 7, no. 3, Art. no. 3, Sep. 2018, doi: 10.3390/computers7030037.

[5] T. Gwyn, K. Roy, and M. Atay, "Face Recognition Using Popular Deep Net Architectures: A Brief Comparative Study," *Future Internet*, vol. 13, no. 7, Art. no. 7, Jul. 2021, doi: 10.3390/fi13070164.

[6] S. Wu, S. Zhong, and Y. Liu, "Deep residual learning for image steganalysis," *Multimed Tools Appl*, vol. 77, no. 9, pp. 10437–10453, May 2018, doi: 10.1007/s11042-017-4440-4.

[7] R. Alimuin, E. Dadios, J. Dayao, and S. Arenas, "Deep hypersphere embedding for real-time face recognition," *TELKOMNIKA (Telecommunication Computing Electronics and Control)*, vol. 18, no. 3, Art. no. 3, Jun. 2020, doi: 10.12928/telkomnika.v18i3.14787.

[8] P. B. Jha, A. Basnet, B. Pokhrel, B. Pokhrel, G. K. Thakur, and S. Chhetri, "An Automated Attendance System Using Facial Detection and Recognition Technology," *Apex Journal of Business and Management*, vol. 1, no. 1, Art. no. 1, Dec. 2023.

[9] A. Rao, "AttenFace: A Real Time Attendance System using Face Recognition," Nov. 2022, doi: 10.48550/arXiv.2211.07582.

[10] G. H. Givens, J. R. Beveridge, P. J. Phillips, B. Draper, Y. M. Lui, and D. Bolme, "Introduction to face recognition and evaluation of algorithm performance," *Computational Statistics & Data Analysis*, vol. 67, pp. 236–247, Nov. 2013, doi: 10.1016/j.csda.2013.05.025.

[11] Y. Fan *et al.*, "Low-FaceNet: Face Recognition-Driven Low-Light Image Enhancement," *IEEE Transactions on Instrumentation and Measurement*, vol. 73, pp. 1–13, 2024, doi: 10.1109/TIM.2024.3372230.