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Optimization of School Administration with Augmented Reality and Payment Gateway

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Abstract

The rapid advancement of digital technology has highlighted the need for efficient and transparent school administration systems. Traditional manual student profile management and tuition payment processes often lead to delays, errors, and inefficiencies. This study proposes an integrated system that combines Augmented Reality (AR) for student profile photo standardization and a Payment Gateway for automated financial transactions. The AR feature enables students to capture standardized profile photos directly through the application, ensuring compliance with school regulations while reducing administrative workload. Simultaneously, the Payment Gateway supports multiple digital payment methods, enhancing transaction speed, security, and transparency. The research follows a four-stage methodology: Needs Analysis, Prototype Design, Application Development, and Testing & Refinement. Through Needs Analysis, key administrative challenges were identified, guiding the design and development of the system. The prototype was developed using Laravel for the backend, React for the front end, OpenCV for AR processing, and Midtrans as the Payment Gateway provider. Extensive testing, including User Acceptance Testing, demonstrated the system's effectiveness in streamlining administrative tasks, achieving a 100% pass rate across 8 test cases, with minor contextual issues (e.g., low-quality cameras, poor lighting, unstable internet) that did not hinder successful task completion, confirming the system's robustness. The AR-based profile photo verification and secure online payment processing significantly improved user experience and efficiency. Refinements were made to optimize system performance, including enhanced image processing for low-quality cameras, real-time transaction retry mechanisms, and User Interface improvements for better navigation. This study contributes to the digital transformation of school administration by integrating AR and Payment Gateway technologies, providing a scalable, efficient, and user-friendly solution for educational institutions.

Keywords: Automation; Digital Payments; Digitization; Ease of Access; Innovative

1 Introduction

The rapid advancement of digitalization has emphasized the critical role of technology in enhancing the efficiency and convenience of school administration (Andriani & Hidayat, 2023). Traditional methods of handling financial processes, such as tuition fees, activity funds, and student admissions, are often conducted manually, resulting in delays, recording errors, and dissatisfaction among students and parents (Airlambang et al., 2021). Payment Gateway technology offers a solution by enabling faster, more secure, and transparent online transactions (Aditya & Sulistyowati, 2023; Patel, 2021). Simultaneously, Augmented Reality technology enhances user experiences, particularly in managing digital student profile photos that comply with school standards (Arena et al., 2022).

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Despite the significant potential of Payment Gateway and AR technologies, their integration within educational environments remains underexplored (Nguyen, 2022). Manual processes for managing school payments and student profiles frequently lead to inefficiencies, inaccuracies, and user dissatisfaction. To address this gap, this study aims to develop a system that integrates AR and Payment Gateway technologies, modernizes school administration, and resolves issues such as inefficiency and errors in financial and profile management.

AR has demonstrated its effectiveness across various sectors (Voinea et al., 2023), including education (Motejlek & Alpay, 2021;, where it enriches interactions and enhances user experiences through dynamic and immersive visualizations. In education, AR is used to support learning processes by visualizing content in more engaging ways (Ado Tukan & Astuti, 2023; Garg et al., 2023; Negahban, 2024). It is also widely employed in fitting-related applications across industries (Battistoni et al., 2022; Dalle Mura & Dini, 2021; Lee et al., 2021; Liu et al., 2024a, 2024b; Long et al., 2022; Xue et al., 2024), showcasing its adaptability in delivering user-centric solutions. Conversely, Payment Gateway technology has become a cornerstone of digital transaction systems, enabling users to perform online payments with speed, security, and efficiency. It is extensively adopted in sectors like e-commerce (Haeruddin et al., 2024; Yaqin et al., 2024), banking (Chouhan et al., 2023; Sardjono et al., 2023), and public services (Sausi & Mtebe, 2021; Tran et al., 2022). Payment Gateway technology automates financial administration processes within the educational sector, such as tuition fee payments and activity fund management (Dwi Nurul Huda et al., 2022; Farhana et al., 2022; Halidar et al., 2023; Rahman et al., 2021; Simatupang et al., 2022; Wulandari & Sholihin, 2023). These traditionally manual processes benefit significantly from digital transformation, improving accuracy and efficiency.

This study introduces a novel approach by integrating AR and Payment Gateway technologies into a single school administration application. The proposed system addresses inefficiencies in payment processes and streamlines student profile management. By combining these technologies, the research provides a secure, interactive, and efficient platform that enhances the administrative experience for all stakeholders.

The novelty of this research lies in its integration of AR and Payment Gateway technologies into a unified system tailored for school administration. Unlike prior studies that employed these technologies independently, this research explores their combined potential to create a more interactive, efficient, and user-friendly experience. Features such as AR-based interactive profile photo updates and secure online payment processing demonstrate the significant advancements achieved by this approach. This innovative integration represents a step forward in the digital transformation of educational institutions in Indonesia, offering a scalable solution for broader adoption in similar contexts.

2 Research Method

This research focuses on developing a system that integrates AR and Payment Gateway technologies to enhance school administration processes, particularly in payment management and student profile photo standardization. The methodology is structured into four key stages, as illustrated in Figure 1, ensuring the effective integration of these technologies.

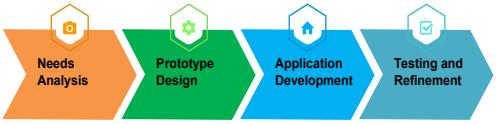

Figure 1. Research stages

a. Need Analysis

The Needs Analysis stage identifies specific requirements for integrating AR and Payment Gateway into school administrative processes. This stage involves interviews with school administrators, treasurers, and students to gather insights into current manual processes, challenges, and expected system functionalities. Observations of existing workflows related to profile management and payment processes were also conducted to identify inefficiencies, such as delays and errors. The collected requirements were mapped into a conceptual interaction model that shows the relationships between students, administrators, servers, AR systems, and Payment Gateway services. This conceptual model

illustrates how the entities interact within the proposed application.

b. Prototype Design

The prototype design stage was developed based on the findings from the Needs Analysis. The design outlines the key functionalities and interactions within the system to ensure seamless integration of AR and Payment Gateway technologies. A flowchart was created to visualize the overall administrative process. It depicts the steps from students capturing profile photos with AR technology to completing payment processing. Additionally, use case diagrams were prepared to outline core user scenarios. These include capturing standardized profile photos, completing payments via the Payment Gateway, and administrators validating the data. These design artifacts serve as a blueprint for application development, ensuring the system meets functional requirements while maintaining ease of use.

c. Application Development

The application development stage focuses on integrating AR and Payment Gateway technologies into the system. An iterative development approach is applied to ensure system stability, functional reliability, user-friendly interfaces, continuous improvement, effective testing, and alignment with user requirements throughout the development lifecycle.

The AR feature for profile photo management is developed using Python (Mehare et al., 2023) and OpenCV to enable automatic image processing. This technology ensures that students can capture standardized profile photos directly through the application, such as photos with proper backgrounds and attire.

The Payment Gateway is integrated into the application using Midtrans (*Midtrans | Solusi Payment Gateway Indonesia Terlengkap*, n.d.) provider, facilitating secure and reliable payment processing. Various payment methods are supported, including bank transfers, credit cards, and digital wallets. Additionally, ngrok (*Ngrok | API Gateway, IoT Device Gateway, Secure Tunnels for Containers, Apps & APIs*, n.d.) enabled real-time Payment Gateway processes by providing internet access to the local server, ensuring smooth and efficient transaction management.

The user interface uses Figma (*Figma: The Collaborative Interface Design Tool*, n.d.) to provide an intuitive and responsive experience for students, administrators, and other stakeholders. The application's backend is built using Laravel (Mangukiya, 2020; Subecz, 2021), a PHP-based framework (Endra et al., 2021), while data storage and management are handled using MySQL (Šušter & Ranisavljević, 2023; Wahyudi et al., 2022). The system is deployed and tested locally through XAMPP (XAMPP Installers and Downloads for Apache Friends, n.d.), with Visual Studio Code (Download Visual Studio Code - Mac, Linux, Windows, n.d.) serving as the primary code editor to support and streamline the development process.

d. Testing and Refinement

The Testing and Refinement stage evaluates the application's functionality and user experience. Functional testing was carried out to verify the stability of AR-based photo management and the integration of Payment Gateway services. User Acceptance Testing (UAT) was conducted with school stakeholders, including treasurers and administrators, to assess the overall usability and performance of the system. Feedback from users was collected to identify potential issues, challenges, and areas for improvement. Based on this feedback, refinements were made to optimize system functionality and user experience. The final version of the application was adjusted to ensure it met user requirements and delivered smooth operations.

3 Result and Discussion

The developed application successfully integrates AR and Payment Gateway technologies to address inefficiencies in school administrative processes. The research results are described below.

a. Need Analysis Result

The Needs Analysis revealed that current school administrative systems heavily rely on manual processes, causing delays in data management, particularly in handling student profile photos and payment records. These inefficiencies also impact the transparency of administrative processes, where students and parents often lack direct access to monitor their administrative status. Consequently, there is a

pressing need for an integrated system incorporating AR and Payment Gateway technologies.

The analysis identified several critical requirements for the proposed system. First, AR-based digital profile photo management was essential to streamline manual efforts while ensuring compliance with school photo standards. Second, the need for an automated and secure payment system was highlighted, focusing on supporting multiple payment methods such as bank transfers, credit cards, and digital wallets. Additionally, the findings emphasized the importance of providing real-time updates and notifications to enhance the transparency and efficiency of both profile verification and payments.

The collected requirements were mapped into a conceptual interaction model depicted in Figure 2. This model illustrates the relationships between key entities, including students, administrators, servers, AR systems, and Payment Gateway services, highlighting how these entities interact within the proposed application.

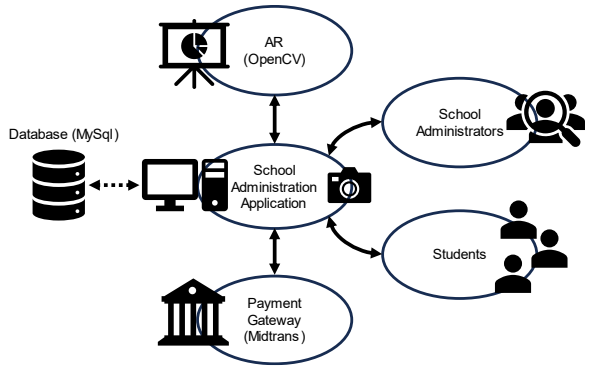

Figure 2. Entity interaction concept diagram

The diagram represents the interaction between various entities involved in a school administration system that integrates AR and Payment Gateway technologies. The application is the primary hub, connecting students, school administrators, the AR system, and the Payment Gateway. Students interact with the system using the AR feature to capture standardized profile photos or initiate school fee payments. The captured photos are sent to the server for storage and validation by the administrator, ensuring compliance with school standards. For payment processes, students select their preferred payment method through the application, which communicates with the Payment Gateway to process transactions securely. The server ensures smooth coordination between the application, AR system, and Payment Gateway, updating records and notifying administrators about completed transactions. Each entity in the system plays a specific role, contributing to a streamlined and efficient school administration process.

b. Prototype Design Result

The Prototype Design stage results emphasize the system's core functionalities, including capturing standardized profile photos using AR technology, verifying data on the server, and processing payments through the Payment Gateway. The design incorporates a detailed flowchart (Figure 3) and use case diagram (Figure 4), outlining user interactions and administrative workflows, ensuring alignment with user needs and system functionality objectives.

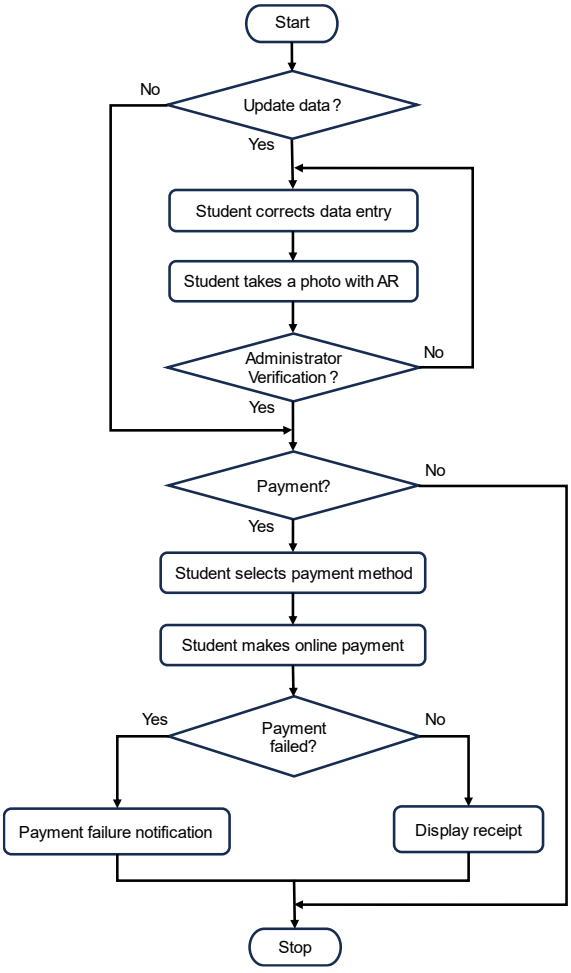

Figure 3. Flowchart of student data update and online payment process

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This flowchart outlines a step-by-step process for updating student data and making an online payment. The process begins with the student updating their personal information. If any errors are found, the student proceeds to correct the data. Once the data is correct, the student takes a profile photo using AR technology. The next step involves the school administrator verifying the student's information. If everything is in order, the student selects their preferred payment method. After choosing a payment method, the student makes an online payment. If the payment fails, a notification is displayed to inform the student of the failure. In the case of a successful payment, a receipt is shown to the student, and the process is completed. The flowchart ensures that all necessary steps are followed, including verification, data correction, and payment handling, providing a smooth and structured experience.

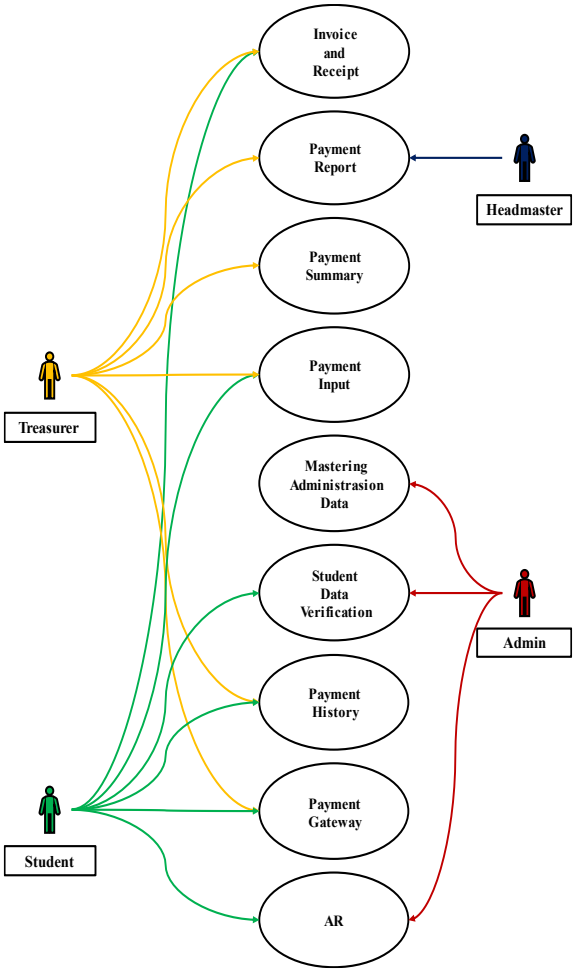

Figure 4. Use case of payment processing and student data verification

This use case outlines an optimized and efficient process for managing student data, verifying profile photos using AR, and processing payments within an educational system. The process begins with Mastering Administration Data, where the Admin systematically organizes and finalizes student information to ensure both accuracy and completeness. This foundational step establishes the reliability of the data for subsequent stages. In the next stage, Verification of Student Data, the Admin carefully validates all details for consistency and correctness. During this phase, students are required to capture a profile photo using AR technology, ensuring the photo meets strict quality criteria, such as proper lighting, clear visibility, correct positioning, and adherence to school standards, including appropriate uniforms and background replacement. Once the data and photo are verified, the Treasurer generates an Invoice outlining the payment details. The process then advances to the Payment Input phase, where the student uses the provided invoice to proceed with payment. Payment details are securely entered, and transactions are processed through a Payment Gateway managed by the system, ensuring a high level of security and accuracy. Upon completing the payment, a Payment Report and Payment History are automatically generated, enabling both the Treasurer and students to monitor and track transactions in real-time. Finally, the Treasurer issues an official receipt, serving as a formal acknowledgment of the completed payment.

c. Application Development Result

Figure 5 presents the system architecture developed for prototype purposes. The diagram illustrates the integration of various components used in the prototype development. Ngrok is used for the payment gateway (Midtrans), which is suitable for testing but not ideal for production environments. More stable solutions, such as Cloud Hosting or a Static IP, should be considered for production to ensure reliable, continuous access.

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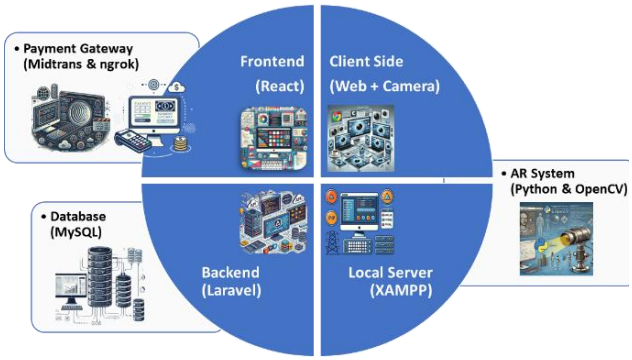

Figure 5. System architecture for school administration prototype development

The front end utilizes React, a powerful library for building user interfaces, which is suitable for prototyping but may need optimization and scalability improvements for a production environment. Similarly, the Client Side includes web and camera functionality, typically for AR applications, which can be enhanced further with more advanced frameworks or optimizations. On the Backend, Laravel is used effectively in the prototype, with MySQL as the database. However, database optimization (e.g., NoSQL or cloud-based databases like Amazon RDS) and performance scaling solutions should be considered for larger-scale production systems. The AR System implemented with Python & OpenCV works well for the prototype but may require more robust server capabilities and optimizations in production for better performance and scalability. The Local Server (XAMPP) is used in the prototype for development purposes. Still, it should be replaced with more powerful and secure server solutions like Apache, NGINX, or cloud platforms (e.g., AWS EC2, Google Cloud, or Azure) for production use. These changes would improve security, performance, and scalability, which are critical for a live production environment.

The development of the application's user interface was completed. Focusing on intuitive navigation and responsiveness to ensure optimal usability for students and administrators, the interface was designed and implemented with a clean layout, user-friendly features, and easy access to essential functions. For students, the Student Panel (Figure 6) provides a centralized platform to manage their profiles and payments. It features an AR-powered tool for capturing standardized profile photos and detailed payment information, including outstanding balances and transaction history. The interface allows students to initiate payments seamlessly using various methods integrated through the Payment Gateway.

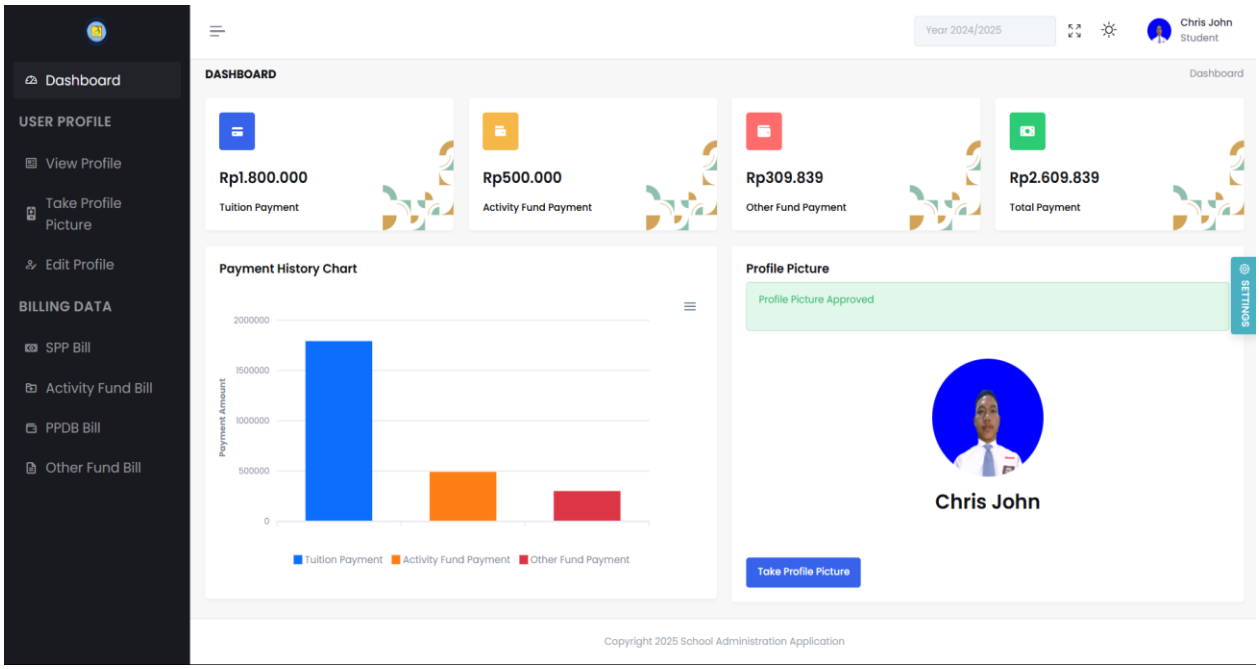

Figure 6. Student panel for profile and payment management

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The Administrator Panel (Figure 7) is designed to support school administrators in managing critical administrative tasks. It includes functionalities to validate and approve student profile photos. The layout ensures efficient workflow management, enabling administrators to perform their duties with minimal effort and maximum accuracy.

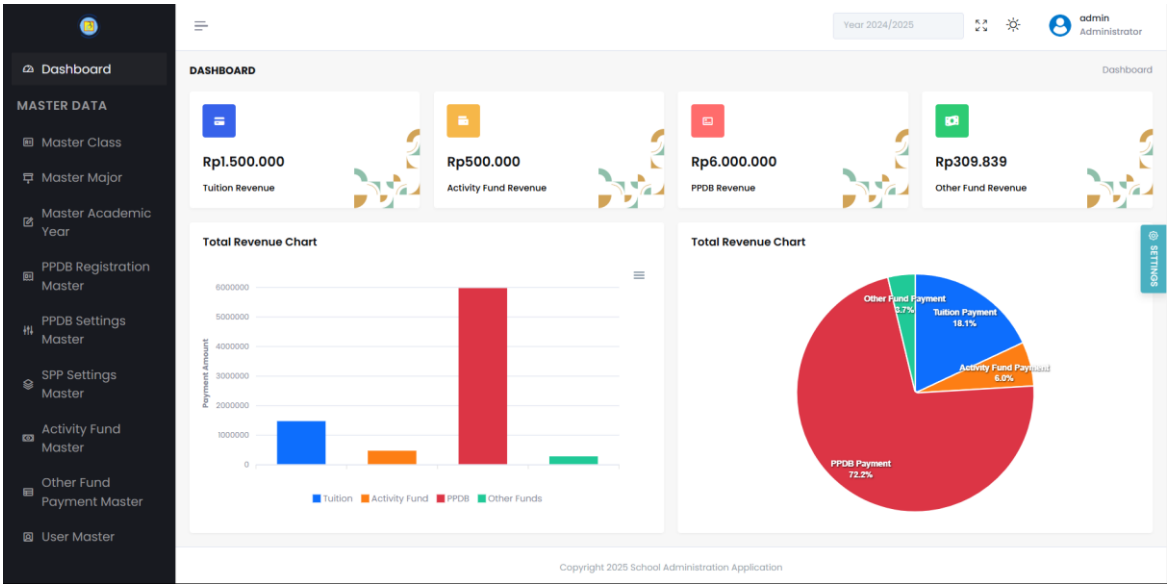

Figure 7. Administrator panel for validation and system management.

The Treasurer Panel, illustrated in Figure 8, is designed to assist the Treasurer in managing payment-related tasks. It provides functionalities for generating and monitoring invoices, processing payments, and tracking students' financial statuses. The layout is optimized for quick access to essential payment functions, ensuring the Treasurer can perform their duties efficiently and accurately.

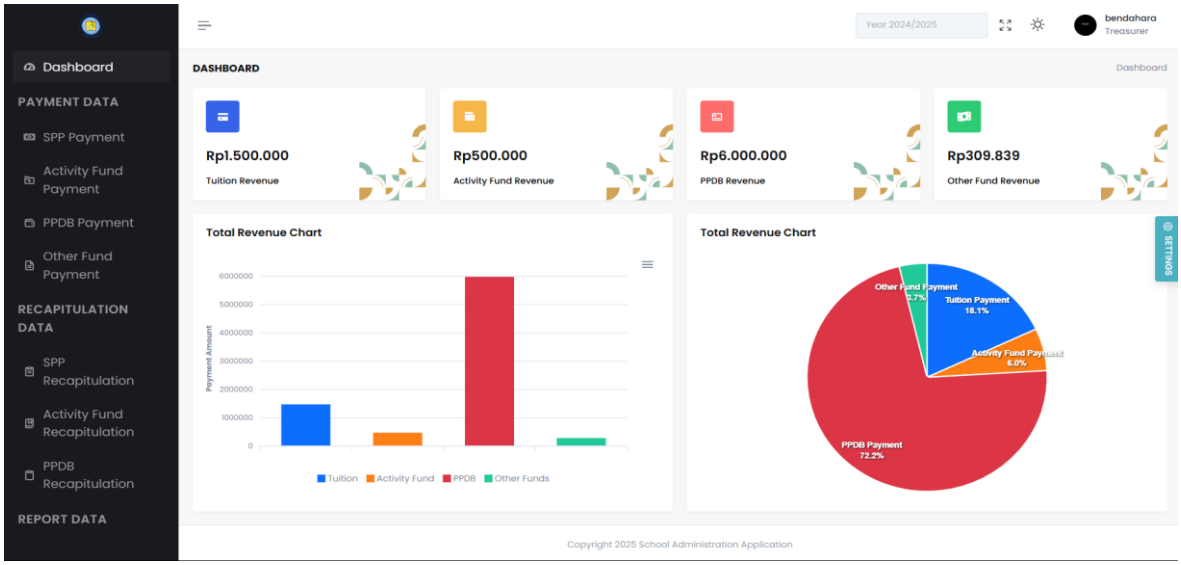

Figure 8. Treasurer panel for financial management

The implementation of AR technology in the application has been successfully realized, providing an innovative solution for profile photo management. This feature lets students capture their profile photos directly through the application, adhering to predefined school standards such as proper backgrounds and attire. The AR Photo Capture Interface (Figure 9) offers a

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dynamic and interactive user experience. The AR functionality ensures that students can easily position themselves within the frame, with real-time visual feedback guiding them to meet the required photo criteria. Once the photo is captured, it is automatically processed and formatted to meet school standards. This AR feature streamlines the process of profile photo submission, eliminating the need for manual editing or external photo services. The system enhances user engagement by integrating AR technology while maintaining consistency and quality in student profile management. The successful implementation demonstrates the potential of AR in simplifying administrative tasks and improving overall efficiency.

Figure 9. AR photo capture interface

Integrating Payment Gateway technology into the application has been completed, providing a secure and efficient solution for managing school payment transactions. This feature allows students and parents to make payments directly through the application using various methods such as bank transfers, credit cards, and digital wallets. The payment transaction interface (Figure 10) displays a clear and user-friendly layout where students can view their payment obligations and transaction history. This interface streamlines the payment process by guiding users through selecting their preferred payment method and completing the transaction seamlessly.

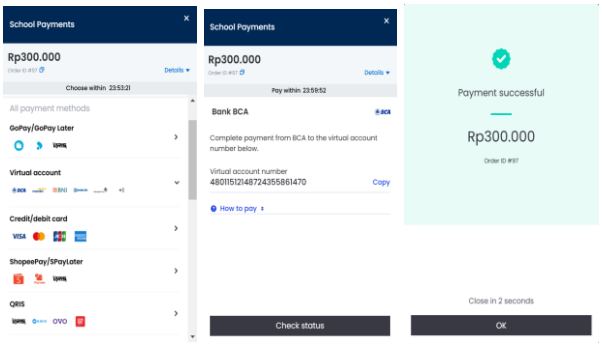

Figure 10. Payment transaction interface

d. Testing and Refinement Result

The Testing and Refinement stage results indicate that the AR-based photo management system and Payment Gateway integration functioned as expected, demonstrating stability and reliability. Functional testing was conducted repeatedly to ensure all system components operated smoothly without errors or malfunctions. This iterative testing process allowed for identifying and resolving technical issues, providing the application achieved optimal performance. By the final round of testing, all key features, including AR-based photo organization, secure payment processing, and seamless data synchronization, were verified to be fully functional and stable.

The results of UAT indicate that the system functions as expected, particularly in AR-based photo management and Payment Gateway integration. Most users, including school treasurers and administrators, provided positive feedback regarding the system's stability and ease of use. As shown in Table 1, most participants rated the system’s performance as satisfactory, though some suggested improved navigation and the clarity of instructions for certain features. While minor delays were reported on lower-spec devices, the system remained functional and user-friendly. The Payment Gateway integration performed well, with no significant transaction failures. Based on these findings, refinements were made to enhance the user experience and ensure the application operates optimally under various usage conditions.

Several refinements were implemented to address the issues identified during UAT and enhance the system's performance, usability, and reliability.

The AR verification process, affected by low-quality cameras on some devices, was optimized by incorporating image processing enhancements. These improvements allow the system to adjust for lower-resolution cameras by refining brightness levels and edge detection to ensure accurate verification (Zhang, 2021). Additionally, poor lighting conditions were identified as a challenge, leading to the development of a lighting detection feature that alerts users if their environment is too dim and provides guidance on improving lighting for successful verification.

Unstable internet connections occasionally led to transaction failures or delays for the Payment Gateway. A retry mechanism was introduced to mitigate this, allowing the system to attempt payment completion when a connection is restored automatically. An offline mode was also added to queue pending transactions, ensuring a seamless payment experience. Further refinements were made by optimizing the server infrastructure, reducing delays, and upgrading to a more stable payment provider.

The AR feature's performance was also improved to prevent lag during profile photo verification. Background processes were minimized, and rendering optimizations were applied to enhance responsiveness, particularly for users with lower-end devices. Additionally, some students found the user interface unclear when completing the AR verification process, leading to a redesign of the interface with step-by-step instructions, ensuring a more intuitive experience.

Students also faced difficulties selecting a non-cash payment method, primarily due to unclear options. A simplified payment selection menu with more explicit icons and descriptions and a built-in tutorial was introduced to solve this. Moreover, some users reported delays in receiving payment verification notifications, which were resolved by integrating a real-time push notification system. This ensures that students and administrators receive immediate confirmation once a transaction is verified.

These refinements collectively enhance the system's reliability, usability, and overall user experience, ensuring a smoother and more efficient AR-based verification and digital payments process (Behl, 2022).

Table 1. User Acceptance Test results

User Acceptance Test	UAT Result	Notes
The AR feature runs smoothly and effectively assists students in verifying their profile photos without technical issues.	Pass	Some devices with low-quality cameras struggled with AR verification, leading to verification failures.
The Payment Gateway system functions seamlessly, ensuring successful and hassle-free school payments.	Pass	Unstable internet connections caused occasional failures in Payment Gateway transactions.
The AR verification feature assures students that their profile photos meet the required standards.	Pass	Poor lighting conditions sometimes resulted in unclear profile photos, affecting verification accuracy.
The Payment Gateway offers a smooth and error-free experience for non-cash school payments.	Pass	Some users reported occasional payment failures or delays when using the Payment Gateway.
The AR feature is optimized to prevent any delays or lag during the profile photo verification process.	Pass	A few users experienced slight lag when using the AR verification feature, impacting efficiency.
The AR feature makes the profile verification process easy and efficient for students.	Pass	Some students found the AR verification process unclear due to the interface layout.
Students can easily select and use non-cash payment methods without difficulties.	Pass	Certain students had trouble selecting a preferred non-cash payment method due to unclear options.
The system reliably sends a payment verification notification immediately after transaction completion.	Pass	In rare cases, students did not receive immediate payment confirmation notifications after completing transactions.

4 Conclusion

This research successfully demonstrates the integration of AR and Payment Gateway technologies to optimize school administration processes, particularly in profile verification and digital payment management. The findings from UAT indicate that the developed system achieved a 100% pass rate across 8 test cases, demonstrating practical usability, efficiency, and security. While minor contextual issues (e.g., low-quality cameras, unstable internet) were noted, these did not prevent successful task completion, indicating that the core system functionality is robust.

The implementation of AR-based photo verification has streamlined student profile validation, ensuring compliance with school standards while reducing administrative workload. Similarly, the Payment Gateway integration has

significantly improved school transactions' speed, accuracy, and convenience, minimizing errors and delays (Alenezi, 2021). The refinements based on UAT feedback—such as optimizing AR performance, improving system compatibility, enhancing payment processing stability, and refining the user interface—have resulted in a more robust and user-friendly system.

5 Future Work

While the developed system has successfully met its objectives, further research is recommended to explore scalability and security enhancements for broader adoption across various educational institutions. Future work may focus on AI-driven automation for AR-based verification, blockchain-based payment security, and integration with government education platforms to enhance data transparency and compliance.

The findings of this study highlight the potential of digital transformation in school administration through the implementation of AR and Payment Gateway technologies. These technologies provide a scalable and efficient model that can be adapted to other sectors requiring secure identity verification, seamless digital transactions, improved operational efficiency, and enhanced system reliability across various organizational contexts.

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References

Aditya, M., & Sulistyowati, D. N. (2023). Web-Based Spp Payment Information System With Midtrans Payment Gateway. *Jurnal Sistem Informasi Dan Ilmu Komputer Prima(JUSIKOM PRIMA)*, *6*(2), 23–27. https://doi.org/10.34012/jurnalsisteminformasidanilmukomputer.v6i2.2942

Ado Tukan, K. A., & Astuti, L. G. (2023). Pengembangan Media Pembelajaran Interaktif Berbasis Teknologi Augment Reality Untuk Meningkatkan Kemampuan Berpikir Kreatif Anak. *JELIKU (Jurnal Elektronik Ilmu Komputer Udayana)*, *11*(4). https://doi.org/10.24843/jlk.2023.v11.i04.p10

Airlambang, D., Pramudya, S. A., Ardiansyah, M., Wijarnako, B., & Susyanto, M. D. P. (2021). Aplikasi Pembayaran SPP Berbasis Web Pada Sekolah Man 15. *Jurnal Ilmu Komputer Dan Bisnis*, *12*(2). https://doi.org/10.47927/jikb.v12i2.147

Alenezi, A. (2021). Digital transformation in higher education: A systematic review. *Education and Information Technologies*, 26, 467–491. https://doi.org/10.1007/s10639-020-10352-0

Andriani, N., & Hidayat, M. (2023). Pengelolaan Administrasi Sekolah. *Jurnal Pelita Nusantara*, *1*(2). https://doi.org/10.59996/jurnalpelitanusantara.v1i2.195

Arena, F., Collotta, M., Pau, G., & Termine, F. (2022). An Overview of Augmented Reality. *Computers*, *11*(2), 28. https://doi.org/10.3390/computers11020028

Battistoni, P., Di Gregorio, M., Romano, M., Sebillo, M., Vitiello, G., & Brancaccio, A. (2022). Interaction Design Patterns for Augmented Reality Fitting Rooms. *Sensors*, *22*(3). https://doi.org/10.3390/s22030982

Behl, A., Pereira, V., Dwivedi, Y. K., & Islam, N. (2022). Role of user experience and system reliability in digital transformation success. Technological Forecasting and Social Change, 174, 121298. https://doi.org/10.1016/j.techfore.2021.121298

Chouhan, V., Ali, S., Sharma, R. B., & Sharma, A. (2023). The effect of financial technology (Fin-tech) on the conventional banking industry in India. *International Journal of Innovative Research and Scientific Studies*, *6*(3). https://doi.org/10.53894/ijirss.v6i3.1578

Dalle Mura, M., & Dini, G. (2021). An augmented reality approach for supporting panel alignment in car body assembly. *Journal of Manufacturing Systems*, *59*. https://doi.org/10.1016/j.jmsy.2021.03.004

Download Visual Studio Code - Mac, Linux, Windows. (n.d.). Retrieved September 29, 2024, from https://code.visualstudio.com/Download

Dwi Nurul Huda, Adyatma, T., & Zulfachmi, Z. (2022). Pengembangan Aplikasi E-Money Dengan Pemanfaatan Payment Gateway Berbasis Android (Studi Kasus Sekolah Tinggi Teknologi Indonesia Tanjungpinang). *Jurnal Bangkit Indonesia*, *11*(2). https://doi.org/10.52771/bangkitindonesia.v11i2.212

Endra, R. Y., Aprilinda, Y., Dharmawan, Y. Y., & Ramadhan, W. (2021). Analisis Perbandingan Bahasa Pemrograman PHP Laravel dengan PHP Native pada Pengembangan Website. *EXPERT: Jurnal Manajemen Sistem Informasi Dan Teknologi*, *11*(1), 48. https://doi.org/10.36448/expert.v11i1.2012

Farhana, Q. N., Arwani, I., & Brata, D. W. (2022). Pengembangan Sistem Informasi Pembayaran Biaya Pendidikan menggunakan Teknologi Payment Gateway (Studi Kasus: SD Islam Terpadu Nurul Fikri Pati). *Jurnal Pengembangan Teknologi Informasi Dan Ilmu Komputer*, *6*(6).

Figma: The Collaborative Interface Design Tool. (n.d.). Retrieved September 29, 2024, from https://www.figma.com/

Garg, D., Dubey, N., Goel, P., Ramoliya, D., Ganatra, A., & Kotecha, K. (2023). Improvisation in Spinal Surgery Using AR (Augmented Reality), MR (Mixed Reality), and VR (Virtual Reality) †. *Engineering Proceedings*, *59*(1). https://doi.org/10.3390/engproc2023059186

Haeruddin, H., Ma'muriyah, N., & Wijaya, W. (2024). Pengembangan System Berlangganan Aplikasi Di Usertip Menggunakan Stripe. *Journal of Information System Management (JOISM)*, *5*(2). https://doi.org/10.24076/joism.2024v5i2.1288

Halidar, A., Irwanda, P., Rahayudi, B., & Brata, D. W. (2023). Perancangan dan Implementasi Aplikasi Toko Koperasi Sekolah berbasis Website dengan Memanfaatkan Payment Gateway Midtrans (Studi Kasus: SMK Negeri Temayang). *Jurnal Pengembangan Teknologi Informasi Dan Ilmu Komputer*, *7*(1).

Lee, H., Xu, Y., & Porterfield, A. (2021). Consumers' adoption of AR-based virtual fitting rooms: from the perspective of theory of interactive media effects. *Journal of Fashion Marketing and Management: An International Journal*, *25*(1), 45–62. https://doi.org/10.1108/JFMM-05-2019-0092

Liu, R., Balakrishnan, B., & Erni Marlina Saari. (2024a). How AR Technology is Changing Consumer Shopping Habits: from Traditional Retail to Virtual Fitting. *Academic Journal of Science and Technology*, *9*(2). https://doi.org/10.54097/n5fk7m44

Liu, R., Balakrishnan, B., & Erni Marlina Saari. (2024b). The Impact of Augmented Reality (AR) Technology on Consumers' Purchasing Decision Processes. *Frontiers in Business, Economics and Management*, *13*(2). https://doi.org/10.54097/1r7f1x56

Long, X., Chen, Y., & Zhou, J. (2022). Affordable Projector-Based AR Experimental Platform with Fitting Simulation Asset for Exploring Thermal Management. *Applied Sciences (Switzerland)*, *12*(16). https://doi.org/10.3390/app12168019

Mangukiya, A. A. (2020). Laravel: A framework for building PHP Apps. *Journal of Innovation Information Technology and Application (JINITA)*.

Mehare, H. Bin, Anilkumar, J. P., & Usmani, N. A. (2023). The Python Programming Language. In *A Guide to Applied Machine Learning for Biologists* (pp. 27–60). Springer International Publishing. https://doi.org/10.1007/978-3-031-22206-1_2

Midtrans | Solusi Payment Gateway Indonesia Terlengkap. (n.d.). Retrieved May 15, 2024, from https://midtrans.com/

Motejlek, J., & Alpay, E. (2021). Taxonomy of Virtual and Augmented Reality Applications in Education. *IEEE Transactions on Learning Technologies*, *14*(3). https://doi.org/10.1109/TLT.2021.3092964

Negahban, A. (2024). Simulation in engineering education: The transition from physical experimentation to digital immersive

simulated environments. *Simulation*. https://doi.org/10.1177/00375497241229757

Ngrok | API Gateway, Iot Device Gateway, Secure Tunnels For Containers, Apps & Apis. (N.D.). Retrieved December 24, 2024, from https://ngrok.com/

Patel, J. (2021). Secured and Efficient Payment Gateways for eCommerce. *International Journal of Research Publication and Reviews*, *2*(7).

Rahman, Rahman, R., & Muin, A. (2021). Penerapan Payment Gateway Pada Sistem Informasi Layanan Registrasi Siswa Baru Berbasis Web (Studi Kasus: Sdit Abu Bakr Ash Shiddiq Pangkep). *Jurnal INSYPRO (Information System and Processing)*, *6*(2). https://doi.org/10.24252/insypro.v6i2.27610

Sardjono, W., Retnowardhani, A., Selviyanti, E., Wijaya, C., & Rahmasari, A. (2023). Identification of various inhibiting factors implementation of national payment gateway in banking corporation. *AIP Conference Proceedings*, *2594*. https://doi.org/10.1063/5.0113095

Sausi, J. M., & Mtebe, J. S. (2021). Revolutionization of Revenue Collection with Government E-Payment Gateway System in Tanzania: A Public Value Creation Perspective. *East African Journal of Science, Technology and Innovation*, *2*(3). https://doi.org/10.37425/eajsti.v2i3.248

Simatupang, A., Irvan, I., & Lubis, F. R. (2022). Pemanfaatan Payment Gateway Ipaymu Dalam Melakukan Transaksi Pembayaran Ppdb Online Pada Mts Al Washiliyah Kuala Bangka Menggunakan Metode Rapid Application Development(Rad). *Djtechno: Jurnal Teknologi Informasi*, *3*(2). https://doi.org/10.46576/djtechno.v3i2.2738

Subecz, Z. (2021). Web-development with Laravel framework. *Gradus*, *8*(1), 211–218. https://doi.org/10.47833/2021.1.CSC.006

Šušter, I., & Ranisavljević, T. (2023). Optimization Of Mysql Database. *Journal Of Process Management and New Technologies*, *11*(1–2). https://doi.org/10.5937/jpmnt11-44471

Tran, N. T. Le, Nguyen, Q. B., Nguyen, T. T., & Dong, L. K. (2022). Factors Influencing Adoption of Online Payment for Public Services in Vietnam. *International Journal of Economics, Business and Management Research*, *06*(05). https://doi.org/10.51505/ijebmr.2022.6515

Voinea, G. D., Gîrbacia, F., Duguleană, M., Boboc, R. G., & Gheorghe, C. (2023). Mapping the Emergent Trends in Industrial Augmented Reality. In *Electronics (Switzerland)* (Vol. 12, Issue 7). https://doi.org/10.3390/electronics12071719

Wahyudi, J., Asbari, M., Sasono, I., Pramono, T., & Novitasari, D. (2022). Database Management Education in MYSQL. *Edumaspul: Jurnal Pendidikan*, *6*(2). https://doi.org/10.33487/edumaspul.v6i2.4570

Wulandari, N., & Sholihin, H. (2023). Aplikasi Pembayaran Sekolah Menggunakan Payment Gateway Tripay Berbasis Android. *WARUNAYAMA Journal*, *27*(2).

XAMPP Installers and Downloads for Apache Friends. (n.d.). Retrieved September 29, 2024, from https://www.apachefriends.org/index.html

Xue, Y., Sun, J., Liu, Y., Li, X., & Yuan, K. (2024). Facial expression-enhanced recommendation for virtual fitting rooms. *Decision Support Systems*, *177*. https://doi.org/10.1016/j.dss.2023.114082

Yaqin, M. A., Listyorini, T., & Supriyati, E. (2024). Aplikasi E-Commerce Berbasis Android Yang Terintegrasi Payment Gateway Pada Pondok Grafis. *Jurnal Dialektika Informatika (Detika)*, *4*(1), 19–25. https://doi.org/10.24176/detika.v4i1.11005

Zhang, Z., Li, Y., & Wang, S. (2021). Robust image enhancement techniques for low-quality camera-based vision systems**.** *Journal of Visual Communication and Image Representation*, *74*, 102995. https://doi.org/10.1016/j.jvcir.2020.102995