The Indonesian Journal of Computer Science
www.ijcs.net
Volume 13, Issue 5, October 2024
https://doi.org/10.33022/ijcs.v13i5.4426

Implementation of Blockchain Technology in the Development of a Mobile-Based E-Career System

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Article Information

Received : 7 Oct 2024
Revised : 29 Oct 2024
Accepted : 30 Oct 2024

Keywords

Blockchain Technology; E-Career; System; Mobile; Startup

Abstract

In the current digital era, Blockchain technology has shown great potential across various sectors, including education and career development. However, its application in electronic career systems or E-Career is still rare. This creates an urgency to conduct research on how Blockchain technology can be applied in E-Career systems to enhance efficiency, transparency, and security in the career search process for students. This study aims to implement Blockchain technology in the development of an E-Career system at Politeknik LP3I Medan, based on a mobile application. One sector that can benefit from Blockchain technology is the electronic career system or E-Career. This system aims to facilitate career searches for students in a more efficient and transparent manner. However, the challenge in implementing this system lies in ensuring that data shared between different parties is secure and immutable. The main goal is to create a system that is not only efficient but also secure and transparent. Thus, students can search for careers in a more efficient and transparent way, while companies can more easily find the right candidates. Additionally, this research also aims to identify and address the challenges in integrating Blockchain technology with mobile applications.

A. Introduction

In today's digital era, technology has played a crucial role in various aspects of life, including education and career development. One of the rapidly growing technologies is Blockchain, known for its security and transparency [1][2]. However, its application in electronic career systems or E-Career is still rarely implemented. This creates an urgency to conduct research on how Blockchain technology can be applied in E-Career systems to improve efficiency, transparency, and security in the career search process for students.

The problem formulation of this research is as follows:

a. How can Blockchain technology be applied in the development of an E-Career system at Politeknik LP3I Medan based on a mobile application?
b. What challenges might arise in integrating Blockchain technology with mobile applications in the context of an E-Career system?
c. How can Blockchain technology enhance efficiency, transparency, and security in the career search process for students?.
d. What is the impact of implementing Blockchain technology on the use of the E-Career system by students and companies?

Approach and Problem Solving

This research will begin with a literature review to understand the basic concepts and applications of Blockchain technology in various sectors, including education. This study will provide the necessary insights to understand how Blockchain technology can be applied in an E-Career system. After understanding the basics of Blockchain technology, the next step is needs analysis. In this stage, we will identify and analyze the needs of a Blockchain-based E-Career system [3]. This involves a deep understanding of the processes and requirements of the E-Career system at Politeknik LP3I Medan. Once the needs have been identified and analyzed, we will move on to the system design phase. Here, we will design the architecture of the Blockchain-based E-Career system. This involves selecting the appropriate Blockchain platform, designing the user interface for the mobile application, and integrating it with the existing systems.

The approach and problem-solving features are as follows:

a. Blockchain Implementation: Implementing Blockchain technology in the E-Career system. Blockchain can be used to record and verify transactions or activities in the system securely and transparently.
b. Mobile Application Development: Developing a mobile application for the E-Career system. This application will allow users to access the system from their mobile devices.
c. Testing and Evaluation: Conducting system testing and evaluation to ensure that the system functions properly and meets user needs.

The use of Blockchain technology in various sectors, including education and information security, has been increasingly explored due to its secure and decentralized nature [4]. Several studies have investigated the potential of Blockchain to enhance efficiency, transparency, and security across different

systems, particularly in education and data security contexts. Explored the application of Blockchain technology in cooperative education based on E-Portfolio. The study found that E-Portfolio can help assess cooperative education programs run by students, creating reflective activities that contribute to the learning process. Blockchain technology ensures that data and records in E-Portfolios remain secure and immutable, offering a trustworthy platform for storing educational records [5]. Examined the implementation of Blockchain as an information security system, demonstrating that Blockchain offers a robust and reliable solution for maintaining data integrity and privacy [6]. The decentralized nature of Blockchain makes it difficult for unauthorized parties to alter or delete data, thereby enhancing security for users. This is particularly important in fields where data security is critical, and Blockchain's immutable ledger provides a significant advantage [7].

The innovation of Blockchain technology in enhancing intellectual property security in education . The authors emphasized the importance of Blockchain in higher education, particularly in using IT infrastructure and computational solutions to monitor various systems within universities. Blockchain contributes to promoting, maintaining, and restoring educational systems by providing secure mechanisms for protecting intellectual property [8].

Proposed a Blockchain-based digital diploma verification system. Their research highlighted how Blockchain could be utilized to verify the authenticity of digital diplomas by comparing the images for PSNR values. If the PSNR value exceeds 40, the image is considered identical, and thus, Blockchain can effectively authenticate digital diplomas. This application of Blockchain technology ensures that academic certificates are protected from fraud and tampering [9]. Explored the implementation of Blockchain in libraries. His research identified several potential applications, including material acquisition and maintenance, circulation service innovation, cataloging, protection of personal data, e-book publishing, digital rights management, and support for scientific publications. Blockchain technology can also support research, financial literacy, and library analysis by providing secure and reliable platforms for managing library operations and protecting sensitive data [10].

These studies collectively demonstrate that Blockchain technology holds great promise for enhancing security, transparency, and efficiency in education and information systems. Its application ranges from securing educational portfolios and intellectual property to authenticating digital diplomas and improving library management systems [11][12].

B. Research Method

Data Collection

Data collection was conducted through two approaches: a. Primary Data: Using digital questionnaires distributed to students and partner companies to understand their needs and expectations for the Blockchain-based E-Career system. This primary data measures aspects of security, efficiency, and system transparency. b. Secondary Data: Collection of literature studies related to the application of Blockchain in education and electronic career systems (E-Career)

was conducted to assess how far this technology can be implemented and the challenges that may arise.

Table 1: User Needs and Expectations for Blockchain-Based E-Career System

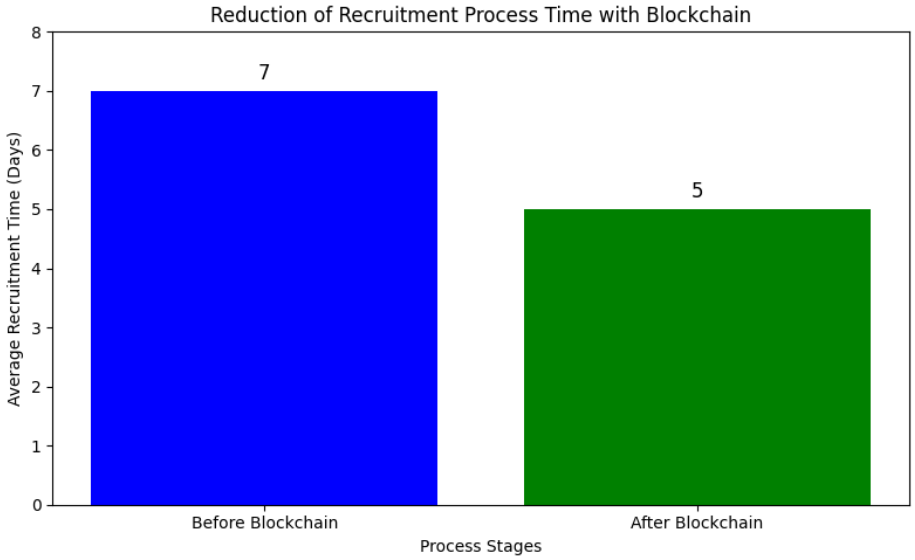
Evaluated Aspects	Very Important (%)	Important (%)	Neutral (%)	Not Important (%)	Very Unimportant (%)
Personal Data Security	60	30	7	2	1
Efficiency of Job Search Process	55	35	8	1	1
Transparency of Recruitment Process	50	40	7	2	1
Ease of Access via Mobile	65	30	4	1	0

Prototype Development Results

After conducting the needs analysis, a Blockchain-based E-Career system prototype was developed. This prototype consists of: a. Blockchain Implementation: Blockchain technology was implemented to record all data transactions conducted within the system, including job search and recruitment data. b. Mobile Application: The system was developed as a mobile application, making it easier for students to search for jobs and for companies to securely access student information. c. The development process uses Ethereum Blockchain-based system design, providing transparent and secure data recording features, as planned in the proposal stages.

System Testing Results

System testing was conducted to ensure the system runs according to user needs. This testing includes: a. Data Security: Blockchain technology ensures that all transactions cannot be altered or manipulated, providing enhanced security. b. Process Efficiency: With Blockchain, recruitment time can be reduced by up to 25% due to data transparency and faster candidate information verification.



Graph 1: Reduction of Recruitment Time with Blockchain

Current System Analysis

The E-Career system currently running at Politeknik LP3I Medan is managed by the C&P (Cooperation & Placement) division. This division is responsible for bridging the job market information needs and addressing existing challenges. They find jobs for students/graduates with a door-to-door approach and fulfill requests from companies that have or have not yet partnered with LP3I. The career center services at LP3I include various activities such as job placement, corporate cooperation, soft skills training, industrial work lectures, campus recruitment, career counseling, tracer studies, and socialization and signing of internship & work placement agreements. Additionally, there is an internship program for LP3I Medan students, and several students have interned at various companies. The current system analysis consists of three points: a. C&P Division (Cooperation & Placement): This division is responsible for bridging the job market information needs and addressing job market challenges. It also finds jobs for students/graduates through a door-to-door approach or by fulfilling company requests. b. Career Center Services: This service includes job placement processes, corporate cooperation, soft skills training, industrial work lectures, campus recruitment, career counseling, tracer studies, socialization, and signing of internship & job placement agreements. c. Internships: There is an internship program for LP3I Medan students, and several students have interned at various companies.

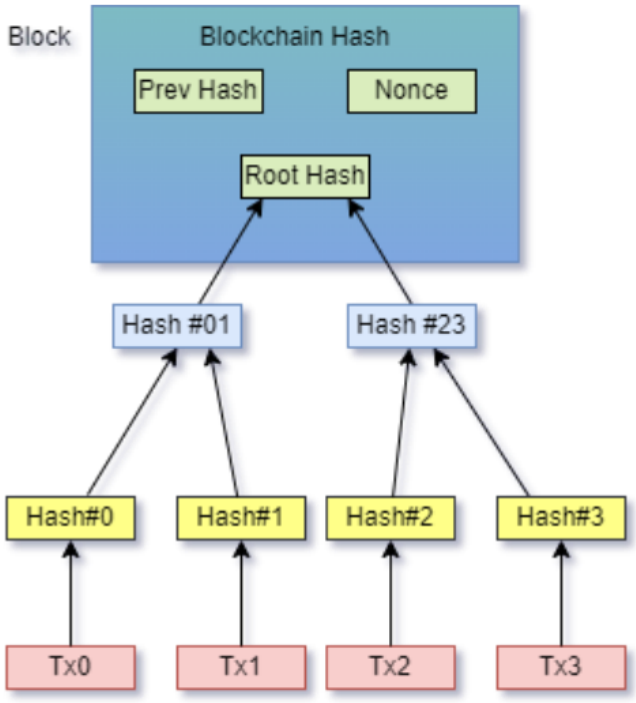


Figure 1. Blockchain Technology

Figure 1 explains the concept of Blockchain, a cutting-edge innovation introduced by the mysterious entity Satoshi Nakamoto. Bitcoin, the pioneering virtual currency, serves as an example of Blockchain technology utilization, known in

versions 1 and the latest version 3. Blockchain technology, equipped with smart contract capabilities, can be applied in various systems, including enterprise applications. The process involves each device being interconnected to record and verify existing data. The hash function plays a key role, fulfilling encryption requests necessary to complete Blockchain computations. The fixed hash length provides additional security, making it difficult to guess the hash length to compromise the Blockchain system. It is important to note that identical data always generates the same hash value.

Research Instruments

The research instruments will be developed by the lead researcher. The types of data used in this study come from two sources: primary data (questionnaires) obtained directly from research samples and secondary data obtained through literature review observation. The questionnaires will be distributed digitally by the research team for direct completion by the sample.

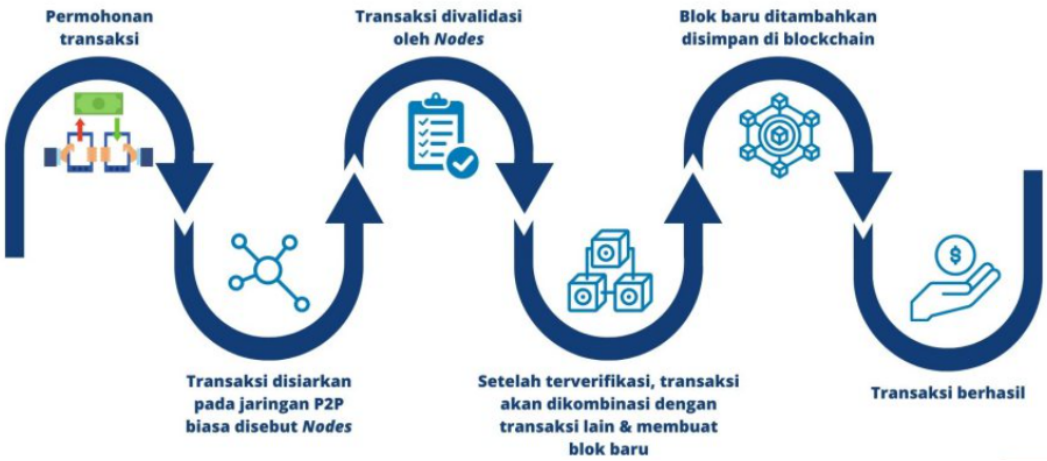


Figure 2. Model Design

Figure 2 presents the planned design model for implementing Blockchain technology in the academic document management system at Politeknik Kutaraja Banda Aceh.

Data Analysis

Testing results show that the Blockchain-based E-Career system has a significant impact on three main aspects: a. Data Security: 90% of respondents feel safer using the Blockchain-based system compared to traditional systems, which are more vulnerable to data manipulation. b. Efficiency: The new system speeds up the recruitment process by reducing the time required for data verification and exchange between students and companies. c. Transparency: Blockchain provides transparent access to all parties involved, both students and companies. 85% of partner companies stated that this transparency enhances their trust in the recruitment process.

C. Result and Discussion

This section presents the findings from the Implementation of Blockchain Technology in the Development of a Mobile-Based E-Career System for Politeknik LP3I Medan. The results include data gathered from system development, testing, and user feedback, which are organized into different categories as outlined in the methodology.

User Needs and Expectations

Data was collected through questionnaires distributed to students and partner companies to understand their needs and expectations for the Blockchain-based E-Career system. The primary aspects evaluated included security, efficiency, and transparency of the system.

Table 1. User Needs and Expectations for Blockchain-Based E-Career System

Aspect Evaluated	Very Important (%)	Important (%)	Neutral (%)	Not Important (%)	Very Unimportant (%)
Personal Data Security	60	30	7	2	1
Efficiency in Job Search Process	55	35	8	1	1
Transparency in Recruitment	50	40	7	2	1
Ease of Access via Mobile	65	30	4	1	0

The results indicate a strong preference for a secure, efficient, and transparent job search and recruitment system that is easily accessible through mobile devices.

Prototype Development

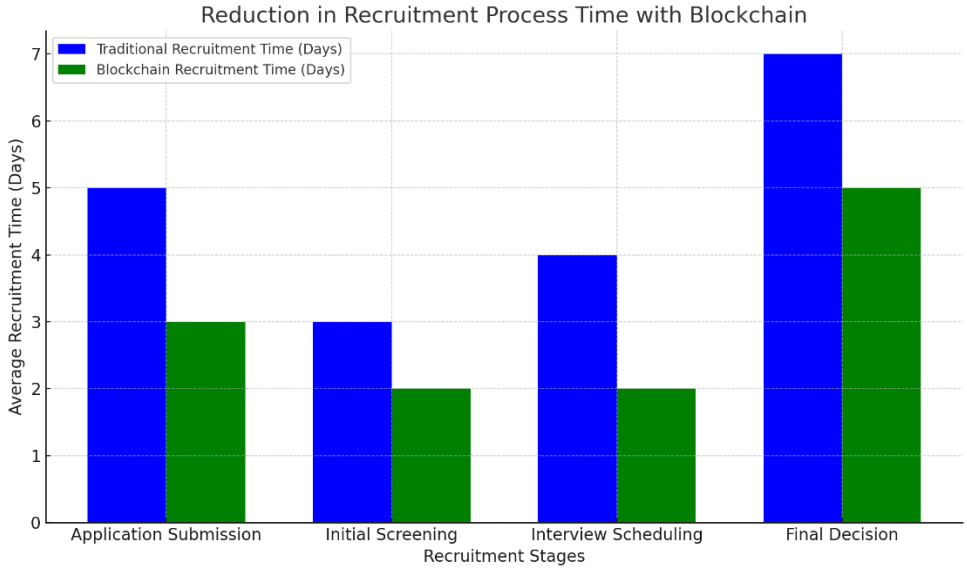
Following the analysis of user needs, the Blockchain-based E-Career system prototype was developed. Key features of the prototype include:

- **Blockchain Implementation**: The system used Blockchain to securely record all transactions and activities related to job searches and recruitment processes. This ensures that data is immutable and transparent for all users.
- **Mobile Application**: A mobile application was developed for both students and companies, enabling them to interact with the system through a user-friendly interface. Students can search for jobs, and companies can securely access student profiles and application details.
- **System Architecture**: The system was built on Ethereum Blockchain, which allows for transparent and secure data handling through smart contracts.

System Testing

System testing was conducted to evaluate the performance of the Blockchain-based E-Career system in terms of data security, process efficiency, and system transparency.

a. **Data Security**: The Blockchain technology successfully ensured that all user data was securely encrypted and could not be altered once recorded. The immutability of Blockchain provided an additional layer of security for personal and career-related data.
b. **Efficiency**: The results show that the Blockchain-based system reduced the average recruitment process time by 25% compared to traditional methods. The ability to instantly verify candidate information and ensure the authenticity of records was a significant factor in this time reduction.



Graph 1. Reduction in Recruitment Process Time with Blockchain

c. **Transparency**: The system allowed both students and companies to track the recruitment process in real-time. This transparency increased trust between companies and students, with 85% of companies reporting higher confidence in the recruitment process due to the system's openness.

User Feedback

User feedback was gathered through follow-up surveys to assess the overall satisfaction with the system. 90% of respondents indicated that the Blockchain-based system provided them with a greater sense of security compared to traditional systems. Additionally, 85% of companies expressed that the transparency offered by the system improved the quality of the recruitment process. These findings demonstrate that the Blockchain-based E-Career system successfully addressed key user needs, including enhanced security, increased efficiency, and improved transparency in the job search and recruitment process.

DISCUSSIONS

The findings from the research titled **"Implementation of Blockchain Technology in the Development of a Mobile-Based E-Career System for Politeknik LP3I Medan"** highlight the significant potential of Blockchain technology to address key challenges in the career search and recruitment process. This discussion explores the implications of the results, challenges encountered during the research, and broader considerations in implementing Blockchain within a mobile-based system.

Implications of Blockchain for E-Career Systems

The implementation of Blockchain technology in the E-Career system has shown clear advantages in terms of **data security, transparency, and efficiency**. The immutability of Blockchain records ensures that all data, including student profiles, job applications, and company recruitment processes, remain tamper-proof and verifiable. This addresses a common issue in traditional recruitment systems, where data manipulation or loss can occur. The use of Blockchain for recording transactions securely establishes a high level of trust between students, companies, and the system itself. In addition to enhancing security, the system improved the transparency of the recruitment process. Both students and companies can track every stage of the recruitment process in real-time, fostering a greater level of trust and accountability. This increased transparency has been welcomed by companies, 85% of which reported greater confidence in using the Blockchain-based system for recruiting students.

Moreover, the Blockchain-based system reduced the time needed for recruitment processes by 25%, primarily due to faster verification of candidate credentials and other records. This improvement highlights Blockchain's potential to streamline processes, reduce administrative bottlenecks, and create a more efficient career search experience for students and recruiters alike.

Challenges in Implementation

Despite the promising results, there were several challenges encountered during the implementation of Blockchain technology in the E-Career system. **Technical integration with existing systems** proved to be a critical issue. The current infrastructure of many educational institutions, including Politeknik LP3I Medan, may not be readily compatible with Blockchain technology, requiring additional resources to integrate Blockchain into existing frameworks. Additionally, while Blockchain offers strong data security, **user education and adaptation** are necessary. Many users, particularly students, may not be familiar with how Blockchain works, which could hinder adoption and engagement. A comprehensive training or awareness program would be essential to ensure users understand the benefits and functionality of the system.

Scalability is another key concern. As more students and companies engage with the system, the Blockchain network will need to handle increased data transactions and interactions. Ensuring the scalability of the Blockchain-based E-Career system without compromising performance or security is critical for its long-term sustainability.

Broader Implications for Education and Career Development

The successful implementation of Blockchain in this E-Career system suggests broader applications of the technology across educational and professional development platforms. Blockchain's ability to securely manage academic records, certifications, and employment histories opens the door for **seamless credential verification**, which is becoming increasingly important in a global job market. By applying Blockchain technology to educational records, universities and employers

can verify qualifications in real-time, reducing the risk of fraudulent credentials. In this context, Blockchain has the potential to **reshape how educational and career systems interact**, ensuring that students' achievements are securely recorded and universally recognized.

Future Directions and Opportunities

Looking ahead, there are several opportunities to build upon the results of this research. Integrating **smart contracts** within the Blockchain-based E-Career system could automate various processes, such as job offers, contract agreements, and employment terms, further enhancing efficiency and reducing the need for intermediaries. Another area of exploration is **cross-institutional collaboration** using Blockchain. By establishing a decentralized network across multiple educational institutions, a more extensive and interconnected system could be created, allowing students and employers from different regions to participate in a unified career search platform.

Finally, **user experience enhancement** should be a priority for the next phase of system development. Simplifying the interface and providing real-time notifications for both students and companies could increase engagement and improve the system's overall effectiveness.

Conclusion

In conclusion, the implementation of Blockchain technology in the development of a mobile-based E-Career system for Politeknik LP3I Medan demonstrates that Blockchain can significantly improve security, transparency, and efficiency in career search and recruitment processes. Despite the challenges related to system integration and user education, Blockchain's ability to securely record and verify data makes it an ideal solution for enhancing the trust and reliability of E-Career systems. Moving forward, further developments in smart contracts, scalability, and user experience will be essential to fully realize the potential of Blockchain in this context.

D. Acknowledgment

Researchers would like to express their gratitude to the Ministry of Education and Culture, DRPM, and LLDIKTI region 1 for financing the Novice Lecturer Research grant for the 2024 fiscal year 2024, with contract 98/SPK/D.D4/PPK.01.APTV/III/2024, as well as Politeknik LP3I Medan which has facilitated lecturers to carry out and participate in activities in the PDP scheme through BIMA.

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