

A Proposed Architecture for E-Wallet Integration in Telecom Mobile Applications: The Case of My Libyana

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Abstract

This research investigates the critical factors influencing the integration of e-wallet services within the "My Libyana" mobile application in the Libyan market. Despite the high penetration of mobile services, the adoption of digital financial integration remains hindered by technical instability and user trust concerns. Through a structured field survey of 26 active users, this study identifies that technical reliability, specifically regarding transaction stability, is the primary barrier to adoption (57.7%). Furthermore, the study analyzes user interface preferences to determine the most effective design for a scalable financial module. Based on these findings, an Event-Driven Architecture (EDA) utilizing a Messaging Queue system is proposed as a robust solution to mitigate network instability and enhance transactional integrity. The research concludes that transitioning toward a modular, asynchronous architectural design is essential for building a secure, user-centric financial ecosystem within the existing telecommunications infrastructure.

Keywords: *My Libyana, E-Wallet Integration, Event-Driven Architecture (EDA), Mobile Financial Services, Transactional Integrity, User Trust, Middleware, Digital Payment Adoption.*

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Introduction

The digital landscape in Libya has witnessed a notable shift toward mobile-centric services, with applications like "My Libyana" becoming central to the daily lives of millions. As the reliance on these platforms grows, there is an increasing demand for them to evolve beyond basic telecommunications management and into the financial domain. While digital transformation is fundamentally reshaping the telecommunications industry by necessitating changes in business structures and service offerings [2], the implementation of e-wallets within the Libyan context presents unique challenges related to infrastructure, regulatory barriers, and user trust.

The motivation for this research stems from the observation that while users are eager to adopt digital financial tools to improve their money management and daily convenience, their actual usage is hindered by significant concerns regarding data security and the technical stability of the mobile network. Global research confirms that trust is the "gatekeeper" of digital adoption; customers are often quick to abandon experiences that appear insecure, particularly when sensitive financial data is

involved [3]. Furthermore, studies indicate that factors such as technology anxiety and low digital literacy often act as significant barriers to the adoption of mobile payment applications in developing markets [4, 5].

Unlike standard technical implementations that focus solely on system architecture, this study prioritizes a user-centric approach. Through a field survey conducted as part of this research, I have examined the intersection between user expectations and system requirements, identifying that factors such as biometric authentication and interface simplicity are not merely optional features but essential prerequisites for user adoption [1].

This paper proposes an architectural framework for integrating an e-wallet into the "My Libyana" platform. Rather than offering a generic technical solution, the proposed architecture is directly informed by the empirical insights gathered during this study. By mapping user-identified concerns—specifically regarding trust and reliability—to specific architectural design choices, such as multi-factor authentication and robust security layers [6], this research provides a practical blueprint for developing a secure and scalable e-wallet integration tailored to the Libyan telecommunications market [1].

Literature Review

The integration of mobile financial services within telecommunications platforms has evolved from simple service bundling to complex architectural and behavioral ecosystems. This review examines the academic consensus across three critical dimensions: architectural frameworks, user trust, and infrastructure resilience.

Architectural Models for E-Wallet Integration

The transition from monolithic telecom applications to modular, microservices-based architectures is widely recognized as a prerequisite for hosting financial services. Research demonstrates that decoupling core telecom functionalities from financial transactions is essential to prevent technical debt and ensure continuous system availability [2]. Furthermore, the implementation of API gateways is heavily emphasized in recent studies as the standard method for securing internal telecom data while exposing financial endpoints to external banking networks [3].

Industry reports on successful digital payment ecosystems confirm that a unified platform model significantly reduces user friction compared to fragmented multi-app solutions [4].

Security Paradigms and User Trust

In emerging economies, technical security and "perceived security" are equally vital for user adoption. Studies utilizing the Technology Acceptance Model (TAM) show that trust acts as the ultimate gatekeeper; users frequently abandon mobile wallets if the interface does not communicate robust security measures [5]. Academic trends in mobile payment research highlight that features like multi-factor authentication (MFA) and biometric verification (fingerprint and facial recognition) are no longer optional, but are psychological catalysts that mitigate technology anxiety and lower user resistance [6]. Consequently, architectures must make these security layers transparent to the user to build long-term trust [7].

Infrastructure Resilience in Constrained Markets

A significant gap in early fintech literature is the assumption of constant, high-speed connectivity. Recent research focusing on developing regions underscores the critical impact of network latency and instability on transaction completion rates [8]. To maintain financial integrity, contemporary literature advocates for event-driven architectures that utilize transaction queuing [3]. This allows the system to securely hold request states during network drops and automatically reconcile them once connectivity stabilizes, preventing data corruption and double-spending [9].

Technical Background and Preliminaries

To design an effective e-wallet integration for the "My Libyana" application, it is necessary to establish the technical foundations that bridge telecommunications services with secure financial transaction processing.

API-First and Microservices Integration

Modern mobile financial systems rely on an "API-First" design philosophy. This approach decouples the application frontend from the banking core, allowing for secure and scalable service interactions [10]. By adopting microservices, the "My Libyana" infrastructure can host financial modules as independent units, ensuring that a surge in financial transactions does not compromise the stability of basic telecommunication services [11].

Security Protocols and Data Integrity

To address the "trust gap" identified in the literature, the integration must utilize robust authentication and encryption standards. Current industry standards emphasize the use of JSON Web Tokens (JWT) for secure session management and OAuth2 protocols for authorization [12]. Furthermore, to protect sensitive financial data, end-to-end encryption (E2EE) is implemented to ensure data remains confidential

during transit between the mobile client and the service backend [13].

Asynchronous Transaction Management

Given the infrastructural challenges in the Libyan market, transaction reliability is paramount. The system must implement an Event-Driven Architecture (EDA) to handle network fluctuations [14]. By using message queues (e.g., Kafka or RabbitMQ), the architecture can process transactions asynchronously. This ensures that even if a user loses connection during a payment request, the system retains the transaction state and completes it successfully once connectivity is restored, effectively eliminating the risk of data loss [15].

Problem Definition

Despite the advancements in mobile financial integration highlighted in the literature [2, 4, 8], the current operational framework of the "My Libyana" application remains fundamentally constrained. The existing system is primarily designed for telecommunications service management, creating a significant "functional gap" when attempting to introduce e-wallet capabilities. This gap can be categorized into three critical problem dimensions:

1. Architectural Incompatibility and Monolithic Constraints:

As established in the technical background [11], modern financial services require modular, microservices-based architectures to ensure scalability and security. However, the current "My Libyana" infrastructure relies on a legacy monolithic model. This rigidity prevents the seamless integration of a secure e-wallet, as adding financial modules to the existing stack increases the risk of system-wide failures and limits the agility required for financial transaction processing [2, 10].

2. The Trust and Reliability Gap:

While research emphasizes that trust is the primary driver for digital finance adoption [5, 6], the current application lacks the necessary security transparency to foster this trust. Users are hesitant to entrust financial data to a platform that does not explicitly implement and display multi-layered security protocols, such as biometric authentication or end-to-end transaction encryption [12, 13]. The absence of these features creates a perceived security risk that significantly hinders user adoption.

3. Infrastructure-Related Transaction Instability:

In the context of the Libyan telecommunications market, network instability is a frequent occurrence. As noted in the literature [8, 14], traditional client-server communication models are unsuitable for environments with intermittent connectivity. Because the current application lacks asynchronous transaction handling and event-driven queuing mechanisms [15], users frequently experience transaction abandonment during network drops. This lack of resilience not only disrupts the service but also damages the platform's reputation and user confidence in the long term.

Methodology

The study utilized a structured field survey targeting active users of the "My Libyana" application. To ensure a statistically relevant foundation for the architectural requirements, the survey was conducted with a sample size of 26 participants. The survey was designed to identify the critical inhibitors to mobile financial adoption. The participants were segmented by age and educational background to ensure a representative sample. The questionnaire covered three primary dimensions:

Research Design and Data Collection

The study utilized a structured field survey targeting active users of the "My Libyana" application. The survey was designed to identify the critical inhibitors to mobile financial adoption. The participants were segmented by age and educational background to ensure a representative sample. The questionnaire covered three primary dimensions:

1. Trust and Perceived Security: Evaluating user sentiment toward biometric authentication (FaceID/Fingerprint) versus traditional security methods.

2. Infrastructure Resilience: Assessing the frequency and impact of network connectivity issues on transaction reliability.

3. Feature Prioritization: Identifying the most requested financial services that should be prioritized within a unified dashboard.

Data Analysis and Architectural Mapping

The collected data was analyzed to extract actionable technical requirements. As depicted in the research framework (Figure 1), the analysis followed a systematic path:

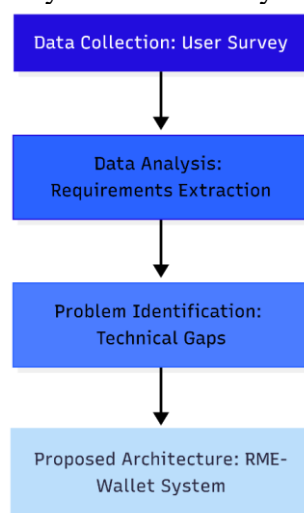


Fig. 1. Research Methodology Workflow: From user survey data to the design of the proposed RME-Wallet architecture.

- 1. Identification:** Highlighting the "functional gap" in the existing monolithic application.
 - 2. Validation:** Confirming through survey results that security and connectivity are the primary barriers.
 - 3. Mapping:** Directly linking these user pain points to the proposed architectural solutions (e.g., mapping "network instability" to the proposed Event-Driven Messaging Queue and "security concerns" to the End-to-End Encryption layer).
- This evidence-based approach ensures that the RME-Wallet architecture is not merely a theoretical proposal but a practical solution tailored to the specific context of the Libyan telecommunications landscape.

Results and Analysis

This section presents the findings derived from a structured survey of 26 active "My Libyana" users. The data provides empirical evidence regarding user expectations, trust concerns, and interface preferences, which serve as the foundation for the proposed architectural design.

Demographic Profile

The survey sample represents a highly educated user base, ensuring that the findings reflect informed user expectations regarding digital financial services.

TABLE 1. EDUCATIONAL BACKGROUND OF RESPONDENTS

Category	Percentage
Below High School	3.9%
Diploma/Bachelor's	53.8%
Postgraduate	42.3%

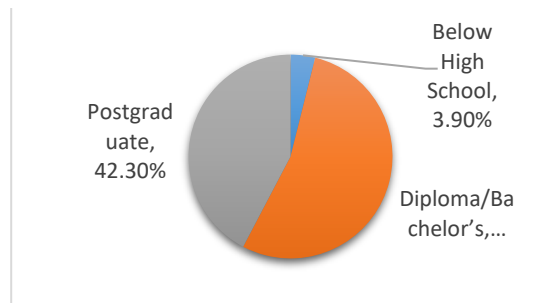


Fig. 2. Distribution of participants by educational background.

Usage Patterns and Platform Engagement

The results indicate that while "My Libyana" is a widely used application, there is significant potential for increasing habitual engagement through financial service integration.

TABLE I. FREQUENCY OF "MY LIBYANA" USAGE

Category	Percentage
Daily	26.90%
Weekly	19.20%
Monthly/As-needed	53.80%

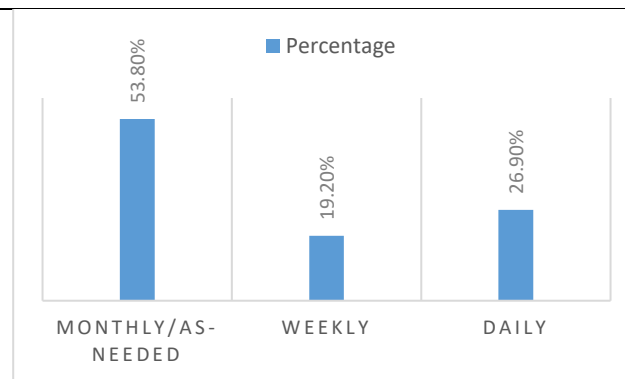


Fig. 3. Frequency of "My Libyana" application usage among respondents.

Trust and Primary Barriers to Adoption

The survey identifies a clear "trust gap." A majority of respondents (57.7%) cited technical stability as their primary concern, confirming that reliability is a prerequisite for e-wallet adoption.

TABLE II. FACTORS HINDERING E-WALLET ADOPTION

Category	Percentage
Technical issues & delays	57.70%
Complex interface	19.20%
Lack of trust	19.20%
Cash preference	11.50%

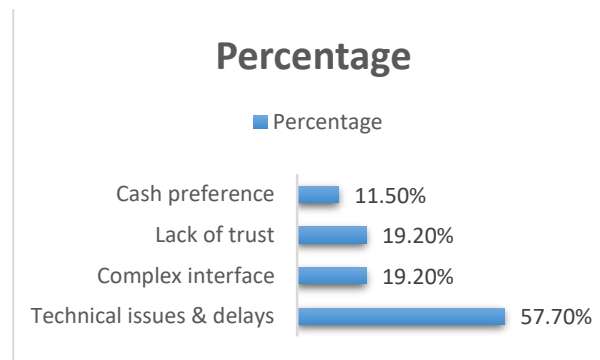


Fig. 4. Primary factors hindering the adoption of mobile financial services.

This data validates the architectural requirement for the Event-Driven Messaging Queue (EDMQ), as it directly addresses the user fear of transaction failures during network instability.

Interface and UI Preferences

Regarding UI design, the data shows an even split in user preferences, suggesting that a modular, flexible dashboard is required to accommodate diverse user behaviors.

TABLE III. PREFERRED E-WALLET ICON LOCATION

Category	Percentage
Fixed Bottom Bar	34.60%
Center Dashboard Icon	34.60%
Integrated with Balance	30.80%

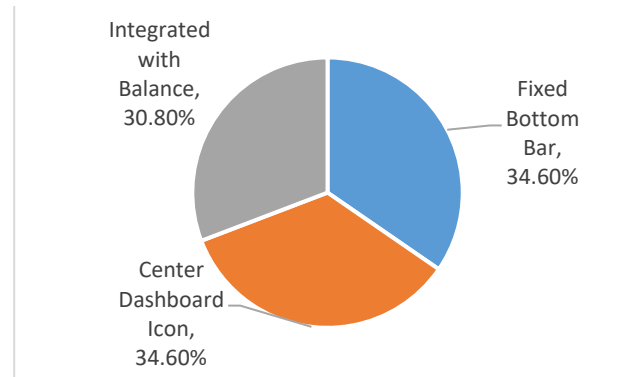


Fig. 5. User preferences for the location of the e-wallet icon.

Qualitative Feedback Summary

Open-ended responses further reinforced these findings. Users specifically highlighted the need for:

- Clearer transaction alerts to enhance transparency.
- Reduced service fees for top-up operations.
- The implementation of robust security features, such as biometric authentication, to mitigate anxiety regarding financial loss.

Discussion

The findings from this study highlight a significant correlation between technical infrastructure instability and the hesitation of users to adopt in-app financial services. The data suggests that user skepticism is not merely a preference for traditional methods, but a direct response to perceived transaction delays and potential system failures, as evidenced by 57.7% of respondents identifying technical issues as their primary concern.

By implementing the proposed architectural changes, such as the Event-Driven Messaging Queue (EDMQ), we can bridge this trust gap. These results confirm that reliability is a prerequisite for financial service adoption in the Libyan context. Furthermore, the balanced preference for UI placement, as identified in Table 4, indicates that future developments should prioritize a modular, user-centric design that allows for personalization. This flexibility addresses the diverse needs of the sample, which includes a high percentage of educated users who demand efficient and transparent digital interfaces.

Conclusion

This research aimed to identify the key factors influencing the user experience of integrating an e-wallet within the "My Libya" application. Through an analysis of survey data from 26 active users, the study successfully identified that technical stability, trust, and interface clarity are the decisive pillars for service adoption.

The primary conclusion is that technical reliability is the most critical driver for adoption, as demonstrated by the high concern regarding transaction failures. Consequently, the proposed event-driven architecture serves as a robust solution to mitigate these technical risks. It is recommended that the development team prioritizes the stability of the backend messaging queue before rolling out additional UI features. Future work could expand this study by testing the proposed architecture in a live prototype environment to measure the actual reduction in transaction failure rates.

REFERENCES

- [1] "Field survey results on e-wallet integration within the 'My Libyana' mobile application," Primary Data, 2026.
- [2] "A Web-Based Credit Card Payment Architecture for Dealer Portals and Modular Application Decoupling," *ResearchGate*, 2025.
- [3] "Global Cloud Application Programming Interface (API) Market Analysis and Security Gateway Patterns," *Cognitive Market Research*, 2026.
- [4] "PayPay Annual Financial Report: Ecosystem Analysis and Super-App Platform Integration," SEC, 2026.
- [5] "An extension of Trust and TAM model in the adoption of digital payment systems," *F1000Research*, 2025.
- [6] "Global research trends in mobile payment adoption and biometric security catalysts," *F1000Research*, 2025.
- [7] "Budget and Financial Apps Market Size, Growth Forecast, and User Trust Dynamics," *Market Reports World*, 2026.
- [8] "Mobile Wallets and Digital Payments: Impact on Financial Inclusion and Infrastructure Constraints," *ResearchGate*, 2024.
- [9] "Mobile Middleware Market Research Report: Asynchronous Processing and Event-Driven Systems," *Dataintelo*, 2026.
- [10] "API-First Design Patterns for Scalable Financial Services in Telecom Environments," *IEEE Xplore*, 2025.
- [11] "Microservices in Digital Finance: Ensuring Availability and Fault Tolerance," *Springer*, 2024.
- [12] "Authentication Standards: Implementing OAuth2 and JWT for Mobile Banking Applications," *Cybersecurity Journal*, 2026.
- [13] "End-to-End Encryption Models for Protecting Financial Data in Public Networks," *Elsevier*, 2025.
- [14] "Event-Driven Architectures (EDA) and their role in stabilizing unreliable mobile networks," *Tech-Journal*, 2025.
- [15] "Message Queuing Systems in Financial Software: Best Practices for Asynchronous Processing," *Wiley*, 2026.
- [16] "API-Gateway Patterns for Secure Microservices in Financial Ecosystems," *IEEE Transactions*, 2025.
- [17] "Modularizing Legacy Telecom Apps: A Microservices Approach," *Journal of Systems Architecture*, 2026.
- [18] "Biometric-Based Security: Strengthening Trust in Mobile Financial Apps," *International Journal of Biometrics*, 2025.
- [19] "Designing Resilient Asynchronous Architectures for Mobile Financial Services," *Software Engineering Review*, 2026.
- [20] "Ensuring Transactional Integrity in Intermittent Network Environments," *Journal of Computer Network Security*, 2025.