

# **Blockchain-Integrated Alumni Tracer System with Social Media Engagement**

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## **Abstract**

This study focused on the design and development of a Blockchain-Integrated Alumni Tracer System with Social Media Engagement implemented in a public higher education institution in the Philippines. The research addressed persistent challenges related to limited alumni engagement, outdated alumni records, and the lack of a secure and transparent mechanism for tracking alumni donations. Existing alumni data collection methods relied heavily on manual processes and online forms, resulting in inefficiencies and reduced institutional connectivity with graduates. A developmental research approach was employed, beginning with a baseline needs assessment involving alumni and university administrators to identify existing problems and system requirements. The system was developed using the Agile Software Development Life Cycle (SDLC) and incorporated key features such as alumni profile management, social media-based authentication, centralized alumni data storage, and a blockchain-enabled donation tracking framework implemented through a private Ethereum network using Hyperledger Besu. System evaluation was conducted using criteria based on the ISO/IEC 25010 Software Product Quality Model, assessing functionality, reliability, usability, efficiency, maintainability, portability, and security. The results indicated that the system achieved an overall mean score of 4.38 (Excellent) across ISO/IEC 25010 quality dimensions. Moreover, both alumni and administrators demonstrated positive perceptions toward the integration of blockchain technology, citing its potential to enhance transparency, trust, and data integrity in donation management. The findings suggest that integrating social media and blockchain technologies into alumni tracer systems can effectively improve alumni engagement and institutional accountability in higher education institutions.

**Keywords:** Alumni Tracer System, Blockchain Technology, Social Media Integration, Donation Transparency, Higher Education Institutions

## **1. Introduction**

Alumni engagement plays a vital role in the sustainability and development of Higher Education Institutions (HEIs), contributing to improved institutional reputation, resource mobilization, and long-term stakeholder relationships [1]. However, many universities continue to rely on manual or fragmented alumni management practices, resulting in outdated records, limited engagement, and inefficiencies in communication and fundraising efforts [2].

Globally, HEIs have increasingly adopted digital alumni management systems to address these challenges. Studies highlight the effectiveness of alumni portals and social media integration in improving data

accuracy and graduate participation [3]. At the same time, blockchain technology has emerged as a solution for enhancing transparency and trust in donation systems by providing immutable and verifiable transaction records [4].

Within the ASEAN region, alumni engagement is largely supported by social media platforms due to their accessibility and widespread use. Research indicates that platforms such as Facebook are commonly utilized to maintain alumni connections; however, formal integration with institutional systems and secure digital donation tracking remains limited [6].

In the Philippine context, public higher education institutions continue to face challenges in alumni data management and engagement due to the absence of centralized systems. Runner EDQ (2025) reported that decentralized and manual approaches contribute to outdated alumni records and weak alumni participation. These limitations highlight the need for an integrated technological framework that combines alumni data management, social media engagement, and secure donation tracking.

This study is anchored on the Information Systems Success Model of DeLone and McLean (2003), which posits that system quality, information quality, and service quality influence user satisfaction and system effectiveness. These dimensions guided the design and evaluation of the proposed alumni tracer system, particularly in assessing functionality, usability, reliability, and security under the ISO/IEC 25010 quality model. Furthermore, the integration of blockchain technology is grounded in decentralized ledger theory, which emphasizes immutability, transparency, and distributed validation as mechanisms for enhancing trust and accountability in digital transactions [4]. By combining these theoretical foundations, the study provides a framework for developing a secure and user-centered alumni management system.

This study aims to design and evaluate a blockchain-integrated alumni tracer system with social media engagement to enhance alumni data management, engagement, and donation transparency in a Philippine higher education institution.

## 2. Literature Review

Alumni engagement has evolved into a strategic priority for higher education institutions seeking long-term sustainability, enhanced reputation, and diversified funding sources [9]. Traditionally, alumni relations relied on reunions, printed newsletters, and membership-based associations. While these methods fostered personal connections, they lacked scalability, efficient data management, and real-time communication capabilities. As alumni populations expanded and became geographically dispersed, institutions faced increasing difficulties maintaining updated records and meaningful engagement.

A primary challenge in alumni management systems is data accuracy and centralization. Fragmented databases and manual record-keeping practices often result in outdated information and inefficient communication. Bracher and Mukherjee (2025) emphasizes the importance of automated verification systems in addressing data inconsistencies and improving institutional efficiency. However, in developing-country contexts such as the Philippines, limited technological infrastructure and budget constraints hinder the adoption of advanced data management systems. Interdepartmental silos further exacerbate inconsistencies, as registrars, alumni offices, and other units frequently maintain separate databases without synchronization.

To address these limitations, modern alumni portals have emerged as centralized digital platforms that enable self-service data updates, event registration, and communication management. These systems enhance operational efficiency while empowering alumni to maintain accurate personal records. Despite their benefits, implementation remains uneven among public universities due to financial and technical limitations.

Technological integration has further transformed alumni engagement through social media platforms, APIs, and digital financial tools. Yumen (n.d.) highlights the broader digital transformation trend in alumni relations, emphasizing real-time connectivity and community-building features. Social networking platforms such as Facebook, Instagram, and LinkedIn serve dual roles as communication channels and professional networking environments. Irianto et al. (2021) argue that social media enhances both institutional outreach and alumni relationship-building. Given the high social media penetration in the Philippines, these platforms provide cost-effective engagement mechanisms.

Application Programming Interfaces enable interoperability between alumni databases and external platforms, ensuring data synchronization and regulatory compliance [19]. API integration supports seamless connectivity with career portals, event management systems, and financial platforms. However, financial constraints often limit API adoption in resource-constrained institutions.

In parallel, digital payment technologies have modernized fundraising mechanisms. E-wallet integration simplifies donation processes, enhances convenience, and increases donor participation [13]. By enabling secure and user-friendly transactions, digital wallets reduce reliance on physical payment methods and expand access to international donors. Nonetheless, implementation requires careful attention to cybersecurity, system compatibility, and user experience design.

Beyond payment facilitation, donation transparency has emerged as a critical institutional concern. Alumni donors increasingly expect accountability and verifiable reporting on fund utilization. Blockchain technology offers a decentralized and immutable ledger system capable of enhancing trust and transparency [17]. Through immutable transaction records, donors can trace contributions, reducing concerns regarding mismanagement [14].

Private Ethereum networks provide permissioned blockchain infrastructures suitable for educational environments. Tools such as Geth and Hyperledger Besu allow institutions to deploy controlled-access systems with customizable governance structures and reduced transaction costs [15]. Unlike public blockchains, private networks eliminate exposure to volatile gas fees and enable institutional oversight. Hybrid blockchain models, which combine centralized databases with decentralized validation mechanisms, further enhance scalability and cost-efficiency [16].

Despite these technological advancements, blockchain adoption in higher education remains limited due to financial investment requirements, technical complexity, and organizational readiness challenges. Gradual implementation strategies and cross-sector partnerships are recommended to facilitate adoption in developing-country institutions.

A critical synthesis of the literature reveals that alumni engagement systems, digital financial integration, and blockchain-based transparency have largely been examined independently. There is limited research

integrating these components into a unified institutional framework, particularly within resource-constrained public universities. The Philippine context presents unique technological and financial constraints that require localized, scalable solutions.

Accordingly, this study addresses a significant research gap by proposing an integrated alumni tracking system that combines centralized data management, social media connectivity, API-based interoperability, digital payment donation processing, and blockchain-enabled transparency. By contextualizing these technologies within a public university environment, the study contributes to strengthening alumni relations, improving institutional accountability, and advancing digital transformation in higher education.

### 3. Methodology

This study adopted a developmental research design to design, develop, and evaluate a Blockchain-Integrated Alumni Tracer System with Social Media Engagement for Mindanao State University – Lanao del Norte Agricultural College (MSU-LNAC). Developmental research is appropriate for technology-oriented studies where the primary objective is the creation and iterative refinement of a functional system aligned with user needs and institutional requirements. The system was developed using the Agile Software Development Life Cycle (SDLC), which emphasizes incremental development, stakeholder feedback, and continuous improvement. The Agile framework allowed progressive implementation of features such as alumni registration, profile management, verification workflows, donation processing, and blockchain integration while enabling early detection and correction of usability and functional issues. The study was conducted within the Alumni Relations Office (ARO) of MSU-LNAC, where current alumni data collection relies primarily on manual processes and Google Form-based submissions. These practices present limitations including fragmented records, outdated information, and minimal monitoring of alumni engagement and donations. The institutional setting therefore provided a practical environment for identifying system requirements and validating operational workflows, particularly in alumni verification and donation transparency.

Data collection occurred in two phases. First, a baseline needs assessment was conducted with a minimum of 120 alumni from various academic programs and graduation years, along with 10 administrators, to determine existing challenges in alumni engagement and data management.

Table 1: Baseline Survey Respondents

<b>Respondents</b>	<b>Frequency</b>
Alumni	120
Administrators	10

Second, system evaluation was performed using a purposive sample of 10 alumni who had actual exposure to the developed system. Additionally, four Alumni Relations Office administrators and one Information Technology expert evaluated operational suitability and technical feasibility. The smaller evaluation sample aligns with usability research principles indicating that a limited number of representative users is sufficient to identify system performance and usability issues (Nielsen, 2010).

Table 2: System Evaluation Respondents

<b>Respondents</b>	<b>Frequency</b>
Alumni	10
ARO Administrators	4
IT Expert	1

The baseline assessment utilized a researcher-developed structured questionnaire composed of declarative statements measuring alumni engagement practices, data accuracy concerns, and perceived need for automation and blockchain integration. Responses were collected using a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). For system evaluation, an adopted instrument based on the ISO/IEC 25010:2011 Software Product Quality Model was employed. The instrument assessed functional suitability, performance efficiency, usability, reliability, security, maintainability, and portability using a five-point scale ranging from Poor (1) to Excellent (5). Reliability analysis was conducted to assess the internal consistency of the research instruments. The baseline needs assessment instrument obtained a Cronbach's Alpha coefficient of 0.86, indicating high reliability. The ISO/IEC 25010 system evaluation instrument yielded a Cronbach's Alpha value of 0.88, demonstrating high internal consistency. Both values exceed the recommended threshold of 0.70, confirming the reliability of the measurement scales.

System requirements were derived from baseline findings and stakeholder consultations. Core functional features included alumni registration with email and OAuth-based social media login, profile updating, administrator verification against registrar records, digital payment gateway using PayMongo, and blockchain-based donation logging. Non-functional requirements addressed security, scalability, and system performance. The system adopted a modular architecture consisting of a web-based alumni interface, a desktop administrative module, a REST API-based backend server, and a Firebird SQL database. Blockchain functionality was implemented using a private Ethereum network via Hyperledger Besu, configured with three validator nodes and one RPC node operating under the IBFT (Istanbul Byzantine Fault Tolerance) consensus mechanism.

Donation transactions were first processed through the digital payment gateway. Upon confirmation, essential metadata, including donor identification, donation amount, and timestamp, were submitted to the private blockchain. The resulting transaction hash was stored within the system's internal database to ensure immutability and traceability without exposing personal information. This layered approach ensured separation between sensitive user data and blockchain records, strengthening privacy compliance while maintaining transparency.

Throughout development, system modeling techniques including Data Flow Diagrams, Entity-Relationship Diagram, Use Case Diagram, Class Diagram, Sequence Diagrams, and Activity Diagram were employed to define structural relationships, data movement, and user interactions. Testing was conducted iteratively within each Agile sprint to validate functional workflows, authentication mechanisms, and blockchain recording procedures.

Descriptive statistics were used to analyze baseline and evaluation data. Mean scores were computed for each ISO 25010 quality attribute and interpreted using predefined score ranges: 4.21–5.00 (Excellent),

3.41–4.20 (Satisfactory), 2.61–3.40 (Needs Improvement), 1.81–2.60 (Poor), and 1.00–1.80 (Very Poor). Ethical approval was secured prior to data collection, participation was voluntary, and confidentiality was maintained through coded responses and aggregated reporting in compliance with the Philippine Data Privacy Act of 2012 (RA 10173)

#### 4. Result and Discussion

A total of 120 alumni and 10 administrators participated in the baseline survey. Reliability testing using Cronbach's Alpha indicated acceptable internal consistency of the instrument, confirming its suitability for descriptive analysis.

##### 4.1 Alumni Engagement and Data Management

Alumni perception of the current state of engagement yielded a higher mean of 4.19, indicating strong agreement that substantial challenges persist, particularly in terms of limited program visibility, ineffective communication channels, and inadequate participation opportunities.

Table 3: Weighted Mean on the Alumni's Perception on the Current State of Alumni Engagement.

Questions Code	Average Weighted Value	Interpretation
AEQ1	4.30	Excellent
AEQ2	4.23	Excellent
AEQ3	4.14	Satisfactory
AEQ4	4.17	Satisfactory
AEQ5	4.21	Excellent
<b>Overall Mean</b>	<b>4.21</b>	<b>Excellent</b>

Similarly, administrators reported an even higher overall mean of 4.34, strongly affirming that despite recognizing the importance of alumni relations, the institution currently lacks a structured and systematic engagement framework.

Table 4: Weighted Mean on the Administrator's Perception on the Current State of Alumni Engagement.

Questions Code	Average Weighted Value	Interpretation
AEQ1	4.55	Excellent
AEQ2	4.32	Excellent
AEQ3	4.26	Excellent
AEQ4	4.27	Excellent
AEQ5	4.29	Excellent
<b>Overall Mean</b>	<b>4.34</b>	<b>Excellent</b>

Regarding alumni data management, alumni responses reflected strong agreement on the presence of significant issues, with a higher mean of 4.36, emphasizing concerns about outdated records, persistent communication gaps, and the absence of reliable and secure mechanisms for updating personal information.

Table 5: Weighted Mean on the Alumni's Perception on the Challenges in Alumni Engagement.

Questions Code	Average Weighted Value	Interpretation
DMQ1	4.21	Excellent
DMQ2	4.61	Excellent
DMQ3	4.27	Excellent
DMQ4	4.38	Excellent
DMQ5	4.35	Excellent
<b>Overall Mean</b>	<b>4.36</b>	<b>Excellent</b>

Administrators likewise strongly affirmed these challenges, reporting a mean of 4.41, particularly highlighting the lack of a centralized data management system and the inefficiency of manual, time-consuming verification processes.

Table 6: Weighted Mean on the Administrator's Perception on the Challenges in Alumni Data Management.

Questions Code	Average Weighted Value	Interpretation
DMQ1	4.33	Excellent
DMQ2	4.77	Excellent
DMQ3	4.16	Satisfactory
DMQ4	4.45	Excellent
DMQ5	4.33	Excellent
<b>Overall Mean</b>	<b>4.41</b>	<b>Excellent</b>

#### 4.2 Desired Features for Alumni Tracer System

Alumni strongly supported the development of an integrated alumni tracer system (Mean = 4.29), emphasizing profile management, event participation, employment analytics, donation tracking, and social media integration.

Table 7: Weighted Mean on the Alumni Perception on the Desired Features of Alumni Tracer System.

Questions Code	Average Weighted Value	Interpretation
DFQ1	4.40	Excellent

DFQ2	4.24	Excellent
DFQ3	4.39	Excellent
DFQ4	4.26	Excellent
DFQ5	4.18	Satisfactory
<b>Overall Mean</b>	<b>4.29</b>	<b>Excellent</b>

Administrators likewise expressed strong agreement (Mean= 4.36) regarding the necessity of centralized data management, improved verification processes, and secure record handling.

Table 8: Weighted Mean on the Administrator Perception on the Desired Features of Alumni Tracer System.

Questions Code	Average Weighted Value	Interpretation
DFQ1	4.40	Excellent
DFQ2	4.42	Excellent
DFQ3	4.39	Excellent
DFQ4	4.29	Excellent
DFQ5	4.31	Excellent
<b>Overall Mean</b>	<b>4.36</b>	<b>Excellent</b>

### 4.3 Blockchain Integration

Both alumni (Mean = 4.39) and administrators (Mean = 4.60) strongly agreed on the importance of transparency, security, and immutability in donation tracking systems. Respondents expressed willingness to adopt a blockchain-enabled system to ensure tamper-resistant donation records and increased trust.

Table 9: Weighted Mean on the Alumni's Perception Towards Blockchain Technology.

Questions Code	Average Weighted Value	Interpretation
BIQ1	4.53	Excellent
BIQ2	4.47	Excellent
BIQ3	4.35	Excellent
BIQ4	4.27	Excellent
BIQ5	4.31	Excellent
<b>Overall Mean</b>	<b>4.39</b>	<b>Excellent</b>

Table 10: Weighted Mean on the Administrator's Perception Towards Blockchain Technology.

Questions Code	Average Weighted Value	Interpretation
BIQ1	4.75	Excellent
BIQ2	4.49	Excellent
BIQ3	4.51	Excellent
BIQ4	4.55	Excellent
BIQ5	4.69	Excellent
<b>Overall Mean</b>	<b>4.60</b>	<b>Excellent</b>

#### 4.4 System Evaluation

System quality was evaluated using the ISO/IEC 25010 Software Product Quality Model. Reliability testing of the evaluation instrument also demonstrated high internal consistency.

Table 11: System's Overall Evaluation Weighted Mean.

Factor	Average Weighted Value	Interpretation
1. Functionality	4.77	Excellent
2. Reliability	4.23	Excellent
3. Usability	4.19	Excellent
4. Efficiency	4.17	Excellent
5. Security	4.37	Satisfactory
6. Maintainability	4.58	Excellent
7. Portability	4.33	Excellent
<b>Overall Mean</b>	<b>4.38</b>	<b>Excellent</b>

#### 5. Conclusion and Recommendation

This study developed and evaluated a Blockchain-Integrated Alumni Tracer System with Social Media Engagement to address institutional challenges in alumni engagement, data management, and donation transparency at MSU-LNAC. Baseline findings revealed limited alumni awareness, fragmented communication, outdated records, and the absence of a centralized digital platform. Both alumni and administrators reported verification difficulties and data security concerns, confirming inefficiencies in the existing manual processes.

Stakeholders strongly supported the implementation of an integrated alumni tracer system incorporating profile management, social media authentication, employment analytics, and donation tracking. Positive perceptions toward blockchain technology further justified its inclusion, particularly for ensuring transparency, immutability, and trust in donation records.

System evaluation using the ISO/IEC 25010 Software Quality Model demonstrated high acceptability across functionality, reliability, usability, efficiency, maintainability, portability, and security dimensions.

These results indicate that the developed system effectively addresses identified institutional gaps and is suitable for deployment. The findings affirm that blockchain-enabled alumni management systems can enhance engagement, improve data integrity, and strengthen transparency in higher education institutions. This study contributes to the literature in three ways. First, it extends alumni management research by integrating blockchain technology with centralized tracer systems and social media integration within a single institutional framework. Second, it demonstrates the practical feasibility of deploying a private Ethereum network using IBFT consensus in a public higher education setting. Third, it provides empirical validation of system quality using the ISO/IEC 25010 model, offering a replicable evaluation framework for similar institutions in developing-country contexts.

Based on the findings, the following recommendations are proposed:

1. The university administration should institutionalize the system as the official alumni engagement and donation platform, supported by policies on data validation and digital communication.
2. Future enhancements may include expanded payment options, advanced analytics for alumni career tracking, and broader blockchain applications in institutional transactions.
3. Further studies may replicate the system in other higher education institutions and explore AI-driven alumni analytics to improve scalability and predictive insights.

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**Competing Interests**

The authors declare that they have no financial, professional, or personal conflicts of interest that could have influenced the work reported in this study.

**Consent for Publication**

The author has reviewed and approved the final manuscript and consent to its publication.

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**References:**

1. Trillano H. Jr. E., Prudente R. S., Mondejar L. A., “Alumni Tracer and Management System with Data Analytics: Enhancing Alumni Engagement and Data Management for South East Asian Institute of Technology, Inc.”, *International Journal of Research and Innovation in Social Science*, 2025, 9 (3), 5142–5155. <https://doi.org/10.47772/IJRIS.2025.90400370>

2. Bracher J., Mukherjee S., “The Role of Social Influence in Alumni Engagement: Examining Behavioural Intentions through Alumni Platforms”, *International Journal of Research and Innovation in Social Science*, 2025, 9 (3), 1340–1349.  
<https://rsisinternational.org/journals/ijriss/articles/the-role-of-social-influence-in-alumni-engagement-examining-behavioural-intention-and-digital-platform-usage/>
3. Dang L. L., “Alumni Information Collection and Management”, Master’s Thesis, University of Chicago, 2023.
4. Antal C., Cioara T., Anghel I., Antal M., Salomie I., “Distributed Ledger Technology Review and Decentralized Applications Development Guidelines”, *Future Internet*, 2021, 13 (3), Article 62.  
<https://doi.org/10.3390/fi13030062>
5. Farooq M. S., Khan M., Abid A., “A Framework to Make Charity Collection Transparent and Auditable Using Blockchain Technology”, *Computers and Electrical Engineering*, 2020, 83, Article 106588. <https://doi.org/10.1016/j.compeleceng.2019.106588>
6. Patulin E., “Tracer Study of Education and Graduate Program Alumni”, *Journal of Interdisciplinary Perspectives*, 2024, 3 (1), 1–15.
7. Runner EDQ, “Maximizing Alumni Engagement with Pristine Data Management”, 2025.  
<https://www.runneredq.com/blogs/maximizing-alumni-engagement-with-pristine-data-management>
8. DeLone W. H., McLean E. R., “The DeLone and McLean Model of Information Systems Success: A Ten-Year Update”, *Journal of Management Information Systems*, 2003, 19 (4), 9–30.  
<https://doi.org/10.1080/07421222.2003.11045748>
9. Oetjen R. M., Oetjen D., Richardson E., Calkins C., Gordon J., “Creating a Culture of Connectedness to Foster Alumni Engagement”, *Journal of Health Administration Education*, 2023, 40 (1), 23–38.
10. Bista B., Shakya A., Joshi B., Pokhrel A., Dangol L., Kedia M., Baral D. S., “An Alumni Portal and Tracking System”, *Journal of the Institute of Engineering*, 2021, 16 (1).
11. Yumen N. M., “Alumni Network Platform Leveraging Regression Models for Data Analysis”, (Unpublished).
12. Irianto W. S. G., Al Idrus S., Gumilar L., Wibawa A. P., Kurubacak G., Wahyuningtyas E. P., Al Rafi M. A. F., “Social Media Utilization for Alumni Interaction”, *Proceedings of the 7th International Conference on Electrical, Electronics and Information Engineering*, 2021, 1–6.
13. Ruffalo Noel Levitz, “Santa Clara University Case Study: Digital Wallet Impact on Giving Day”, 2022. <https://www.ruffalonl.com/wp-content/uploads/2022/08/Santa-Clara-University-Case-Study.pdf>
14. Avdoshin S., Pesotskaya E., “Blockchain in Charity: Platform for Tracking Donations”, *Proceedings of the Future Technologies Conference*, 2020, 689–701.
15. Wong K. Y., “The Frontier of Blockchain Privacy: Development of a Private Ethereum Network”, 2024. <https://www.researchgate.net/publication/382097659>
16. Marar H., Marar R., “Hybrid Blockchain”, *Jordanian Journal of Computers and Information Technology*, 2020, 6 (1).
17. An M., Fan Q., Yu H., Zhao H., “Blockchain Technology Research and Application: A Systematic Literature Review and Future Trends”, *arXiv*, 2023. <https://arxiv.org/abs/2306.14802>



18. Nielsen J., Landauer T. K., “A Mathematical Model of the Finding of Usability Problems”, Proceedings of the INTERACT '93 and CHI '93 Conference on Human Factors in Computing Systems, 1993, 206–213. <https://doi.org/10.1145/169059.169166>
19. Rafalski K., “API Integration in Web Development: Best Practices”, 2024. <https://www.netguru.com/blog/api-integration-best-practices>