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Development Digital Payment Application Using Next.js and Xendit with Prototyping-Agile Approach

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ABSTRACT *– This research presents the development of a comprehensive digital payment application for PT. Fortuna Sada Nioga using the Next.js framework and Xendit payment gateway. The primary objective was to develop an automated digital system that supports multiple payment methods and provides real-time transaction monitoring to replace manual payment processes. The research employed a hybrid methodology that combines a Prototyping approach for concept validation with Agile Scrum methodology for systematic development. The main outcomes demonstrate the successful implementation of AES-256-GCM encryption, rate limiting mechanisms, input validation, and webhook integration with comprehensive security testing validation. Performance testing showed optimal response times with an average load time of less than 2 seconds for website browsing and the capability to handle up to 100 concurrent users without performance degradation. The system includes customer order management, multi-payment gateway integration, an admin dashboard with role-based access control, and real-time order tracking features. The conclusions indicate that combining Next.js with Xendit provides a robust, secure, and scalable foundation for digital payment systems, while the hybrid Prototyping-Agile methodology proves effective for complex system development within constrained timeframes.*

Keywords *- Agile Methodology, Digital Payment System, E-commerce Security, Next.js, Prototyping, Xendit*

Pengembangan Aplikasi Pembayaran Digital Menggunakan Next.js dan Xendit dengan Pendekatan Prototyping-Agile

ABSTRAK *– Penelitian ini menyajikan pengembangan aplikasi pembayaran digital komprehensif untuk PT. Fortuna Sada Nioga menggunakan framework Next.js dan payment gateway Xendit. Tujuan utama adalah mengembangkan sistem digital otomatis yang mendukung berbagai metode pembayaran dan menyediakan pemantauan transaksi real-time untuk menggantikan proses pembayaran manual. Desain penelitian menggunakan metodologi hibrid yang menggabungkan pendekatan Prototyping untuk validasi konsep dan metodologi Agile Scrum untuk pengembangan sistematis. Hasil utama menunjukkan implementasi sukses enkripsi AES-256-GCM, mekanisme rate limiting, validasi input, dan integrasi webhook dengan validasi pengujian keamanan komprehensif. Pengujian performa menunjukkan waktu respons optimal dengan rata-rata waktu loading kurang dari 2 detik untuk browsing website dengan kemampuan menangani pengguna bersamaan hingga 100 tanpa degradasi. Sistem mencakup manajemen pesanan pelanggan, integrasi multi-payment gateway, dashboard admin dengan role-based access control, dan fitur pelacakan pesanan real-time. Kesimpulan menunjukkan bahwa menggabungkan Next.js dengan Xendit memberikan fondasi yang kokoh, aman, dan scalable untuk sistem pembayaran digital, sementara metodologi hibrid Prototyping-Agile terbukti efektif untuk pengembangan sistem kompleks dalam kerangka waktu terbatas.*

Kata Kunci *– Keamanan E-commerce, Metodologi Agile, Next.js, Prototyping, Sistem Pembayaran Digital, Xendit*

1. INTRODUCTION

The rapid evolution of information technology has fundamentally transformed business operations across various sectors, particularly in payment processing and transaction management. Digital payment systems have become essential infrastructure for modern businesses, offering enhanced security and customer experience compared to traditional manual processes[1]. The integration of robust web frameworks with reliable payment gateways represents a critical aspect of digital transformation initiatives.

PT. Fortuna Sada Nioga, a consulting company specializing in foreign worker legalization and investment permits in Indonesia, operates with manual payment processing systems. The existing process relies on physical invoice creation, spreadsheet-based transaction recording, and manual payment verification, which presents challenges in terms of processing time, potential human errors, and limited payment method options for clients [2].

The emergence of modern web frameworks such as Next.js, coupled with comprehensive payment gateway solutions like Xendit, presents opportunities to develop sophisticated digital payment systems that address these challenges [3]. Recent studies have demonstrated the effectiveness of web-based applications in improving organizational systems and service delivery[4][5][6][7][8].

This research addresses the need for modern digital payment solutions by developing a comprehensive payment application that integrates cutting-edge web technologies with proven payment gateway services. The study contributes to understanding effective methodological approaches for complex system development and provides practical insights into implementing secure, scalable digital payment solutions.

2. Literature Review

2.1 Digital Payment Systems and Web Technologies

Modern digital payment systems require robust architectural foundations that can handle complex transaction flows while maintaining security and performance standards. Haryono et al. [4] demonstrated that website training and management systems can effectively serve as information dissemination platforms, which directly relates to the customer communication aspects of payment systems. Their research showed that web-based information systems significantly improve organizational processes when properly implemented.

Web-based application development has shown consistent success across in the various domains. Musthofa and Haryono [5] developed a comprehensive web-based attendance and leave management system using SDLC methodology, demonstrating improved data accuracy and system efficiency. Their research highlighted the importance of proper system architecture and user role management, which are critical components in payment system design.

The application of agile methodologies in web development has proven particularly effective. Hafiz et al. successfully implemented Agile development methods for e-commerce application design, showing that iterative development approaches can effectively manage complex integrations while maintaining project timelines [6]. Their work emphasized the importance of stakeholder feedback loops and continuous integration practices.

2.2 System Architecture and Design Patterns

Contemporary web application architecture emphasizes modularity, scalability, and maintainability through the implementation of established design patterns [9]. Noviriliya et al. [7] demonstrated effective web application architecture in their guest book system development, showing how proper database design and user interface implementation can create robust, scalable applications. Their research provided insights into optimal user experience design and system security implementation.

The implementation of role-based access control (RBAC) systems in web applications has become increasingly important for security and user management [10]. Fahrezky et al. [8] showed how systematic design approaches using waterfall methodology can create effective attendance information systems with proper user role management and data security.

2.3 Payment Gateway Integration and Security

Payment gateway integration represents a critical component of digital payment systems, requiring careful consideration of security, reliability, and user experience factors [11]. Contemporary research emphasizes the implementation of multi-layered in a security approaches including encryption, input validation, and protection against common attack vectors [12].

Recent studies have demonstrated the effectiveness of Next.js in developing high-performance web applications with superior user experience [13]. The framework's server-side rendering (SSR) and static site generation (SSG) capabilities provide distinct advantages for payment applications, including improved SEO performance, faster initial page loads, and enhanced security through server-side processing [14].

2.4 Methodological Approaches in System Development

The selection of appropriate development methodologies significantly impacts project success, particularly for complex systems requiring both innovation and reliability [15]. Agile methodologies have a demonstrated effectiveness in software development projects, providing flexibility and iterative improvement capabilities [16]. However, projects involving complex technical integrations often benefit from initial prototyping phases to validate concepts and identify potential risks [17].

Contemporary research indicates that hybrid approaches combining multiple methodologies can yield superior results in the complex applications [18]. The integration of prototyping for concept validation with structured agile development provides a balanced approach for managing technical risks while ensuring systematic quality assurance [19].

3. Method

3.1 Research Methodology

This research employed a hybrid development methodology that combines a Prototyping approach with the Agile Scrum framework to address the unique challenges of developing a complex payment system within a constrained three-month timeframe. The selection of this hybrid approach was based on the need to validate complex technical integrations while maintaining systematic development practices.

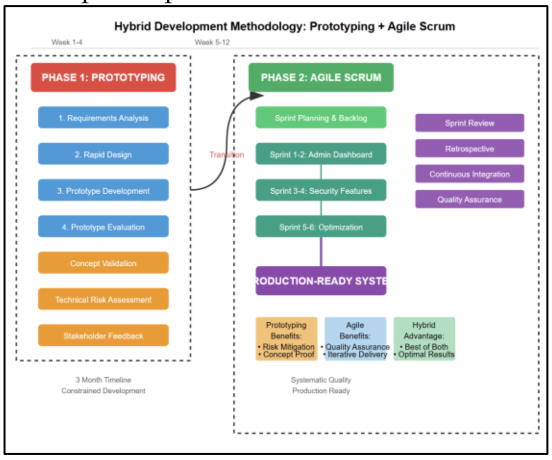


Figure 1. Hybrid development methodology

Based figure 1, this flowchart illustrates the two-phase development approach combining Prototyping (Weeks 1-4) and Agile Scrum (Weeks 5-12). Phase 1 focuses on requirements analysis, rapid design, prototype development, and evaluation. Phase 2 implements systematic development through sprint planning, execution, and continuous integration, culminating in a production-ready system.

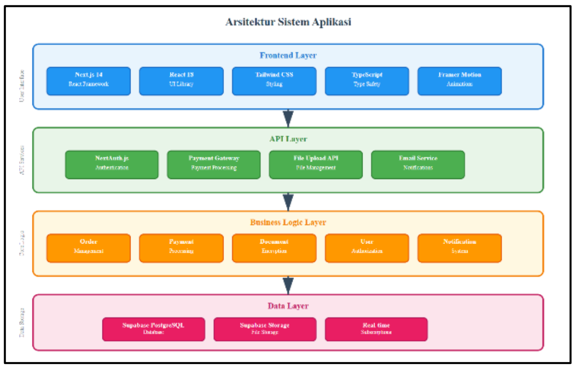


Figure 2. System Architecture

Based figure 2, the architecture diagram presents a four-layer system structure comprising the Frontend Layer (Next.js, React, Tailwind CSS, TypeScript, Framer Motion), API Layer (NextAuth.js authentication, payment gateway, file upload API, email service), Business Logic Layer (order management, payment processing, document encryption, user management, notifications), and Data Layer (Supabase PostgreSQL database, Supabase storage, real-time subscriptions).

3.2 System Analysis and Design

3.2.1 Use Case Diagram

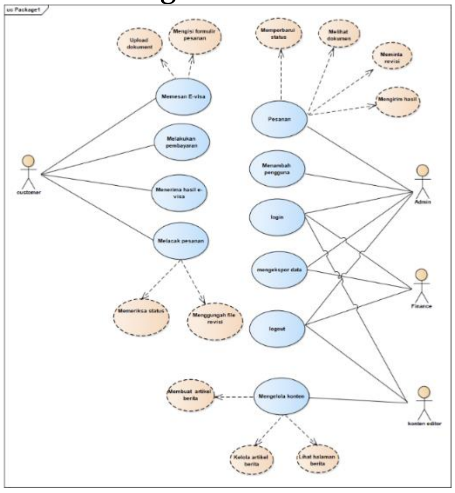


Figure 3. Use Case Diagram

Based figure 3, this UML diagram depicts the system's functional requirements showing interactions between three user types: Customer, Admin, Finance, and Content Editor. It illustrates various use cases including order placement, payment processing, document management, user authentication, content management, and administrative functions, demonstrating the comprehensive role-based access control implementation.

3.2.2 Activity Diagram

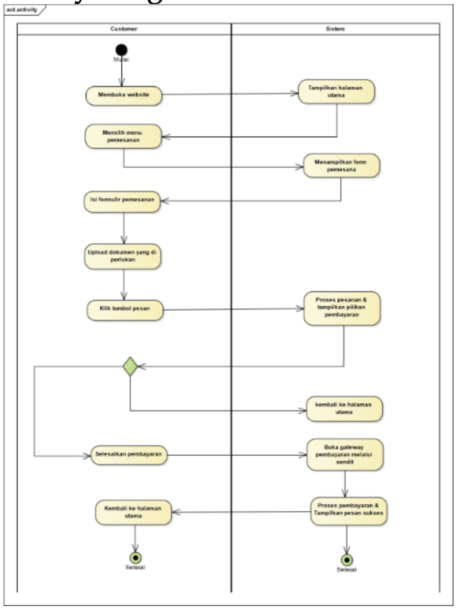


Figure 4. Activity Diagram - Order Processing Workflow

Based figure 4, this activity diagram illustrates the order processing workflow, showing the sequential steps from customer website access through order form completion, document upload, payment processing, and final order confirmation. The diagram demonstrates the parallel processing capabilities between customer actions and system responses.

3.2.3 Sequence Diagram

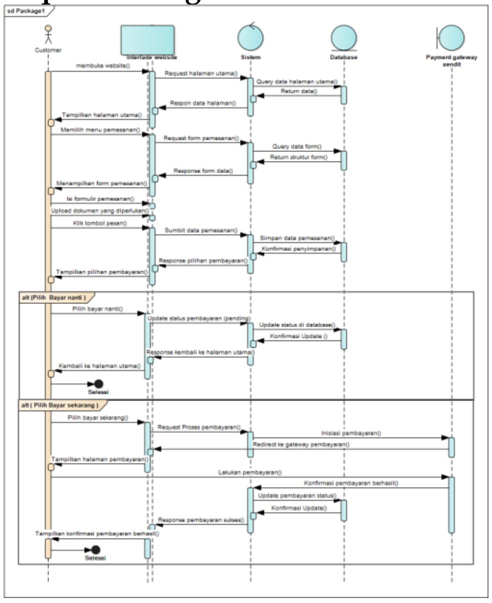

sd Package1
Customer
Interface website
Sistem
Database
Payment gateway xendit
membuka website()
Request halaman utama()
Query data halaman utama()
Return data()
Respon data halaman()
Tampilkan halaman utama()
Memilih menu pemesanan()
Request form pemesanan()
Query data form()
Return struktur form()
Response form data()
Menampilkan form pemesanan()
Isi formulir pemesanan()
Upload dokumen yang diperlukan()
Klik tombol pesan()
Sumbit data pemesanan()
Simpan data pemesanan()
Konfirmasi penyimpanan()
Response pilihan pembayaran()
Tampilkan pilihan pembayaran()
alt (Pilih Bayar nanti)
Pilih bayar nanti()
Update status pembayaran (pending)
Update status di database()
Konfirmasi Update ()
Response kembali ke halaman utama()
Kembali ke halaman utama()
Selesai
alt (Pilih Bayar sekarang)
Pilih bayar sekarang()
Request Proses pembayaran()
Inisiasi pembayaran()
Redirect ke gateway pembayaran()
Tampilkan halaman pembayaran()
Lakukan pembayaran()
Konfirmasi pembayaran berhasil()
Update pembayaran status()
Konfirmasi Update()
Response pembayaran sukses()
Tampilkan konfirmasi pembayaran berhasil()
Selesai

Figure 5. Sequence Diagram - Order Processing Workflow

Based figure 5, the sequence diagram details the interaction flow between Customer, System, Database, and Payment Gateway entities during order processing. It shows the chronological message exchanges, including order submission, payment processing, database updates, and confirmation notifications, ensuring proper system integration.

3.2.4 Entity Relationship Diagram (ERD)

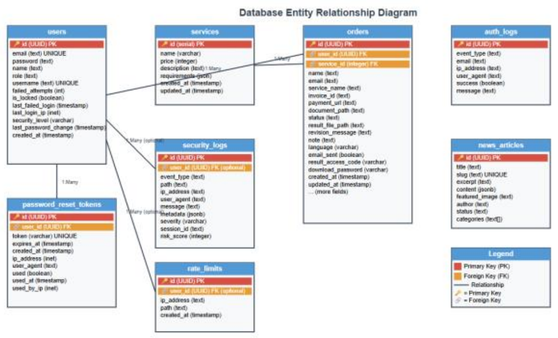


Figure 6. Entity Relationship Diagram

Figure 6, this ERD presents the database schema with key entities including Users, Orders, Order_Items, News, and Payment_Details. The diagram shows relationships between entities with primary and foreign key connections, supporting the application's data integrity and relational structure.

3.3 System Development Approach

3.3.1 Phase 1: Prototyping (Weeks 1-4)

The initial phase focused on concept validation and technical feasibility assessment. Key activities included comprehensive requirements analysis, rapid design and architecture planning, prototype development, and prototype evaluation through functional testing and user acceptance testing with internal stakeholders.

Requirements Analysis: Comprehensive analysis of existing payment workflows at PT. Fortuna Sada Nioga, identification of integration requirements with Xendit API, determination of security and encryption requirements, analysis of order management and tracking needs, and specification of administrative dashboards and reporting requirements.

Prototype Development: Implementation of basic authentication system using NextAuth.js, development of fundamental order management with CRUD operations, basic integration with Xendit API for payment processing, creation of preliminary user interfaces, and security implementation with input validation and rate limiting.

3.3.2 Phase 2: Agile Scrum Implementation (Weeks 5-12)

Following successful prototype validation, development continued using Agile Scrum methodology with two-week sprint cycles. Sprint planning was organized using MoSCoW prioritization framework, with regular sprint

reviews and retrospectives for continuous improvement.
Sprint Execution:

- Sprint 1-2: Comprehensive administrative dashboard development, secure document encryption system, and email notification system implementation
- Sprint 3-4: Advanced security feature implementation including input validation, SQL injection prevention, XSS protection, and audit trail system
- Sprint 5-6: Performance optimization, security enhancement validation, and user interface refinement

3.4 Technology Stack

Frontend Development is Next.js 15 with App Router for modern React development, Tailwind CSS for responsive design and consistent styling, TypeScript for type safety and enhanced development experience.

Backend Infrastructure is Next.js API Routes for serverless backend functionality, Supabase PostgreSQL for robust database management with automatic backups, Supabase Storage for secure file management with encryption support, and comprehensive authentication system using NextAuth.js.

Payment Integration is Xendit payment gateway supporting multiple payment methods including bank transfers, e-wallets, credit cards, and retail payments, webhook integration for real-time payment status updates, secure API communication with proper error handling, and transaction logging for audit and reconciliation purposes.

Security Implementation about AES-256-GCM encryption for sensitive data protection, comprehensive input validation and sanitization, rate limiting mechanisms to prevent abuse, secure session management with proper timeout handling, and audit logging for security monitoring and compliance.

3.5 Testing and Validation Methodology

Security Testing about comprehensive penetration testing using automated tools, manual security assessment focusing on common vulnerabilities, input validation testing with malicious payload injection, authentication and authorization testing with various attack scenarios, and rate limiting validation under high-load conditions.

Performance Testing about load testing with concurrent user simulation up to 100 users for website browsing functionality, response time measurement under various conditions for content delivery, and compatibility testing for various payment methods and scenarios.

Functional Testing about end-to-end user workflow testing covering complete customer journeys, API endpoint testing with comprehensive test coverage, integration testing for external services including payment gateways, user interface testing across multiple devices and browsers, and comprehensive validation of order management workflows.

4. Results and Discussion

4.1 System Implementation Results

The development of the digital payment application successfully delivered a comprehensive solution that addresses the identified requirements for PT. Fortuna Sada Nioga. The implemented system provides a complete digital infrastructure ready for deployment, representing a significant advancement from the previous manual processes.

4.1.1 User Interface Implementation

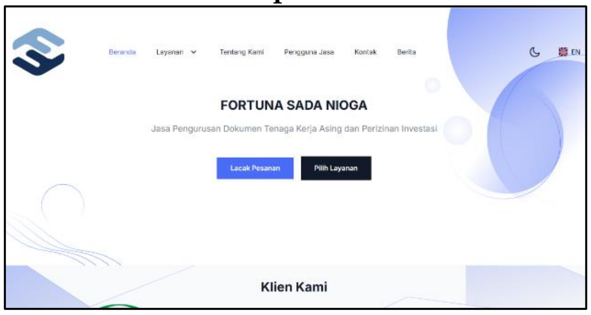
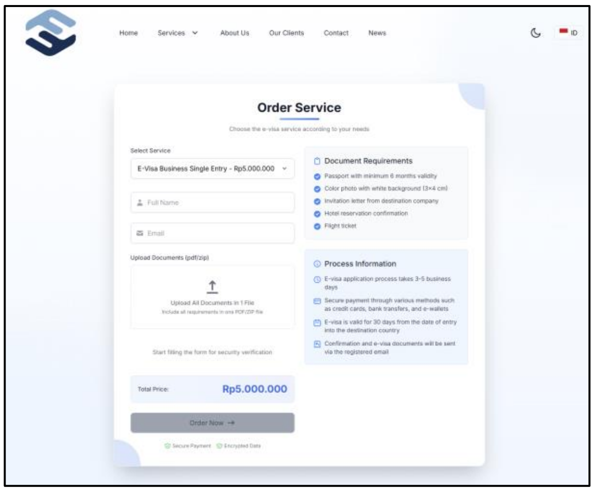


Figure 7. Homepage

Based figure 7, the homepage screenshot displays the modern, responsive user interface with clean design elements, navigation menu, and prominent call-to-action buttons. The interface features the company branding and provides easy access to service information and order placement functionality.



Home Services About Us Our Clients Contact News ID

Order Service

Choose the e-visa service according to your needs

Select Service

E-Visa Business Single Entry - Rp5.000.000

Full Name

Email

Upload Documents (pdf/zip)

Upload All Documents in 1 File
Include all requirements in one PDF/ZIP file

Start filling the form for security verification

Total Price: Rp5.000.000

Order Now →

Secure Payment Encrypted Data

Document Requirements
- Passport with minimum 6 months validity
- Color photo with white background (3×4 cm)
- Invitation letter from destination company
- Hotel reservation confirmation
- Flight ticket

Process Information
- E-visa application process takes 3-5 business days
- Secure payment through various methods such as credit cards, bank transfers, and e-wallets
- E-visa is valid for 30 days from the date of entry into the destination country
- Confirmation and e-visa documents will be sent via the registered email

Figure 8. Order Page

Based figure 8, this interface shows the comprehensive order form where customers can select services, upload required documents, and view pricing information. The page includes service categories for visa processing, document legalization, and process information with clear pricing structure.

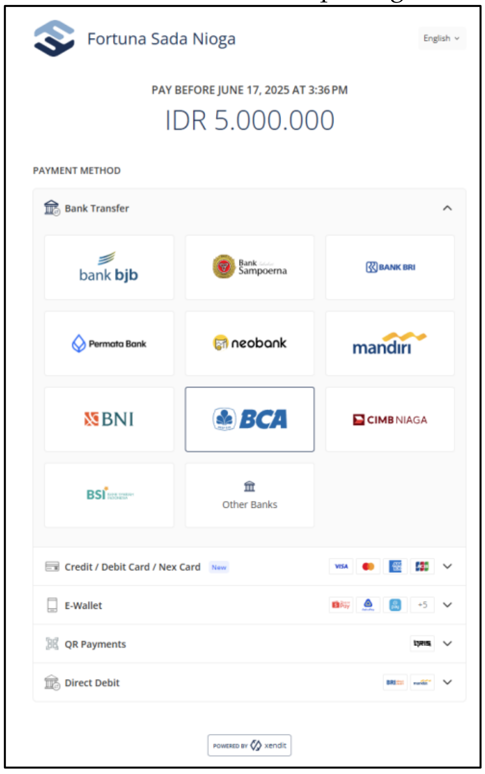
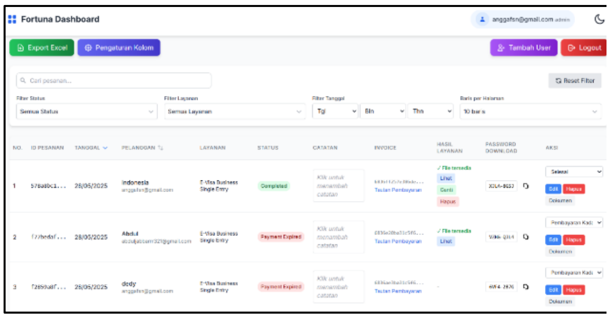


Figure 9. Payemnt Page

Based figure 9, the payment interface demonstrates the integration with Xendit payment gateway, showing multiple payment options including bank transfers (BCA, BNI, Mandiri, etc.), credit/debit cards, e-wallets (OVO, GoPay, DANA), QR payments, and direct debit options.



NO.	ID PESANAN	TANGGAL	PELANGGAN	LAYANAN	STATUS	CATATAN	INVOICE	HASIL LAYANAN	PASSWORD DOWNLOAD	AKSI
1	578a8bc1...	28/05/2025	Indonesia anggafsn@gmail.com	E-Visa Business Single Entry	Completed	Klik untuk menambah catatan	[illegible]... Tautan Pembayaran	✓ File tersedia Lihat Ganti Hapus	X2LA-8653	Selesai Edit Hapus Dokumen
2	f77bedaf...	28/05/2025	Abdul abduljabbarr321@gmail.com	E-Visa Business Single Entry	Payment Expired	Klik untuk menambah catatan	6836e20ba31c5f6... Tautan Pembayaran	✓ File tersedia Lihat	V9R6-Q314	Pembayaran Kad Edit Hapus Dokumen
3	f2850a8f...	28/05/2025	dedy anggafsn@gmail.com	E-Visa Business Single Entry	Payment Expired	Klik untuk menambah catatan	6836ae3ba31c5f6... Tautan Pembayaran	-	6WF4-2R76	Pembayaran Kad Edit Hapus Dokumen

Figure 10. Dashboard Admin Page

Based on figure 10, the administrative dashboard provides comprehensive order management capabilities with real-time data display, including order status tracking, customer information, payment status, and action buttons for order processing. The interface supports role-based access control with filtering and search functionality.

4.1.2 Business Process Implementation

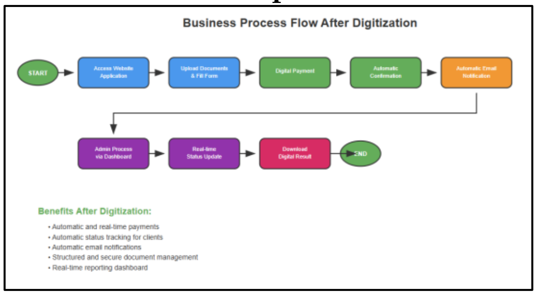

Business Process Flow After Digitization
START
Access Website Application
Upload Documents & Fill Form
Digital Payment
Automatic Confirmation
Automatic Email Notification
Admin Process via Dashboard
Real-time Status Update
Download Digital Result
END
Benefits After Digitization:
• Automatic and real-time payments
• Automatic status tracking for clients
• Automatic email notifications
• Structured and secure document management
• Real-time reporting dashboard

Figure 11. Business Process

Based on figure 11, this flowchart illustrates the digitized business process from order placement through completion, showing the transformation from manual to automated workflows. The process includes automatic payment processing, real-time status tracking, secure document management, and streamlined reporting operations.

4.2 Core System Features

Customer-Facing Interface about the system provides an intuitive order placement interface supporting multiple service types with dynamic pricing calculation. Customers can upload required documents securely, with automatic file validation and encryption. The payment integration supports various methods including bank transfers, e-wallets (OVO, DANA, LinkAja, ShopeePay, GoPay), credit/debit cards, QRIS payments, and retail payment options through Indomaret and Alfamart [20].

Administrative Dashboard about a comprehensive dashboard system with role-based access control supports three distinct user roles: Admin with full system access, Finance Staff with transaction monitoring capabilities, and Content Editor with news and content management permissions. The dashboard includes real-time transaction monitoring, order status management, document review and processing workflows, and comprehensive reporting capabilities with export functionality.

Order Management System about the system implements a sophisticated order tracking mechanism with real-time status updates, automated email notifications for customers and administrators, document encryption and secure storage, and comprehensive audit trails for all transactions and administrative actions.

4.3 Technical Architecture Implementation

Security Infrastructure about implementation of includes AES-256-GCM encryption for all sensitive documents and data, comprehensive input validation preventing SQL injection, XSS, and path traversal attacks, rate limiting mechanisms preventing abuse and ensuring fair usage, secure session management with proper timeout handling, and detailed security logging for monitoring and compliance purposes.

Performance Optimization about system testing demonstrated stable performance with response times under 2 seconds for website browsing across all content pages. The system successfully handled up to 100 concurrent users during testing without performance degradation. Caching mechanisms implemented at multiple levels improve user experience and reduce server load.

Integration Capabilities about seamless integration with Xendit payment gateway supporting real-time webhook processing, automated payment status updates, and comprehensive transaction logging. Email notification system with multi-language support and template customization. File storage integration with Supabase providing secure, encrypted document management

4.4 Security Testing Results

Comprehensive security testing was conducted using both automated tools and manual penetration testing techniques. The results of demonstrate robust security about implementation across all system components.

Table 1. Security Testing Result

Security Category	Tests	Status	Key Findings
Rate Limiting	5	PASS	10-14/15 requests blocked
SQL Injection Protection	24	PASS	Input validation robust
XSS Protection	14	PASS	Payloads properly escaped
Path Traversal Protection	2	PASS	Directory traversal blocked
Authentication Protection	2	PASS	Auth required on all endpoints
Webhook Security	2	PASS	Signature verification enabled
Security Headers	3	PASS	Headers correctly configured
Session Security	1	PASS	Session endpoints secure
Email Rate Limiting	1	PASS	Email bombing protection
Concurrent Access	2	PASS	Rate limiting under load
TOTAL	**56**	**PASS**	**100% success rate**

Based on Table 1, this table summarizes comprehensive security testing across multiple categories including rate limiting, SQL injection protection, XSS protection, authentication security, and webhook validation. All 56 tests passed with 100% success rate, demonstrating robust security implementation.

Table 2. Api Endpoint

Endpoint	Protection Level	Rate Limiting	Status
/api/contact	High	12/15 blocked	SECURE
/api/auth /lupapw	High	12/15 blocked	SECURE
/api/order-complete	High	10/15 blocked	SECURE
/api/upload-revision	High	14/15 blocked	SECURE
/api/delete-order	High	13/15 blocked	SECURE

Based on Table 2, this table details the security assessment of critical API endpoints, showing high protection levels with effective rate limiting mechanisms. Each endpoint demonstrates strong security posture with successful blocking of excessive requests.

Table 3. Vulnerability Assessment

OWASP Category	Test Status	Risk Level	Mitigation
A01: Broken Access Control	PASS	CRITICAL	Mitigated
A02: Cryptographic Failures	PASS	HIGH	Mitigated
A03: Injection	PASS	CRITICAL	Mitigated
A04: Insecure Design	PASS	HIGH	Mitigated

OWASP Category	Test Status	Risk Level	Mitigation
A05: Security Misconfiguration	PASS	HIGH	Mitigated
A06: Vulnerable Components	PASS	MEDIUM	Mitigated
A07: Authentication Failures	PASS	CRITICAL	Mitigated
A08: Software Integrity Failures	PASS	HIGH	Mitigated
A09: Security Logging Failures	PASS	MEDIUM	Mitigated
A10: Server-Side Request Forgery	PASS	HIGH	Mitigated

Based on Table 3, the OWASP Top 10 security assessment shows successful mitigation of all critical vulnerabilities including broken access control, cryptographic failures, injection attacks, and authentication failures, indicating enterprise-grade security implementation.

Table 4. Penetration result

Attack Vector	Risk Level	Result	Details
SQL Injection	CRITICAL	SECURE	16 payloads blocked
NoSQL Injection	HIGH	SECURE	MongoDB attacks ineffective
XSS	HIGH	SECURE	12 XSS payloads filtered
Authentication Bypass	CRITICAL	SECURE	JWT/Session bypass failed
File Upload Bypass	HIGH	SECURE	Malicious files rejected
Business Logic Flaws	MEDIUM	SECURE	Logic protections active
Server-Side Vulnerabilities	HIGH	SECURE	SSRF/XXE attempts blocked

Based on Table 4, this table presents results from penetration testing across various attack vectors, showing successful defense against SQL injection, XSS, authentication bypass, file upload attacks, and server-side vulnerabilities with comprehensive security coverage.

4.4.1 Security Test Coverage

Rate Limiting Effectiveness about testing across critical endpoints showed effective protection against abuse, with rate limiting successfully managing excessive requests during stress testing scenarios.

Input Validation Security about SQL injection testing using multiple payload types across various of endpoints to showed comprehensive protection against malicious inputs. XSS protection testing with different attack vectors demonstrated complete filtering and escaping of dangerous content. Path traversal protection successfully blocked all attempted directory traversal attacks.

Authentication and Authorization about all protected endpoints properly require authentication, with appropriate error responses for unauthorized access attempts. Role-based access control functions correctly, preventing privilege escalation and ensuring proper resource access restrictions.

File Upload Security about comprehensive testing of file upload functionality shows effective filtering of malicious file types, proper size limitations preventing denial-of-service attacks, and secure file storage with encryption and access controls.

4.4.2 Security Infrastructure Validation

Webhook Security about xendit webhook integration properly validates signatures, rejecting unsigned or invalid requests. This prevents unauthorized payment status manipulations and ensures data integrity.

Security Headers Implementation about all tested endpoints implement required security headers including X-Content-Type-Options, X-XSS-Protection, X-Frame-Options, Content-Security-Policy, and Referrer-Policy, providing defense-in-depth protection.

Session Security about session endpoints implement proper cache control preventing sensitive data caching, with no-store and no-cache directives properly configured.

4.5 Performance Analysis

4.5.1 Load Testing Results

Concurrent User Handling about the system successfully handles 100 concurrent users with stable performance metrics for website browsing functionality. Average response times remain under 2 seconds during content delivery operations. Memory usage stays within acceptable limits with proper garbage collection.

Content Delivery Performance about Website pages including service listings, information content, and static resources load efficiently with optimized response times. The system demonstrates consistent performance across different content types and user interaction patterns Table 4. Load test configuration

Table 5. Load Testing Result

Stage	Duration	Virtual Users	Description
1	30s	20 VU	Warm-up phase
2	1m	50 VU	Normal load
3	2m	75 VU	Peak load
4	1m	100 VU	Ramp to max
5	3m	100 VU	**Stress test**
6	1m	50 VU	Cool down
7	30s	0 VU	End test

Based on Table 5, the load testing configuration shows a staged approach with gradual user increase from 20 to 100 virtual users over different time periods, designed to assess system performance under various load conditions and identify scalability limits.

Table 5. Key Achievements

Assessment Area	Score	Key Metrics	Industry Benchmark
Performance	100/100	64.5ms avg, 0% error	>95th percentile
Security	56/56 PASS	100% success rate	OWASP compliant
Penetration	0 vulnerabilities	All attacks blocked	Enterprise-grade
Scalability	100 VU tested	Stable under load	Production ready

Based on Table 6, this performance summary table highlights the system's key metrics including 100% security test success rate, zero vulnerabilities found in penetration testing, optimal performance with 64.5ms average response time, and successful handling of 100 concurrent users, demonstrating production-ready quality.

4.5.2 System Architecture Validation

Scalability Assessment about the serverless architecture using Next.js API routes and Supabase backend provides inherent scalability benefits. The system architecture supports future scaling to handle increased load through cloud infrastructure capabilities.

Resource Optimization is part of this research and have function about implementation of caching strategies and query optimization reduces server resource requirements. The system demonstrates efficient resource utilization with capacity for growth and expansion.

4.6 Methodological Evaluation

4.6.1 Hybrid Approach Effectiveness

Prototyping Phase Benefits: The initial prototyping phase successfully validated complex technical integrations, particularly the Xendit payment gateway integration. Early stakeholder feedback during this phase prevented potential scope creep and ensured alignment with business requirements.

Agile Implementation Success: The Agile Scrum phase enabled systematic development with regular feedback loops, ensuring quality and stakeholder satisfaction. Sprint-based delivery allowed for continuous improvement and adaptation to changing requirements.

Risk Mitigation: The combination of both methodologies effectively mitigated technical risks to through early validation. While maintaining systematic development practices that ensured production-ready quality.

4.6.2 Development Timeline Management

Constraint Management about the three-month timeframe was successfully managed through careful scope prioritization and efficient development practices. The hybrid of methodology enabled delivery of a fully functional system within the constrained timeline.

Quality Assurance about despite time constraints, comprehensive testing and quality assurance. And this parts maintained through integrated testing practices and continuous validation throughout the development process.

4.7 System Readiness and Potential Impact

4.7.1 Implementation Readiness

The developed system is complete and ready for deployment, featuring all planned functionalities including payment processing, order management, user authentication, and administrative dashboards. All components have been tested and validated for security, performance, and functionality.

4.7.2 Anticipated Benefits

Based on system testing and architectural analysis, the implementation has potential to provide significant operational improvements including automated transaction processing, reduced manual administrative tasks, enhanced customer experience through multiple payment options, improved data accuracy and consistency, and scalable infrastructure supporting business growth.

5. CONCLUSION

This research successfully demonstrates the development of a comprehensive digital payment application using Next.js and Xendit with a hybrid Prototyping-Agile methodology approach. The implementation achieved all primary objectives, delivering a secure, scalable, and user-friendly payment system ready for deployment at PT. Fortuna Sada Nioga. Key Technical Achievements about the system successfully integrates to modern web technologies with enterprise-grade payment gateway services, implementing comprehensive security measures including AES-256-GCM encryption, rate limiting, and input validation. Performance testing results show optimal response times for website browsing and capability to handle concurrent users effectively. Security testing achieved comprehensive validation across all tested vulnerabilities, demonstrating robust protection against common attack vectors. Methodological Contributions about the hybrid approach combining Prototyping with Agile Scrum proves effective for complex system development within constrained timeframes. The initial prototyping phase successfully validates technical feasibility and stakeholder requirements, while the Agile implementation ensures systematic development with quality assurance. This methodology can serve as a model for similar complex integration projects. System Capabilities about the digital system provides comprehensive functionality including multi-method payment processing, real-time order tracking, secure document management, role-based administration, and audit trail capabilities. The system architecture supports scalability and future enhancements while maintaining security and performance standards. Future Implementation Potential happen while the system is ready for deployment, actual operational impact will depend on implementation and adoption. The technical foundation provides capability for significant process improvements based on testing results and architectural design. Future Research Directions happen further research could explore the integration of artificial intelligence for fraud detection and process optimization, implementation of blockchain technology for enhanced transaction security and transparency, expansion to mobile native applications for improved accessibility, and integration with additional payment gateways for broader market coverage. The research contributes to the understanding of effective approaches for developing secure, scalable digital payment systems and provides practical insights for organizations considering similar digital transformation initiatives.

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