



# Analysis and Development of A Web-Based Digital Pawn Application and Application Management Information System to Improve Transparency and Efficiency of Collateral Services

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## Abstract

Pawn services represent one of the fastest financial solutions for lower-middle-income communities. However, manual and non-transparent appraisal processes often create uncertainty for prospective customers regarding the valuation of pledged assets. This study aimed to design and develop a digital pawn information system that emphasized automated price appraisal features and online pawn applications. The system integrated an artificial intelligence (AI)-based automated appraisal engine with a human-in-the-loop approach, in which the system generated objective appraisal recommendations that were subsequently validated by administrators to ensure decision accuracy and accountability. The transparency indicator in this system was implemented by providing customers with a real-time estimated loan value range (minimum and maximum limits) based on measurable asset specifications, thereby reducing subjectivity during the initial assessment process. Key system features included a pawn value estimation calculator, a physical item photo documentation upload form to support remote verification, and a centralized management dashboard for application validation. The research findings are expected to reduce service waiting times compared with conventional methods and provide customers with greater certainty regarding estimated appraisal values before completing physical transactions.

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## INTRODUCTION

The era of digitalization and technological innovation has fundamentally transformed how people conduct transactions and access financial services, shifting from conventional systems toward more modern and efficient solutions (Yulianti et al., 2024). The development of Financial Technology (FinTech) in Indonesia has enabled various financial services to reach previously underserved segments of society, particularly by facilitating fast and inclusive access to financing (Billyahsan et al., 2025). Pawn services, which provide loans based on the collateral value of movable assets (Hadinegoro, 2020), represent one of the most accessible financial service options for many communities.

Despite the rapid growth of the pawn industry, operational management and collateral appraisal processes continue to face significant challenges (Hadinegoro, 2020). Loan eligibility and collateral valuation often depend on the individual expertise of appraisal officers, resulting in variations in price estimates and creating concerns regarding transparency for customers (Hadinegoro, 2020). Furthermore, pawn service operations are generally still conducted through face-to-face procedures, with customer data management and transaction documentation relying on manual records (Surbakti et al., 2023). These practices may result in customer queues lasting approximately 8–15 minutes per transaction, along with challenges

related to document accumulation, data retrieval difficulties, and increased risks of transaction record loss or damage (Surbakti et al., 2023).

Therefore, a comprehensive solution is required through the development of a web-based digital pawn appraisal and submission management information system to improve transparency and efficiency in collateral services (Putra, 2022; Sari et al., 2023). Digitalizing pawn service management through a web-based platform can address limitations associated with manual documentation, accelerate the application process, and provide both automated and centralized appraisal capabilities (Bhattacharya & Sinha, 2022). Previous research has demonstrated that implementing computerized information systems in pawn services can reduce transaction processing time by up to 76.33% compared with manual calculation methods (Surbakti et al., 2023).

The research gap identified in this study lies in the limited integration of advanced artificial intelligence (AI), particularly generative AI and multimodal computer vision capabilities, into pawn appraisal systems (Lazaros et al., 2026; Can, 2022). Although previous studies have explored web-based information systems and fuzzy logic-based decision-support approaches, limited research has integrated a human-in-the-loop AI framework that combines automated market price estimation, image-based asset analysis, and human validation (Caridi et al., 2026; Molakatala et al., 2024). The specific problem addressed in this study is the absence of a comprehensive digital platform that simultaneously provides customers with real-time and objective valuation estimates while maintaining administrator oversight to ensure accuracy and accountability (Tang et al., 2025; Moharrak & Mogaji, 2025; Ogundimu, 2025; Meero, 2025; Qothrunnada et al., 2023).

The urgency of this research is supported by measurable efficiency improvements demonstrated in previous studies, including reductions in service processing time from 8–15 minutes to approximately 2–3.5 minutes per transaction through digitalization. In addition, the increasing adoption of AI technologies in financial services and the growing demand for transparent and accessible financial solutions among lower-middle-income communities highlight the relevance of this research (Hunter et al., 2025; Jha & Dangwal, 2025; Mishra et al., 2024). This study also supports Indonesia's broader agenda of financial inclusion and digital transformation within the financial services sector (Pradhipta et al., 2025; Shofawati, 2019).

The novelty of this research lies in the integration of a Generative AI-based automated valuation engine (Google Gemini) with a human-in-the-loop architecture. In this framework, the system generates objective, real-time lower and upper valuation estimates based on item specifications and physical condition analysis through image recognition, while administrators retain validation authority. This approach differs from previous systems that relied solely on static rule-based methods or fully automated processes without human oversight. The proposed system provides customers with an estimated loan value range based on measurable collateral characteristics, thereby reducing subjectivity during the initial assessment while maintaining professional verification and accountability.

The purpose of this research was to analyze and develop a web-based digital pawn appraisal and submission management information system that integrates collateral assessment features, provides a digital pawn application platform, and establishes a backend storage and management system. Specifically, this research aimed to: (1) develop a website-based pawn

application information system integrated with collateral appraisal features to improve loan value transparency; (2) provide a digital pawn application platform to reduce manual documentation complexity and shorten service processing time; and (3) develop a backend storage and management system to support data retrieval, agreement document storage, and monitoring of loan extensions and auction processes.

## **METHOD**

This research employed the Rapid Application Development (RAD) method for system development. The RAD method was selected because it supported an iterative, flexible, and responsive development process integrated with field observation activities. Considering that the system implemented Artificial Intelligence (AI) as an automated appraisal engine using a human-in-the-loop approach, RAD was considered suitable because it enabled rapid prototype development, model refinement, and accuracy adjustments based on administrator feedback throughout the development process. The development stages included system requirement planning, interface and database prototype design, system construction, and final implementation.

### **Problem Identification**

Based on the background and observations that have been described, the problem identification in this research is:

1. The uncertainty of estimating the collateral value experienced by customers is because the price appraisal process is still carried out manually and subjectively by officers, thus potentially causing value discrepancies.
2. Lack of service time efficiency in the transaction process due to operational systems that still rely on conventional recording with physical books.
3. Managing a database that is still in the form of a pile of physical files makes it difficult for managers to monitor, search for application status, and increases the risk of losing transaction evidence.

### **Research Objectives**

1. Analyze and develop a website-based mortgage application information system that integrates collateral assessment features to increase loan value transparency for customers and managers.
2. Providing a digital pawn application platform to reduce the complexity of manual recording and reduce service time at the pawn office.
3. Building a backend storage and management system to make it easier for administrators to search for data, store agreements, and monitor the status of extensions and auctions of collateral.

### **Benefits of Research**

The expected benefits of this research include:

1. For Academics: Providing insights into software engineering and serving as a reference for studies related to the development of operational management information systems in the financial technology services sector.
2. For Pawn Service Managers: Drastically increase the efficiency of managers' work by reducing the operational duration of transactions and ensuring the security of customer transaction agreement documents so that they are not easily lost.

3. For the Community: Opening the way for financial inclusion and providing certainty and efficiency for customers to gain access to transparent, easy-to-use, and fast financial services

### **NotebookLM**

Digitalization offers measurable urgency. Based on previous research conducted by Surbakti and colleagues in 2023, the operational shift from physical books to a computerized platform has been proven to reduce estimated service times from 8 to 15 minutes to just 2 to 3.5 minutes per transaction. Through the "Gadai Berkah" system I propose, we aim to achieve this standard operational efficiency improvement of 76.33%.

## **RESULTS AND DISCUSSION**

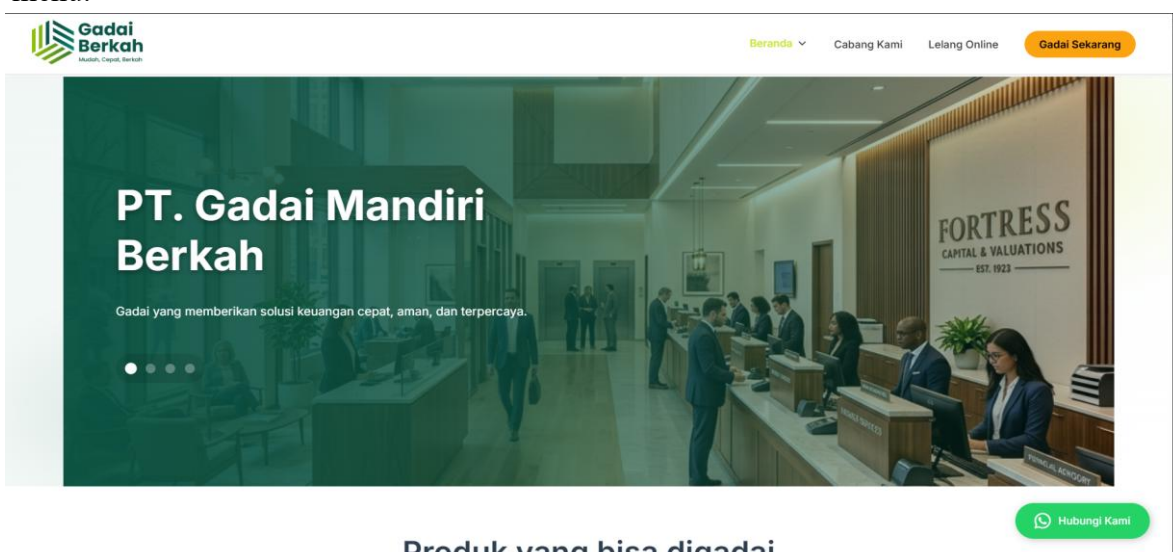
This chapter discusses the implementation results of the developed Web-Based Digital Pawn Appraisal and Application Management Information System, as well as its testing stages. The discussion in this chapter is divided into two main parts: first, a description of the application interface results that reflect the operational flow of pawn applications from the customer to the administrator; and second, the functional validation process to ensure the reliability of the Artificial Intelligence (AI)-based automatic appraisal feature and the smoothness of communication integration.

### **System Implementation Results**

This section details the user interface and functionality of the system we've developed. The description is structured chronologically, following the operational flowchart of a digital pawn application, from the customer's initial access to administrator verification:

#### **Home Page (Landing Page) and Main Navigation**

The system implementation begins with the homepage, which serves as the primary access point for customers when opening the platform through a web browser. This page features an intuitive navigation menu (navbar), providing at-a-glance information about the service and a Call-to-Action (CTA) button that directs customers to the "Digital Estimate" menu.



**Produk yang bisa digadai**

**Figure 1. Home Page of the Digital Pawn Information System**  
Source: Developed by the authors (2026).

## Collateral Category and Product Selection Page

After the customer enters the appraisal menu, the system displays an item category selection interface. The customer is required to select the main category (e.g., Electronics or Gold) and specify the specific product to be pawned (e.g., an ASUS laptop or an Antam gold ring) from the catalog provided by the database.

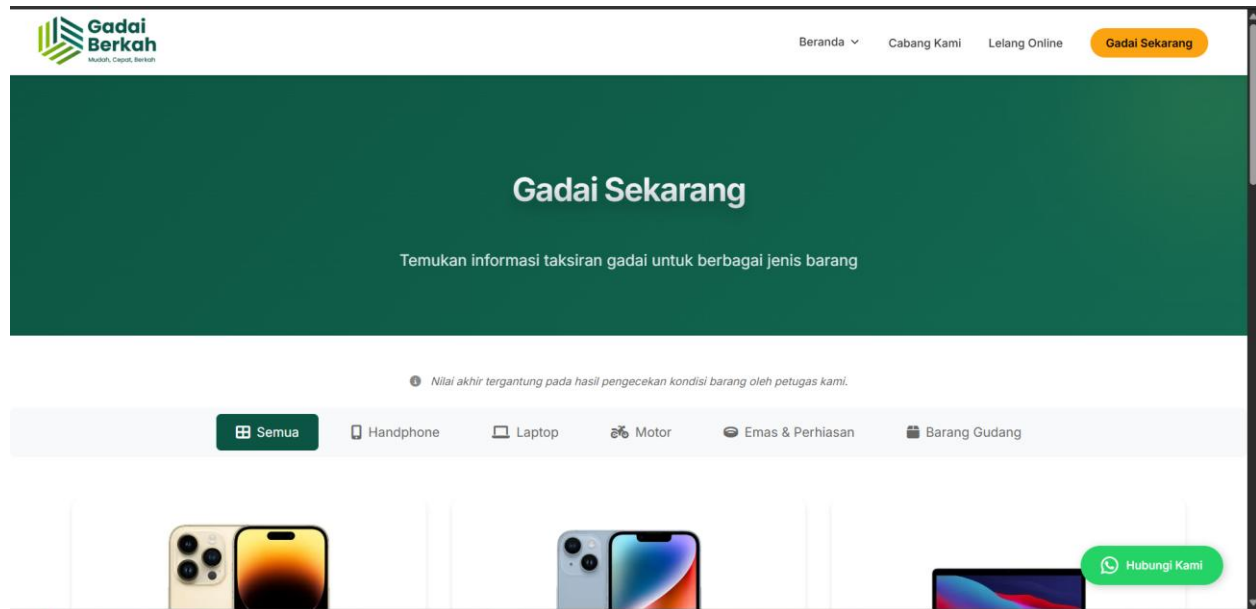


Figure 2. Collateral Item Category Selection Interface

Source: Developed by the authors (2026)

## Loan Calculation and Estimate View Page (AI-Powered)

Based on the selected product category, customers enter the item's specifications or condition. The system (a Django backend integrated with Gemini AI) then processes this data against the latest market prices. The results are implemented in the form of an estimated loan range (minimum to maximum) that the customer will receive. At this point, the customer can decide to click the "Continue to Apply for Pawn" button.

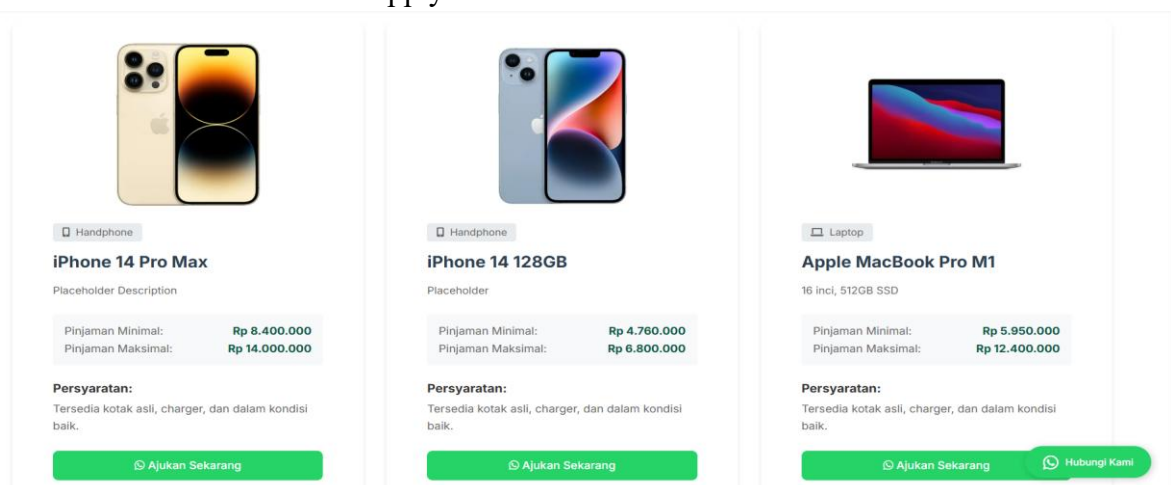


Figure 3. Artificial Intelligence-Based Loan Estimation Interface

Source: Developed by the authors using Google Gemini AI (2026)

## Digital Pawn Application Form Page

If the customer approves the estimate, the system redirects to a form filling page. This page includes fields for personal data (name, contact number) and item details (such as gold carat, electronic components, and a description of the physical condition). The form is designed to be concise to ensure customer time efficiency.

The form is titled "Pengajuan Gadai" and contains the following sections:

- Nama Lengkap:** A text input field containing "Benny sinaga".
- No. WhatsApp:** A text input field containing "081234567878".
- Kapan Mau Datang?:** A dropdown menu with "Hari ini" selected.
- Foto Barang Gadai (wajib diisi, maks. 5 foto):** A section for uploading photos. It shows one photo of a smartphone and a "Tambah" (Add) button. Below the photo, it says "1 dari 5 foto dipilih".
- Kondisi & Kelengkapan (membantu AI lebih akurat):** A text input field containing "mulus dan full set, minum battery health 70%".
- Taksir Harga dengan AI:** A purple button with a pencil icon.
- Ringkasan Barang:** A section showing a summary of the item: "iPhone 14 Pro Max" with an estimated price range of "Rp 8.400.000 — Rp 14.000.000".
- Footer:** A note "Nilai akhir ditentukan petugas setelah pengecekan fisik" and a button "Gunakan AI Terlebih Dahulu".

**Figure 4. Digital Pawn Submission Form**

Source: Developed by the authors (2026)

### Feature to upload photos of physical evidence of goods

As part of the initial validation process, the form includes a media upload feature. Customers are required to upload or photograph the physical condition of their collateral. These photo files will be securely uploaded to the server as supporting documentation.



**Figure 5. Collateral Image Upload Interface**

Source: Developed by the authors (2026)

### AI-Based Price Estimation Process (Image Recognition)

After uploading a physical photo of the item, the system's main feature processes the image in real time using Artificial Intelligence (Gemini Vision). The AI analyzes the item's physical condition from the photo, matches it to the entered specifications, and pulls current market price data to generate an accurate and objective loan estimate. During this intelligent calculation process, the interface displays the loading status or confirms the final estimate to the customer.



**Figure 6. Loan Estimation Process Using Google Gemini Vision AI**

Source: Developed by the authors using Google Gemini Vision API (2026)

**Foto Barang Gadai** (wajib diisi, maks. 5 foto)





Tambah

1 dari 5 foto dipilih

**Kondisi & Kelengkapan** (membantu AI lebih akurat)

mulus dan fullset, min battery health 70%

**Taksir Harga dengan AI**

**Ringkasan Barang**



**iPhone 13 Pro (Perkiraan 128GB)**  
**Kondisi:** Mulus tanpa goresan signifikan pada bagian luar, fullset (lengkap dengan kotak dan kabel original). Namun, kondisi kesehatan baterai rendah (70%), yang mengindikasikan perlunya penggantian baterai dalam waktu dekat untuk performa optimal.  
**Estimasi AI:** Rp 4.900.000 — Rp 5.250.000

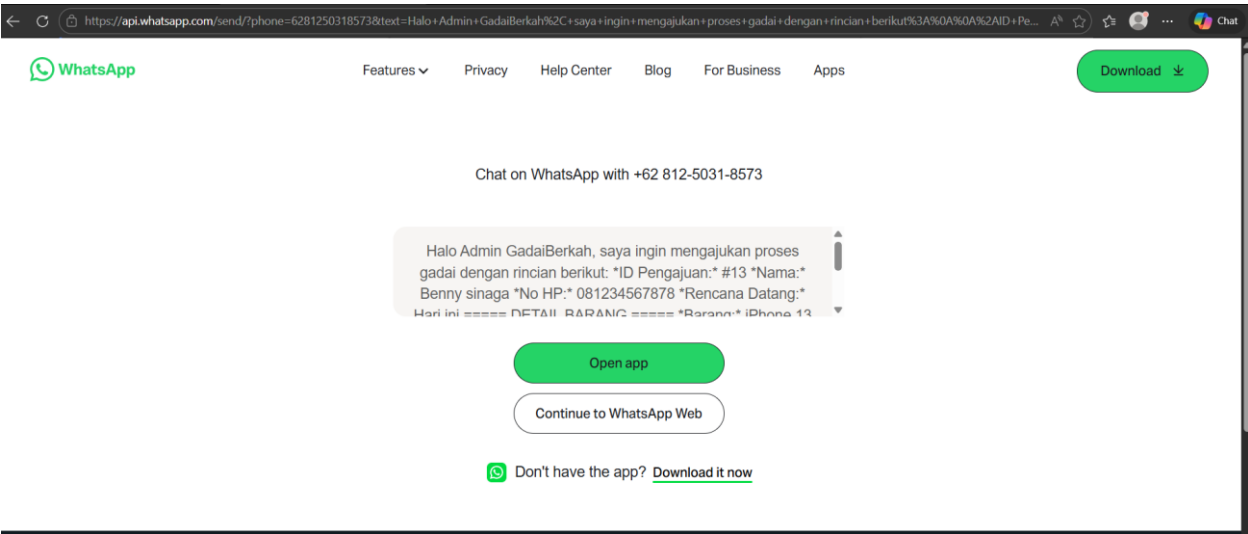
Nilai akhir ditentukan petugas setelah pengecekan fisik

**Kirim ke WhatsApp Admin**

**Figure 7. Artificial Intelligence-Based Loan Estimation Results**  
Source: Generated from the developed system using Google Gemini AI (2026)

### WhatsApp Redirect Process and Message Interface

After the customer presses the "Send Application" button, the system saves all data (including the photo path) to the database. As part of the communication automation process, the customer's browser is immediately redirected to the WhatsApp application. The system automatically creates a structured message format containing a summary of personal data, the type of item, and a unique application ID. The customer only needs to press the send button to the admin number.



**Figure 8. Automatic Redirection to WhatsApp Administrator**  
Source: Developed by the authors using WhatsApp API (2026)

## Administrator Dashboard and Data Verification

On the operational side, all customer-submitted data is centralized on the Admin Dashboard, built using the Django Unfold interface. Admins have full access to monitor the incoming application table, view uploaded documentation photos, and change application statuses. Through this dashboard, admins can conduct initial verification before agreeing on a physical meeting schedule for the handover of goods and disbursement of funds.

Administrasi Django

Autentikasi dan Otorisasi

Grup

Pengguna

Main

Auction Categories

Auction Items

Bank products

Blog posts

Board Members

Carousel Slides

Company Profile

Company Values

Daftar Pengajuan Gadai

FAQs

Favicon

Footer Contact

Footer Content

LPS Rate

Missions

Aadminadmin@gmail.com

Main

>

Daftar Pengajuan Gadai

Pengajuan Gadai "sdfrksjdfrds - iPhone 14 128GB" berhasil dihapus.

Type to search

/

Filters

| <input type="checkbox"/> | Nama         | No hp        | Barang & Kondisi                                             | Estimasi AI  | Waktu kedatangan | Foto              | Created at          | Aksi             |
|--------------------------|--------------|--------------|--------------------------------------------------------------|--------------|------------------|-------------------|---------------------|------------------|
| <input type="checkbox"/> | Benny sinaga | 081234567878 | iPhone 13 Pro<br>mulut full set, minus baterai health 70%... | Rp 5.250.000 | Hari ini         | <div>1 foto</div> | 28 April 2026, 2:36 | <div>Hapus</div> |

1 Pengajuan Gadai

**Figure 9. Administrator Dashboard for Pawn Application Verification**

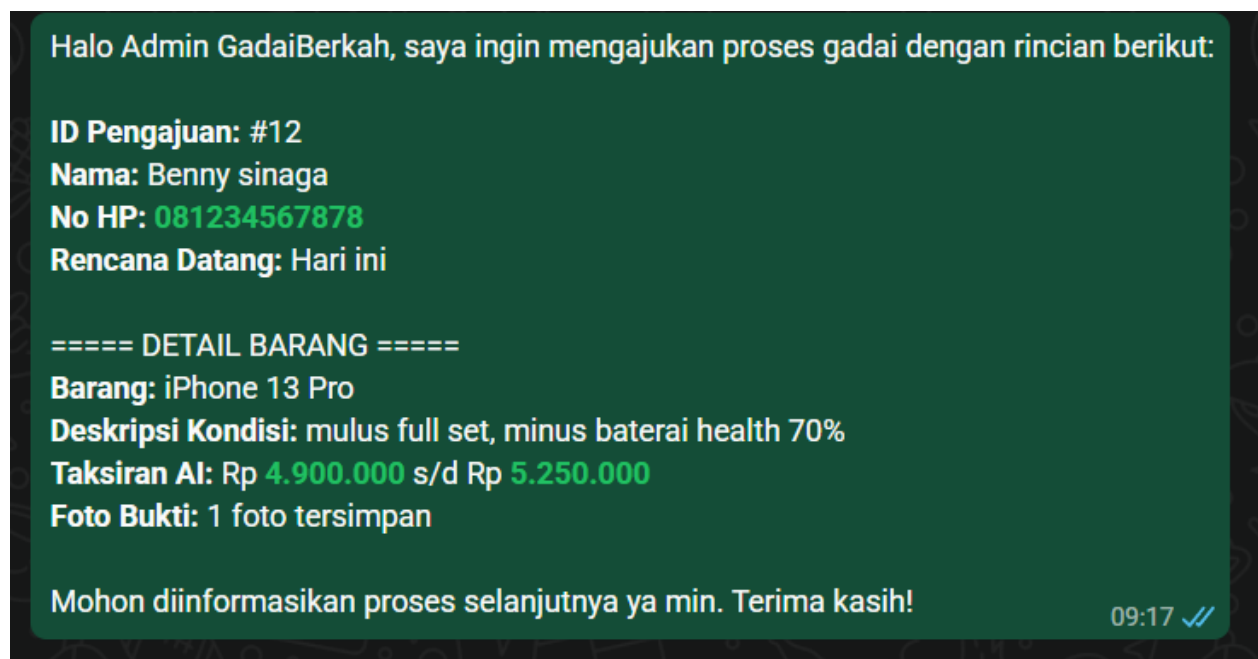
Source: Developed by the authors using the Django Unfold Framework (2026)

## Functional Validation

The validation stage is carried out to test the reliability of the main system flow functionality, to ensure that automatic data processing and communication with customers can run according to design:

### WhatsApp Gateway Integration Validation

Testing was conducted to ensure the redirection process at the end of the application was successful. The system's ability to automatically structure a message (containing a summary of the data and a unique application number) and direct the customer to send it directly to the WhatsApp admin officer was validated.



**Figure 10. WhatsApp Integration Testing Results**  
Source: System testing conducted by the authors (2026)

### Validation of AI Estimation Accuracy and Processing

This test is intended to validate that the AI module (Gemini) successfully works in extracting the latest market price information and calculating the loan-to-rent ratio (LTV) accurately for price estimation.



**Figure 11. Accuracy Validation of AI-Based Loan Estimation**  
Source: Experimental results obtained using Google Gemini AI (2026)

### Ringkasan Barang



#### iPhone 13 Pro Max 128GB

Kondisi: Mulus (tidak ada goresan/dent berarti di bodi dan layar), fullset (lengkap dengan box dan kabel original), namun memiliki Battery Health yang rendah yaitu 70%.

Estimasi AI: Rp 4.900.000 — Rp 5.600.000

Nilai akhir ditentukan petugas setelah pengecekan fisik

Kirim ke WhatsApp Admin

**Figure 12. Overall System Testing and Validation Results**

Source: Experimental results conducted by the authors (2026)

## CONCLUSION

Based on the overall analysis, design, and development process of the *Gadai Berkah* information system described in the previous sections, several conclusions can be drawn regarding its contribution to addressing operational challenges in pawn services:

1. **Increased Transparency through AI-Based Valuation:** The system successfully addressed uncertainty in collateral valuation, which has traditionally been influenced by officer subjectivity. Through the integration of a Generative AI-based automated valuation engine (*Google Gemini*), the system was able to provide objective, real-time lower and upper valuation estimates. This approach improved price transparency for customers before proceeding with physical transactions at branch offices.
2. **Improved Transaction Service Efficiency:** The transformation of the application process from conventional manual documentation to a digital platform reduced administrative complexity. By enabling customers to complete self-service application forms and upload collateral photos online, the initial assessment process could be conducted remotely, reducing queue times and minimizing the duration of in-person services.
3. **Optimized Backend Management and Data Integrity:** The backend architecture developed using the Django framework provided a centralized and structured database management system. This approach reduced the risks associated with physical document accumulation, damage, and loss of transaction records. Furthermore, administrators gained access to efficiently retrieve data, monitor application status, validate uploaded collateral images, and manage auction item records.
4. **Support for Inclusive Financial Services:** Overall, the *Gadai Berkah* system architecture successfully addressed the need for fast and accessible financing solutions among lower-middle-income communities through the integration of digital technology. The system not only improved pawn service operational effectiveness but

also enhanced the customer experience by providing a more predictable, efficient, transparent, and accessible financial service process.

## REFERENCES

- Billyahsan, M. F., Al-Faqih, M., Syahputra, I., Sialagan, W., Mahardiksa, A., & Damanik, B. E. (2025). Pengaruh Fintech Terhadap Inklusi Keuangan di Indonesia. *Jurnal Inovasi Artificial Intelligence & Komputasional Nusantara (JIKOMNUS)*, 3(1), 59-63. <https://ejournal.siantarcodesacademy.com/jikomnus/index.php/public/article/view/81>
- Hadinegoro, A. (2020). Fuzzy Mamdani dan Fuzzy Tsukamoto Untuk Kesesuaian Prediksi Pemberian Kelayakan Pinjaman (Studi Kasus : Sentra Gadai). *Information System Journal (INFOS)*, 3(2), 18-22. <https://jurnal.amikom.ac.id/index.php/infos/article/view/419>
- Surbakti, O. R. J., Brata, A. H., & Brata, K. C. (2023). Pengembangan Sistem Informasi Usaha Gadai Berbasis Web (Studi Kasus: UD. Ricky Gadai Medan). *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer*, 7(6), 2992-30 <https://j-ptiik.ub.ac.id/index.php/j-ptiik/article/view/12788>
- Yulianti, G., Chaidir, M., & Pramono, A. S. (2024). Peran Teknologi Keuangan (Fintech) Dalam Mendorong Pertumbuhan Ekonomi dan Inklusi Keuangan di Indonesia: Tantangan dan Peluang. *CITIZEN: Jurnal Ilmiah Multidisiplin Indonesia*, 4(4), 349-355. <https://www.journal.das-institute.com/index.php/citizen-journal/article/view/649>
- Bhattacharya, C., & Sinha, M. (2022). The role of artificial intelligence in banking for leveraging customer experience. *Australasian Accounting, Business and Finance Journal*, 16(5), 89–105.
- Can, Y. S. (2022). Classification of original and counterfeit gold matters by applying deep neural networks and support vector machines. *Uludağ Üniversitesi Mühendislik Dergisi*, 27(1), 89–102. <https://doi.org/10.17482/uumfd.1054013>
- Caridi, A., Giovannini, M., & Ricciardi Celsi, L. (2026). AI-assisted value investing: A human-in-the-loop framework for prompt-guided financial analysis and decision support. *Electronics*, 15(6), Article 1155. <https://doi.org/10.3390/electronics15061155>
- Lazaros, K., Vrahatis, A. G., & Kotsiantis, S. (2026). Human-in-the-loop artificial intelligence: A systematic review of concepts, methods, and applications. *Entropy*, 28(4), Article 377. <https://doi.org/10.3390/e28040377>
- Meero, A. (2025). Islamic vs. conventional banking in the age of FinTech and AI: Evolving business models, efficiency, and stability (2020–2024). *International Journal of Financial Studies*, 13(3), Article 148. <https://doi.org/10.3390/ijfs13030148>
- Moharrak, M., & Mogaji, E. (2025). Generative AI in banking: Empirical insights on integration, challenges and opportunities in a regulated industry. *International Journal of Bank Marketing*, 43(4), 871–896.
- Molakatala, N., Undru, V. B., Tambala, S. R., Tejaswini, M., Teja Kiran, M., Tejo Seshadri, M., & Juturi, V. S. (2024). Fraudulent practice detection in bullion trade in selling of gold jewellery through AI methods. In B. J. Choi, D. Singh, U. S. Tiwary, & W.-Y. Chung (Eds.), *Intelligent Human Computer Interaction* (Lecture Notes in Computer Science, Vol. 14531, pp. 1–10). Springer. [https://doi.org/10.1007/978-3-031-53827-8\\_34](https://doi.org/10.1007/978-3-031-53827-8_34)
- Ogundimu, O. (2025). Artificial intelligence in financial and operational risk management: A critical analysis. *Cognizance Journal of Multidisciplinary Studies*, 5, 484–506.
- Putra, F. A. D. T. (2022). Rancangan sistem informasi berbasis web untuk pengelolaan data transaksi nasabah pada perusahaan pegadaian. *Jutisi: Jurnal Ilmiah Teknik Informatika dan Sistem Informasi*, 11(1), 123–130. <https://doi.org/10.35889/jutisi.v11i1.821>

- Qothrunnada, N. A., Iswanto, J., Fitrotus, D., Hendrarti, B. G., & Subekan, S. (2023). Transformasi digital lembaga keuangan syariah: Peluang dan implementasinya di era industri 4.0. *Indonesian Journal of Humanities and Social Sciences*, 4(3), 741–756.
- Sari, N., Husaini, H., & Razi, Z. (2023). Sistem pendukung keputusan penerimaan barang gadai nasabah dikantor pegadaian cabang Sigli menggunakan metode profile matching berbasis web. *Jurnal Riset Rekayasa*, 5(3), 459–463. <https://doi.org/10.47647/jrr.v5i3.1526>
- Tang, Y., Liu, Y., & Liu, D. (2025). Data asset valuation model based on generative artificial intelligence. *PLOS ONE*, 20(8), Article e0328926. <https://doi.org/10.1371/journal.pone.0328926>
- Hunter, S., Pham, C., Kim, K., Trinh, L. Q., Chai, A., Deshpande, S., Johl, S., Morgan, P. J., & Obucina, M. (2025). Factors influencing digital financial services adoption in low- and medium-income countries: a systematic literature review. *International Journal of Bank Marketing*, 43(9), 1884–1909.
- Jha, S., & Dangwal, R. C. (2025). Fintech services and financial inclusion: a systematic literature review of developing nations. *Journal of Science and Technology Policy Management*, 16(7), 1167–1198.
- Mishra, D., Kandpal, V., Agarwal, N., & Srivastava, B. (2024). Financial inclusion and its ripple effects on socio-economic development: a comprehensive review. *Journal of Risk and Financial Management*, 17(3), 105.
- Pradhipta, R. D., Wafdayanti, H., Mawardi, W., & Pangestuti, I. R. D. (2025). Measuring fintech and digital banking scalability to enhance financial inclusion in Indonesia. *Economic and Business Horizon*, 4(3), 449–458.
- Shofawati, A. (2019). The role of digital finance to strengthen financial inclusion and the growth of SME in Indonesia. *KnE Social Sciences*, 389–407.