I-Secure: An Application of Blockchain Technology for the NEUST Graduate School Enrolment System

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Abstract. This paper proposed the design and assessment of I-Secure—a blockchain-based enrollment payment system for the NEUST Graduate School. The product was created specifically to address issues around how cumbersome the manual payment process is, not to mention how slow, opaque, and insecure. The goal of this study was to develop an online system for enrollment that would be secure, transparent, and easy to use and would be integrated with the existing institution's systems.

The research design used in the study was quantitative studies with the use of Agile Software Development Methodology. A RESTful Application Programming Interface (API) was built to connect the web interface and the blockchain network. The system evaluation was based on the ISO/IEC 25010:2011 Software Product Quality Requirements covering functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. Information was received from expert and graduate students selected based on a purposive random method and analyzed based on weighted mean.

Findings revealed that the system was very functionally suitable, very efficient, very compatible, very usable, very reliable, very secure, very maintainable, and very portable. Such evaluations indicate that users are highly satisfied with the performance of the scheme in terms of usability, secure transaction handling, and its integration capabilities.

One of the distinctive properties of I-Secure is its stable digital token linked to the Philippine peso, promoting and following national monetary standards, as well as predictability in transactions. Additionally, the survey brought home the salience of the

system to the MSIT program by pointing out its practical realization of modern development techniques and QA practices.

Conclusion This study proved that I-Secure resolves many of the shortfalls in the process of enrollment payment and offers a highly secure, reliable, and scalable platform. It also proposed the creation of a separate team to maintain further system development and ensure stability for the future.

1. Introduction

Many schools are still using old and centralized methods of processing enrollment payments that are usually slow, cumbersome, or susceptible to fraud. Such difficulties have prompted the inquiry into new technologies that can offer better transparency, security, and automation. The blockchain, with its decentralized, immutable ledger, offers a compelling alternative. Its promise in enhancing educational digital transactions, especially in the enrollment processes, credentialing, and administrative payments, has been extensively highlighted in literature (Alammary et al., 2019; Bhaskar et al., 2020; Fedorova & Skobleva, 2020).

At an international level, literature has emphasized the role of blockchain to improve the accuracy of data, decrease time-consuming tasks, and enable secure peer-to-peer transactions (Raimundo & Rosário, 2021; Shang et al., 2022). For the Philippines, the Bangko Sentral ng Pilipinas' issuance of the PHPC stablecoin opens an avenue for secure and legal digital money (GMA News, 2024). However, application of these systems in local schools of medicine is currently limited.

In this paper, we will be addressing that gap by developing and evaluating I-Secure, a blockchain-enabled enrollment payment system that is designed specifically for the NEUST Graduate School. The project follows the Agile Software Development (Beck et al., 2001; Highsmith, 2009) and a quality model proposed by ISO/IEC 25010 (ISO/IEC, 2011). The protocols incorporate smart contracts and PHPC tokens hosted on a testnet to simulate secure live transactions in an educational setting. By employing technical analysis and user evaluation, the paper demonstrates how blockchain may be optimally utilized in Philippine tertiary education.

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2. Methodology

The study used a developmental approach based on Agile and ISO 25010 methodologies. The development process was matched to Agile's seven phases: plan, design, develop, test, release, review, and launch. The tools employed included Node.js, Solidity, PHP, and Web3.js. Blockchain features were implemented on the Sepolia Testnet to validate real PHPC transactions.

The instruments used in the survey are validated. IT professionals reviewed the technical quality, while graduate students assessed the usability and acceptability. Overall, quantitative analysis involved weighted means and t-tests.

Figure 1.
Conceptual Framework of the I-Secure System Using Agile and ISO 25010
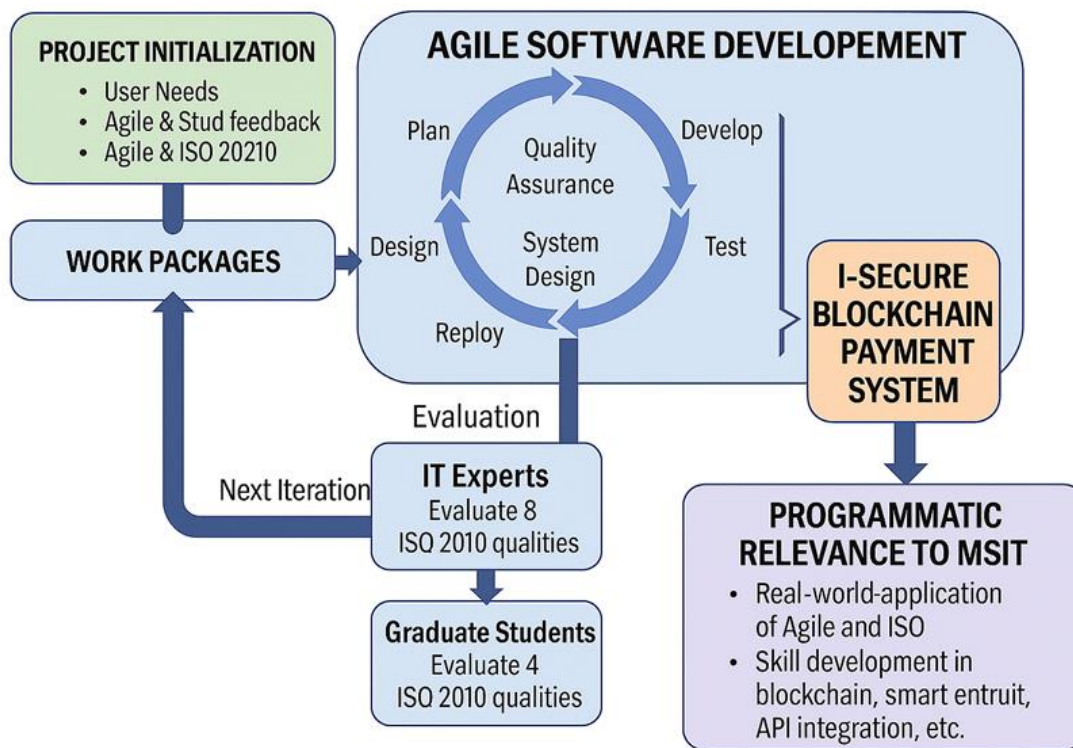
2.1. Sampling Procedure

Respondents with relevant expertise and experience were purposively chosen. Five IT professionals (referred by the NEUST MIS Office by virtue of their expertise in systems development and blockchain) evaluated the technical quality of the system based on the ISO/IEC 25010 standard. Moreover, 35 graduate students from different master-level programs at NEUST were enrolled as end-

users in the simulated enrollment. Their diverse disciplinary backgrounds enabled them to offer feedback on the system from representative usability, functionality, and acceptance perspectives. This approach allowed for a thorough review of both the technical and user aspects.

2.2. Respondents

The participants formed two groups. The initial group was composed of five IT professionals with knowledge of system development and blockchain who were in charge of assessing the technical soundness of the system. The thirty-five graduate students from NEUST Graduate School also had an average age of 33 years and were matriculated in various programs, such as information technology, education management, engineering management, and public administration. Their perception was important as a way of evaluating the usability and practicality of the system. Table 1 presents the distribution of respondents.

Table 1.
Distribution of the Respondents

Respondent	Sample Size	%
IT Experts	5	12.5
Graduate Students	35	87.5
Total	40	100

2.2.1 Research Site

The study was carried out in NEUST Graduate School in Sumacab Campus, Cabanatuan City, Philippines. NEUST was selected mostly for its centralized nature and manual enrollment, making it an example case for blockchain incorporation. Innovation-oriented university culture and support from stakeholders such as the MIS Office and faculty members were important factors contributing to the successful implementation of the I-Secure system as a pilot project in the university setting. This made NEUST suitable as the place where a blockchain-based enrollment system can be deployed and tested in an actual academic setting.

Figure1. Research Locale

3. Results and Discussion

3.1. Evaluation of IT Expert

A group composed of the top IT experts, who have been involved in the development, evaluation, and integration of systems as well as blockchain, was selected, and the blockchain-based enrollment payment system (I-Secure) proposed by our researchers was introduced to this group. After the system demonstration, the experts evaluated the application using an ISO/IEC 25010-based evaluation tool.

Table 3. IT Experts' Evaluation Summary Results based on ISO/IEC 25010

PRODUCT QUALITY STANDARDS	Weighted Mean	Verbal Interpretation
1. Functional Suitability	3.81	Very Functionally Suitable
2. Performance Efficiency	3.76	Very Efficient
3. Compatibility	3.74	Very Compatible
4. Usability	3.78	Very Usable
5. Reliability	3.79	Very Reliable
6. Security	3.8	Very Secure
7. Maintainability	3.77	Very Maintainable
8. Portability	3.75	Very Portable

The results indicate that the system consistently achieved high scores across all ISO 25010 product quality standards. The highest weighted mean was recorded for functional adequacy, 3.81, which suggested that the system successfully satisfied its primary functional requirements. Security and reliability also registered high scores, which underpinned the strength of blockchain infrastructure. These assessments confirm that the system is very much in line with technical expectations and that the development of ISO-compatible blockchain solutions in academic administration has been successfully implemented.

3.2. Evaluation of End-Users (Graduate Student)

The I-Secure was reviewed by graduate students after being used for their enrollment. They assessed the user-friendliness, functional fit, portability, and acceptance of the system based on a customized questionnaire derived according to the guidelines of the ISO/IEC 25010 standard.

Table 4. End-Users' Evaluation Summary Results based on ISO/IEC 25010

PRODUCT QUALITY STANDARDS	Weighted Mean	Verbal Interpretation
1. Functional Suitability	3.78	Very Functionally Suitable
2. Usability	3.79	Very Usable
3. Portability	3.77	Very Portable
4. Acceptability	3.8	Very Acceptable

These results show a good level of satisfaction on the part of the student users. Usability and acceptability were particularly highly valued, with weighted mean values of 3.79 and 3.80, respectively. Positive response indicates that the interface was user-friendly, accessible, and convenient to perform a digital transaction. Portability was also highly rated, confirming that the system was easily accessible on multiple devices and platforms. The high functional adequacy score indicates that the I-Secure system implemented its functions as originally intended in practice in an academic environment.

3.3. Comparative Analysis

The I-Secure was well received by the IT professionals and the student end-users, who had rated all significant software quality attributes "very" or

"highly" positive. The IT specialists emphasized the system's technical strengths, such as its security and robustness, along with improvements to the reliability and maintainability of the server component, while students highlighted the system's usability, including its ease of transport into a classroom and overall convenience. The consistency of these assessments, coming from two different groups of users, is an indication of the goodness and relevance of the system. It demonstrates that I-Secure successfully integrates its strong technical capabilities with user-oriented design, which is crucial for the adoption of educational technology.

High scores reported by both groups support that the system satisfies ISO/IEC 25010 requirements and covers practical enrollment requirements. This convergence provides further evidence for I-Secure's institutionalization and potential scalability.

4. Conclusions

The I-Secure was developed using the Agile approach as a project management process throughout all development stages, from planning to launch. IT experts confirmed that it complies with ISO/IEC 25010 standards, especially in terms of functionality, performance, and security. Postgraduate students evaluated the system as very usable and efficient in registration. These results support the potentiality of using blockchain technology in academic payments. The successful operation of the system leads to the possibility of further scaling across NEUST as well as potential commercialization as a Blockchain-as-a-Service (BaaS) solution.

Acknowledgements

References

Alammary, A., Alhazmi, S., Almasri, M., & Gillani, S. (2019). Blockchain-based applications in education: A systematic review. *Applied Sciences*, 9(12), 2400-2415.

Ameen, N., Tarhini, A., Reppel, A., & Anand, A. (2022). Customer experiences in the age of digital banking: A study of Internet banking services. *Journal of Retailing and Consumer Services*, 60, 102-109.

Beck, K., Beedle, M., van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., ... & Thomas, D. (2001). Manifesto for agile software development. *Agile Alliance*.

Bhaskar, M., Tan, S. H., & Yong, J. S. (2020). Blockchain and its applications-A review. *Technology in Society*, 63, 101-119.

Fedorova, I., & Skobleva, E. (2020). Blockchain in education: Opportunities, implementation, and challenges. *International Journal of Open Information Technologies*, 8(2), 1-7.

GMA News. (2024). BSP recognizes PHPC stablecoin for compliant digital transactions. *GMA News Online*. Retrieved from https://www.gmanetwork.com/news/money/

Highsmith, J. (2009). *Agile Project Management: Creating Innovative Products*. Addison-Wesley Professional.

ISO/IEC. (2011). ISO/IEC 25010:2011 Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — System and software quality models. *International Organization for Standardization*.

Raimundo, R. & Rosário, A. (2021). Blockchain system in the higher education. *Education and Information Technologies*, 26(3), 2707-2733.

Shang, W., Luo, Z., & Wang, X. (2022). Fraud prevention in digital systems using blockchain: Case studies and challenges. *Journal of Information Security and Applications*, 65, 103-113.