P-ISSN: 2808-0831
E-ISSN: 2808-0009

Farming Performance can be Estimated using Blockchain Technology

Milenia Ramadona[1], **Rianda Abzie**[2], **Muhammad Luki Alamsyah**[3], **Yunando Tenario Putra**[4]
Technical Information, University of Raharja[1]
Information Systems, University of Raharja[2,3,4]
Modern, Jl. Jenderal Sudirman No.40, RT.002/RW.006, Cikokol, Kec. Tangerang,Kota Tangerang, Banten 15117
Indonesia
e-mail: milenia@raharja.info, rianda@raharja.info, luki.alamsyah@raharja.info, yunando@raharja.info

Author Notification
25 July 2022
Final Revised
28 July 2022
Published
29 July 2022

Ramadona, M., Abzie, R., Alamsyah, M. L., & Putra, Y. T. (2022). Farming Performance can be Estimated using Blockchain Technology. Blockchain Frontier Technology, 2(1), 58–63. **DOI:** https://doi.org/10.34306/bfront.v2i1.112

Abstract

On a wireless blockchain-based network, a sustainable smart farm with noise signal or noise signal with the ratio (SIR/SNR) to be employed as the optimal relay has already been addressed. During the uninterrupted selection of the optimal relay performance, the transmission success rate (TRS), overall communication throughput (OCT), power splitting relaying (PSR), and time switching relay (TSR) are also output. As the number of potential relay nodes increases, the performance of TRS, OCT, PSR, and TSR all improve. Numerical simulations were used to verify the validity of the theoretical values' strength.

Keywords: *Blockchain, Time switching relay, Relaying, Wireless sensor network, Communication, Sustainable farming*

1. Introduction

The goal of next-generation accounting and storage is accomplished in a way that ensures next-generation blockchain technology. Data security on the blockchain is highly protected due to its decentralized characteristics which make it difficult to tamper with the information that is being stored properly[1]. When there are anonymous participants involved, transactions are able to be tracked in a way trusted by blockchain technology.This technology offers optimal solutions and transparency in terms of food safety and quality-related issues. Blockchain provides dispersed management in scenarios like unmanned agriculture and wastelands, where a central authority is not required for the efficient management of transfers and payments. Blockchain technology, specifically Decode and Forward (DF), is used to allow wireless networks.The frequently used Nakagami-m, Rice and Rayleigh channels pose a variety of challenges when modeling the complex farming environment and channel conditions. In addition there is the unclear performance of DF relays for smart farming as using a wireless network compliant with blockchain technology is a challenge[2].

In order to provide sensor nodes and relay with a specified amount of power storage, a wireless sensor network needs an external charging method[3]. In a wireless network compliant with blockchain technology for sustainable smart agriculture. transmission success rate (TRS), Overall communication throughput (OCT), power splitting relaying (PSR), and switching relaying time (TSR), the most Significant metrics on blockchain technology-facilitated wireless networks were investigated[4]. Closed expressions for TRS,

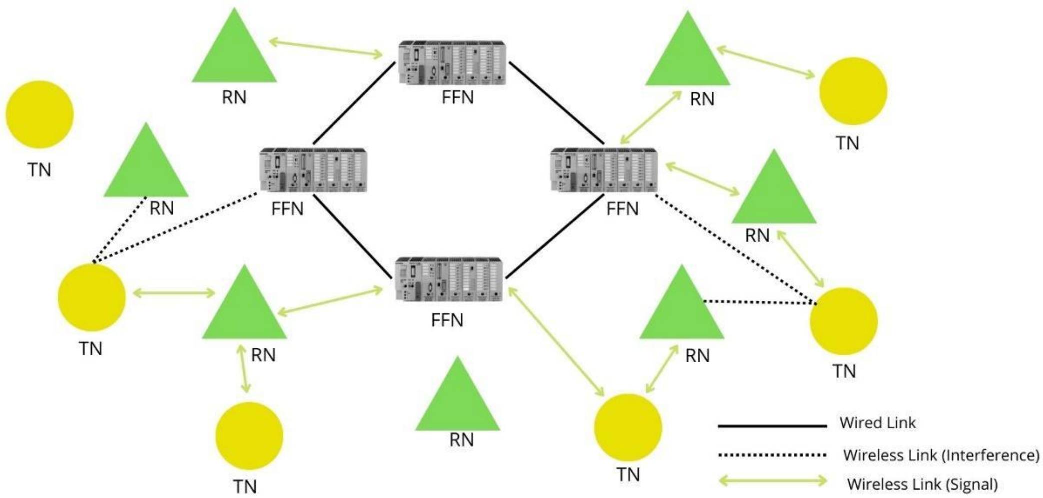
P-ISSN: 2808-0831
E-ISSN: 2808-0009

OCT, PSR, and TSR are lowered when Relationships between network parameters and performance metrics were examined[5].

2. Research Method

Figure 1 depicts the planned wireless network for a sustainable smart farm that uses blockchain technology. There are many nodes available on the network, including fully functional nodes (FFN), relay nodes (RN), and transaction nodes (TNs)[6]. Transaction nodes are often low power, normally low cost sensor nodes that can support blockchain transactions, such as solar energy charging stacks, smart electricity meters, and smart water meters. When agricultural applications employ TN, general information and sums are used to generate transactions. It's crucial to send the transactions produced by the wireless link to the FFN before running a new block for transactions[7].

Due to the low transmit power of TN, it is impractical and ineffective for TN to broadcast to FFN directly. Utilizing blockchain technology, it is possible to foresee implementation flaws in sustainable smart agriculture by using an inactive TN or pre-set network RN[8]. With the use of RN, transaction transfer from TN to RN is accomplished. From RN, the transaction is subsequently transmitted to FFN. In addition to transaction signals, interference signals can also be received by FFN and TN recipients when many transactions take place at once. Wired links are used to notify other FFNs of successful transaction acceptance by FFNs for acceptance approval and storage in the block. Reports that can be received by the RN are decoded and transmitted to the FFN after modulation in the DF RN



mode and carried out flexibility[9].

Gambar 1. An architecture for wireless networks for sustainable smart farming is proposed

$$RS_{RN}=\sqrt{P_{TN}C_1TS_{TN}}+N_{RN} \text{ -------- } (1)$$

when there are no interruptions. A P_{TN} is a service N_{RN} transmitted by an involved TN. Is the signal sent by the associated TN, TSRN is the noise picked up at the RN, and C_1 is the signal. the conduit connecting TN and RN. Additionally, the FFN received signal is expressed in the manner as follows[10]. The following equation

$$RS_{FFN}=\sqrt{P_{RN}\,C_2 T P_{RN}}\;+N_{FFN} \text{ -------- } (2)$$

If the transmit power of RN is represented by TP_{RN}, the transmit channel between FFN and RN is represented by C_2, the noise received by FFN is represented by N_{FFN}, and the signal received by FFN is represented by RS_{FFN}. The following equations can be used to determine the SNR values of RN and FFN using the normalized values of TS_{TN} and TP_{RN}[11].

$$SNR_{RN} = \frac{P_{TN|C_1|^2}}{\delta^2_{RN}} \text{ ------ } (3)$$

$$SNR_{FFN} = \frac{P_{RN|C_2|^2}}{\delta^2_{FFN}} \text{ ------ } (4)$$

As shown here, the signal-to-noise ratio at RN and FFN is SNR_{RN} and SNR_{FN}. Respectively. The noise variance in RN and FFN is expressed as δ^2_{RN} and δ^2_{FFN}, respectively[12]. Taking into account the threshold t,

$$TRS = Pr\ \{\ SINR > t\} \text{ ------}(5)$$

$$OCT = LMPr\ \{\ SINR > t\} \text{ ------}(6)$$

where L is the size of the transaction and M is the total number of transactions that were executed[13].

2.1 Literature Review

With the rapid advancement of information and communication technology, smart sensors, smart farm equipment, and other smart gadgets have considerably increased the productivity and sustainability of agricultural production processes. Further advancements in smart farming are possible with smarter models and systems[14]. The pursuit of quality assurance, data integrity, record management, etc. is being taken into consideration for the integration of blockchain and smart farming systems due to the characteristics of blockchain technology. Many scholars from both the academic and industrial worlds have recently been interested in it[15]. The functional framework of blockchain-based smart agricultural systems is made up of sensors and low-power IoT devices. The system is maintained in an eco-friendly, transparent, self-organized, and trustworthy manner and leverages IoT-based blockchain to improve food traceability.Certification based on blockchain technology is implemented in real-time scenarios to safely track grain quality. Throughout the produce supply chain, soy traceability and tracking is efficiently performed through Ethereum's blockchain-based business transactions. Smart contract[16].

Responding to the growing demand for direct communication between blockchains is a challenge. Inadequate communication model and traditional cellular nodes and smart devices Rural systems with inadequate coverage]. Smart farming system. To solve this problem, we need to integrate it into a flexible transmission method[17]. backed relays both the distance and the quality of the transmission By putting the received signal through a relay, it can be improved. There are many different relay mechanisms available, including compress and transfer, decode and transfer, amplification and transfer, and others. This objective. The DF relay model is compatible with the original transmission mode. It will be a simple solution to deploy. Using linear complexity to calculate multicast capacity. Approximate with algorithm while analyzing 2-hop DF relay system Its multicast capacity]. Partial encodings for Cover-ElGamal and Marton encodings Combined to provide a distributed DF scheme for the forwarding channels of the three nodes under[18]. Nakagami m Fading Channel, DF Relay Cognitive Network and Their Performance Confidentiality is analyzed. For multi-carrier, full-duplex, double-hope directional finding relay systems. As a characteristic, a power allocation model was considered in which the DF model for each group and for the entire carrier was used[19].

3. Findings

For the purpose of evaluating the effectiveness of proposed wireless networks including blockchain technology for sustainable smart farming, OCT, PSR, TSR, and TRS scores are estimated. The overall communication throughput needed for blockchain transaction transmissions is provided by OCT, while the likelihood of a successful transmission is provided by TRS[20]. OCT and TRS values can be obtained using thresholds. The performance of the model is validated and examined using numerical simulations of various performance factors. demonstrates the signal-to-noise ratio's cumulative distribution function in the absence of interference. When there is interference between different channel delivery settings, this value is likewise estimated[21].

With different channel distribution settings and RN numbers, the performance of the DF relay network relative to TRS performance in the absence of interference is also simulated[22]. The TRS will function much better if a model that chooses the best relay is used. The simulation curve and the analytical curve perfectly match each other. OCT comparisons between several RNs in a DF relay network with blockchain technology activated in the presence of interference. This graphic demonstrates how a large number of RNs may be utilized to achieve considerably faster and maximal OCT as SNR transmission increases. Multiple RNs may be signaled at once. Relay selection necessitates SIR maximization[23].

Performance of the DF relay network in comparison to TRS performance when there is interference but no signal-to-noise ratio. If there are several RNs willing to relay the signal, you can transmit by choosing the most likely RN. The SINR value is influenced by the coefficients for OCT, PSR, TSR, and TRS. In the absence of interference at the RN, the SNR and SNIR are identical to one another. The best RN can be chosen using the greatest end-to-end SNR as a criterion[24].

4. Conclusion

This article suggests a blockchain-based wireless network-based sustainable smart farming system. By increasing the SIR or SNR value for selecting the best relay end-to-end, this enhances performance. The relationship between performance metrics and network parameters is mathematically analyzed and modeled to derive OCT, PSR, TSR, and TRS closed equations. The findings indicate that as the number of relay nodes rises, OCT and TRS performance do as well. By using numerical simulation, the theoretical concept's accuracy is confirmed. Future research will concentrate on real-time value analysis in a regulated smart agricultural environment.

References

[1] M. N. M. Bhutta *et al.*, "A survey on blockchain technology: evolution, architecture and security," *IEEE Access*, vol. 9, pp. 61048–61073, 2021.
[2] J. Golosova and A. Romanovs, "The advantages and disadvantages of the blockchain technology," in *2018 IEEE 6th workshop on advances in information, electronic and electrical engineering (AIEEE)*, 2018, pp. 1–6.
[3] S. Saberi, M. Kouhizadeh, J. Sarkis, and L. Shen, "Blockchain technology and its relationships to sustainable supply chain management," *International Journal of Production Research*, vol. 57, no. 7, pp. 2117–2135, 2019.
[4] M. Andoni *et al.*, "Blockchain technology in the energy sector: A systematic review of challenges and opportunities," *Renewable and sustainable energy reviews*, vol. 100, pp. 143–174, 2019.
[5] E. Tijan, S. Aksentijević, K. Ivanić, and M. Jardas, "Blockchain technology implementation in logistics," *Sustainability*, vol. 11, no. 4, p. 1185, 2019.
[6] H.-N. Dai, Z. Zheng, and Y. Zhang, "Blockchain for Internet of Things: A survey," *IEEE Internet of Things Journal*, vol. 6, no. 5, pp. 8076–8094, 2019.
[7] M. A. Ferrag, M. Derdour, M. Mukherjee, A. Derhab, L. Maglaras, and H. Janicke, "Blockchain technologies for the internet of things: Research issues and challenges," *IEEE Internet of Things Journal*, vol. 6, no. 2, pp. 2188–2204, 2018.
[8] Y. P. Tsang, C.-H. Wu, W. H. Ip, and W.-L. Shiau, "Exploring the intellectual cores of the blockchain–Internet of Things (BIoT)," *Journal of Enterprise Information Management*, 2021.
[9] W. Zheng, Z. Zheng, X. Chen, K. Dai, P. Li, and R. Chen, "NutBaaS: a blockchain-as-a-service platform," *Ieee Access*, vol. 7, pp. 134422–134433, 2019.
[10] A. Shahnaz, U. Qamar, and A. Khalid, "NutBaaS: a blockchain-as-a-service platform," *IEEE Access*, vol. 7, pp. 147782–147795, 2019.
[11] R. Zhang, R. Xue, and L. Liu, "Security and privacy on blockchain," *ACM Computing Surveys (CSUR)*, vol. 52, no. 3, pp. 1–34, 2019.
[12] U. Bodkhe *et al.*, "Blockchain for industry 4.0: A comprehensive review," *IEEE Access*, vol. 8, pp. 79764–79800, 2020.
[13] A. A. Monrat, O. Schelén, and K. Andersson, "A survey of blockchain from the perspectives of applications, challenges, and opportunities," *IEEE Access*, vol. 7, pp. 117134–117151, 2019.
[14] S. Saurabh and K. Dey, "Blockchain technology adoption, architecture, and sustainable agri-food supply chains," *Journal of Cleaner Production*, vol. 284, p. 124731, 2021.
[15] M. K. Lim, Y. Li, C. Wang, and M.-L. Tseng, "A literature review of blockchain technology applications in supply chains: A comprehensive analysis of themes, methodologies and industries," *Computers & Industrial Engineering*, vol. 154, p. 107133, 2021.
[16] J. Xie *et al.*, "A survey of blockchain technology applied to smart cities: Research issues and challenges," *IEEE Communications Surveys & Tutorials*, vol. 21, no. 3, pp. 2794–2830, 2019.
[17] X. Pan, X. Pan, M. Song, B. Ai, and Y. Ming, "Blockchain technology and enterprise operational capabilities: An empirical test," *International Journal of Information Management*, vol. 52, p. 101946, 2020.
[18] H. Feng, X. Wang, Y. Duan, J. Zhang, and X. Zhang, "Applying blockchain technology to improve agri-food traceability: A review of development methods, benefits and challenges," *Journal of cleaner production*, vol. 260, p. 121031, 2020.
[19] P. Garg, B. Gupta, A. K. Chauhan, U. Sivarajah, S. Gupta, and S. Modgil, "Measuring the perceived benefits of implementing blockchain technology in the banking sector," *Technological forecasting and social change*, vol. 163, p. 120407, 2021.

[20] A. Esmat, M. de Vos, Y. Ghiassi-Farrokhfal, P. Palensky, and D. Epema, “A novel decentralized platform for peer-to-peer energy trading market with blockchain technology,” *Applied Energy*, vol. 282, p. 116123, 2021.
[21] H. Sun, X. Wang, and X. Wang, “Application of blockchain technology in online education.,” *International Journal of Emerging Technologies in Learning*, vol. 13, no. 10, 2018.
[22] R. L. Rana, C. Tricase, and L. De Cesare, “Blockchain technology for a sustainable agri-food supply chain,” *British Food Journal*, 2021.
[23] H. Albayati, S. K. Kim, and J. J. Rho, “Accepting financial transactions using blockchain technology and cryptocurrency: A customer perspective approach,” *Technology in Society*, vol. 62, p. 101320, 2020.
[24] M. Warkentin and C. Orgeron, “Using the security triad to assess blockchain technology in public sector applications,” *International Journal of Information Management*, vol. 52, p. 102090, 2020.