Fund Tracing using Blockchain for Multinational Corporations and Businesses

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Abstract— **Blockchain is one of the underlying technologies which is an open and distributed ledger that efficiently, verifiable, and permanent records of transactions between two parties. It can be used to store data on cryptocurrency exchanges or even anything that needs to be secure and transparent. It is a decentralized database containing blocks of data that are cryptographically linked together and stored on each computer or node (computer connected to the network) that contains a complete copy of the blockchain.**

Often, when a project receives funds, it is not known how the funds were used, and many of those transactions never appear on file due to poor resource management. To solve this problem, a system has been proposed that uses Blockchain to provide transparency. This article also describes a prototype developed using Blockchain delegation, it then discusses the future development of this prototype and, finally concludes on the applicability of Blockchain.

Keywords— Blockchain, Distributed Databases, Proof of Work, Transparency

I. INTRODUCTION

The Blockchain system initiates transactions by placing them in groups called blocks and then linking these blocks through what is called Blockchain. The transactions in blockchain represented as individual blocks are said to be taking place at the same time. These blocks are linked to each other (like a chain) in a proper linear, chronological order with every block containing the hash of the previous block, each block will be accepted in the blockchain provided it contains "proof of work"—node generating a block needs to prove that it has put enough computing resources. The "proof of work" consists of a "nonce" when hashed with previous transactions or the genesis block and the hash block generates a hash with a leading zero. The average effort required is exponential with the number of zero bits required but the verification process is simple and can be done by running a single hash function.

It is difficult to grant resources and control them across multiple organizations. This is especially true for a large-scale dynamic system. One of the main problems of such a system is to provide secure access control. In particular, the transfer of an entity's access rights to another item safely, flexibly, and precisely. In this project report, we present a cross-organizational authorization framework using blockchain. Our solution is built on the blockchain concept of smart contracts to define a communication channel and grant and control funds between businesses. We show the feasibility of our solution in a real scenario using the grant of credits within a multi-level organizational framework. Our results show that the proposed system is effective and can be used for businesses and organizations, even scalable across the government entities with a shared blockchain with complex access control rules. It also brings more transparency to authorization access and control over the transaction of credits in the organization.

Blockchain technology can be used to build applications where multiple parties can transact directly through a peer-to-peer network without a central authority verifying the transaction. Each participant in the network has access to a shared ledger that records all transactions cryptographically and immutably, and there is no single owner of the network.

A. Problem Statement and interpretation of the solution

In a business is necessary to perform multiple operations with a limited number of operational resources. These manipulations are visible in everyday life. The problem can be described as the Distribution of finite indivisible objects between a finite number of agents or processes resulting in poor fund tracing. This can be seen in the budgeting allocation of funds. In this case, the improved system performance is highly desirable, but the complexity involved in resource granting and tracing can become very difficult.

Blockchain technology has the potential to deal with these problems associated overcome the restrictions of fund tracing mechanisms in a very economical and fine-grained way. The distributed platform of blockchain permits a lucid balance of power wherever no taking part entity has sole control of the system, this implies that the parties should reach an agreement on any additions, deletions, or updates to the contract and therefore the payments for every transaction. This creates a balanced atmosphere for the business enterprises through a web

application where tracing and demand are dynamic. In addition, blockchain as a base delivers new opportunities by providing distributed storage and process framework, which ultimately ends up in the distributed database and provides secure and safe facilities for transparency, audit, and efficiency. In addition, the utilization of blockchain as a platform presents new opportunities by providing a distributed database and immutability framework for efficiency, secure and personal interactions can be set dynamically whereas it inherits the properties of the blockchain.

II. PROPOSED SYSTEM

In this section, we have elaborated on (i) features of the proposed system (ii) contributions of the system, and the solution to the problem statement (iii) system requirements (iv) User interface, (v) Server-side of the web application and (vi) working process of the proposed system:
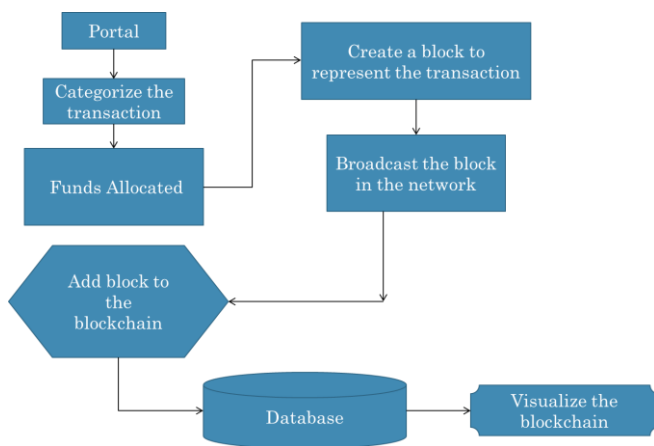

Fig. 1. Workflow of the web application

With blockchain, the transactions are tracked and documented updates to a single shared ledger, which provides complete data visibility and a single source of truth. Because transactions are always time-stamped and up to date, businesses can query a payment status at any point in time. This helps to combat issues like compliance violations, delays, and waste. In addition, immediate action can be taken during emergencies and regulatory warnings are ensured by the ledger audit trail. Moreover, combining blockchain with finance makes it easy in tracing the status of the transaction.

A. Features of the proposed system

We take advantage of blockchain to offer granulated decentralized administration of resource grants and traces within a business establishment. It also features a business-centric ecosystem catered to other blockchain entities in various disciplines. The various aspects of the proposed system are as follows:

- A web application to bid the interface for the officials and the employees to achieve decentralization.
- To achieve a three-dimensional graphical database to model blocks by detouring conventional ledgers and provide a visual aid for laymen.
- To obtain immutability, tamper-proof and fault-tolerant application to represent the transactions.
- Develop a system to provide transparency for the employee.

B. Contributions

The main contributions of the proposed system can be summarized as follows:

- Enhanced protection for monetary data: Blockchain's function as an enhancement for administrators is described by its security capabilities. Blockchain has been confirmed to be very powerful for software program protection and threat management. Blockchain implementations can assist and save financial data theft of sensitive monetary records. Admittance to the network is restricted.

- Streamline payroll and expense tracking: Blockchain can update manual work and eliminate latency in contemporary payroll systems. Smart contracts help businesses to validate and regulate their transactions. These contracts may be designed so that, as soon as the transaction is initiated, the system relies absolutely on those codes. It additionally cannot be modified except for the phrases of the settlement that want to be updated. Real-time, blockchain system assists trace invoices and facilitates the distribution, and transparency of transactions.

C. System requirements

These are the tools that need to be installed to run the web application.

Ganache   v2.5.4
Node.js   v10.19.0
Meta Mask   v9.5.4
Truffle   v4.0.8 (core: 4.0.7)
Neo4j Database   v4.4.6
Web Browser

D. User Interface

The frontend portal is developed which provides the user to grant funds and later trace back the funds granted. To develop the front-end of the web application we have designed the portal using technologies like HTML5 and CSS3, and for dynamic nature and operations handling, we have used JavaScript.

The User Interface acts as the pathway between the end-user and the database where the administrator (granting funds) and end-user (tracing funds) were using this transparent and tamper-proof system powered by blockchain.

E. Server-side

The server side of the web application comprises delegated frameworks based on blockchain technology with the power to the web application.

To harness the ability of blockchain in the web application, we have used Ganache which is a personal development environment for executing tests, and conditions and inspecting the current state of the blockchain transactions. Similarly, each transaction made in the network is stored in the form of blocks with some properties like Timestamp, proof of work, hashes, and other necessary details needed to make the registry complete.

To develop the DApps i., e Distributed applications smoothly and efficiently we make use of Truffle which is IDE i.,e Integrated Development Environment and testing framework altogether. Using Truffle, we can test the blockchain suite seamlessly and helps in deploying it in the form of a web application.

The key part of the web application is the graphical database, so we use the Neo4j graph database system. Neo4j database uses cypher query and it has massive write and read scalability, it also has single sign-on which increases the authenticity of the web application. To carry out the financial transactions we have used the meta-mask, which is a digital wallet and acts as a payment gateway.

All of the blockchain suites and implementation is carried out by using Node.js which increases the reliability of the application and easy execution of the blockchain frameworks for the web application.

F. Process

To overcome the problem of corruption and tampering with the transactional data which is difficult to trace so we developed a system that is purely based on blockchain delegation, that comprises granting of the funds and tracing of the funds granted till a low-level transaction in the businesses. This allows the businesses to keep track of the transactions and funds allocated on a demand-to-know basis. This creates a crystal-clear ledger with a three-dimensional data representation

The system is designed to use encryption standards to secure transaction data by using a hash function to maintain a block of transactions in an on-chain manner maintained and verified by each node involved to verify the transaction and record data transparently.

This system enables a secure, secure, and authentic fund tracing and granting system to help shape the integrity of transactions in the enterprise process. The whole process starts with the transaction made by the granting authority and ends with a publicly available transparent database. Thus, the details of the transaction like granting authority, time of the transaction, fund availability, and reason for the transaction, all are noted and recorded in the distributed database.

Additionally, a block containing transaction details is added to the network. After the validation process, the block containing the transaction details with the checksum is then added to the blockchain network. The transaction can then be displayed in the network. All transactions and transaction details, published and will be added to the distributed ledger, and will be available to the public to trace the transactions in an immutable way.
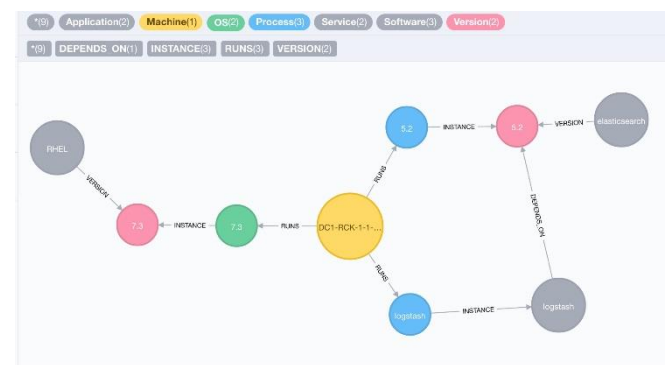

Fig. 2. Three-dimensional depiction of the funds for tracing.

Here we illustrate the final achieved result in a graph database system and cater to the needs of a fault-tolerant tracing system.

III. CONCLUSION AND FUTURE WORK

In the proposed system, we discussed resource allocation from a supported multi-organization point of view by blockchain technology. We used access control authorization Transfer, maintain and control granting and tracing of funds in the organization. The proposed system uses blockchain smart contracts to maintain Safe and secure interaction between organizations and businesses without the need for trusted third parties. The use of blockchain smart contracts allows the resource that the exchange takes place on an open market without an imbalance of power among the participants. it also allows some market participants and consumers. Our proposed system is catered to provide a security system unleashing the power of blockchain technology.

In the future, we plan to conduct further tests to evaluate security levels and see the feasibility of our framework with more complex access control policies. We also plan to add more application functions to the system based on patterns in historical transit data. Each of these features will add Another aspect of this that can be seen in traditional fund allocation methods today, with the aim of creating a transparent economy and truly decentralized open fund allocation system. We are planning on evaluating the effectiveness of that proposed system and highlight the main advantages of implementing such a system.

REFERENCES

[1] J. Magiera and A. Pawlak, "Security frameworks for virtual organizations," in Virtual Organizations. M Camarinha-Matos, H. Afsarmanesh H., M. Ollus (eds). Springer, 2005, pp. 133–148.

[2] S. Pal, T. Rabehaja, M. Hitchens, V. Varadharajan, and A. Hill, "On the design of a flexible delegation model for the internet of things using blockchain," IEEE Transactions on Industrial Informatics, vol. 16, no. 5, 2019, pp. 3521–3530.

[3] S. Pal, Internet of Things and Access Control: Sensing, Monitoring and Controlling Access in IoT-Enabled Healthcare Systems. Springer Nature, 2021, vol. 37.

[4] M. Ghorbel-Talbi, F. Cuppens, N. Cuppens-Boulahia, and A. Bouhoula, "Managing delegation in access control models," in the 15th International Conference on Advanced Computing and Communications (ADCOM), 2007, pp. 744–751.

[5] L. Atzori, A. Iera, and G. Morabito, "The Internet of Things: A survey," Computer Networks, vol. 54, no. 15, 2010, pp. 2787–2805.

[6] S. Ravidas, A. Lekidis, F. Paci, and N. Zannone, "Access control in internet-of-things: A survey," Journal of Network and Computer Applications, vol. 144, 2019, pp. 79–101.

[7] S. Pal, M. Hitchens, and V. Varadharajan, "Towards a secure access control architecture for the internet of things," in the 42nd Conference on Local Computer Networks (LCN). IEEE, 2017, pp. 219–222.

[8] S. Pal, M. Hitchens, V. Varadharajan, and T. Rabehaja, "Policy-based access control for constrained healthcare resources," in the 19th WoWMoM Conference. IEEE, 2018, pp. 588–599.

[9] S. Pal, M. Hitchens, T. Rabehaja, and V. Varadharajan, "Policy-based access control for constrained healthcare resources in the context of the internet of things," Journal of Network and Computer Applications, vol. 139, 2019, pp. 57–74.

[10] T. Rabehaja, S. Pal, and M. Hitchens, "Design and implementation of a secure and flexible access-right delegation for resource constrained environments," Future Generation Computer Systems, vol. 99, 2019, pp. 593–608.

[11] S. Pal, T. Rabehaja, A. Hill, M. Hitchens, and V. Varadharajan, "On the integration of blockchain to the internet of things for enabling access right delegation," IEEE Internet of Things Journal, vol. 7, no. 4, 2019, pp. 2630–2639.

[12] L. Koh, A. Dolgui, and J. Sarkis, "Blockchain in transport and logistics–paradigms and transitions," Production Research, vol. 58, no. 7, 2020, pp. 2054-2062.

[13] M. Pournader, Y. Shi, S. Seuring, and S. Koh, "Blockchain applications in supply chains, transport and logistics: a systematic review of the literature," Production Research, vol. 58, no. 7, 2020, pp. 2063–2081.

[14] E. Androulaki, et al., "Hyperledger fabric: a distributed operating system for permissioned blockchains," in Proceedings of the 13th EuroSys Conference, 2018, pp. 1–15.

[15] S. Pal, M. Hitchens, V. Varadharajan, and T. Rabehaja, "On design of a fine-grained access control architecture for securing iot-enabled smart healthcare systems," in Proceedings of the 14th MobiQuitous Conference, 2017, pp. 432–441.

[16] S. Pal, M. Hitchens, and V. Varadharajan, "On the design of security mechanisms for the internet of things," in the 11th International Conference on Sensing Technology (ICST). IEEE, 2017, pp. 1–6.

[17] V. Astarita, V. Giofre, G. Mirabelli, and V. Solina, "A review of ` blockchain-based systems in transportation," Information, vol. 11, no. 1, 2020.

[18] M. Mollah, et al., "Blockchain for the internet of vehicles towards intelligent transportation systems: A survey," IEEE Internet of Things Journal, vol. 8 no. 6, 2020, pp. 4157–4185.

[19] U. Lang and R. Schreiner, "Managing security in intelligent transport systems," in the 18th International Conference on Intelligent Transportation Systems. IEEE, 2015, pp. 48–53.

[20] E. Vazquez and D. Landa-Silva, "Towards blockchain-based ride-´ sharing systems." in ICORES Conference, 2021, pp. 446–452.

[21] Y. Yuan and F. Wang, "Towards blockchain-based intelligent transportation systems," in the 19th International Conference on Intelligent Transportation Systems (ITSC). IEEE, 2016, pp. 2663–2668.

[22] X. Jiang, F. Yu, T. Song, and V. Leung, "Intelligent resource allocation for video analytics in blockchain-enabled internet of autonomous vehicles with edge computing," IEEE Internet of Things Journal, 2020.

[23] M. Gupta, J. Benson, F. Patwa, and R. Sandhu, "Dynamic groups and attribute-based access control for next-generation smart cars," in Data and Application Security and Privacy Conference, 2019, pp. 61–72.

[24] M. Gupta, et al., "An attribute-based access control for cloud-enabled industrial smart vehicles," IEEE Transactions on Industrial Informatics, vol. 17, no. 6, 2021, pp. 4288–4297.

[25] L. Verdonck, A. Caris, K. Ramaekers, and G. Janssens, "Collaborative logistics from the perspective of road

transportation companies," Transport Reviews, vol. 33, no. 6, pp. 700–719, 2013.

[26] T. Darwish and K. Bakar, "Fog based intelligent transportation big data analytics in the internet of vehicles environment: motivations, architecture, challenges, and critical issues," IEEE Access, vol. 6, pp. 2018, pp. 15679–15701.

[27] F. Xhafa, A. Aly, and A. Juan, "Allocation of applications to fog resources via semantic clustering techniques: With scenarios from intelligent transportation systems," Computing, vol. 103, no. 3, 2021, pp. 361–378.

[28] M. Gerla, E. Lee, G. Pau, and U. Lee, "Internet of vehicles: From intelligent grid to autonomous cars and vehicular clouds," in the world forum on internet of things (WF-IoT). IEEE, 2014, pp. 241–246.

[29] J. Zhao, C. He, C. Peng, and X. Zhang, "Blockchain for effective renewable energy management in the intelligent transportation system," Journal of Interconnection Networks, 2021.

[30] Z. Ning, et al., "Blockchain-enabled intelligent transportation systems: A distributed crowdsensing

[31] M. Möser, R. Böhme noD. Breuker, "An investigation into fraudulent tools in the Bitcoin ecosystem," 2013 APWG at Crime Researchers Summit, San Francisco, CA, 2013, pages 1-14, doi: 10.1109 / CRS. 2013.6805780.

[32] Mohanta, Bhabendu & Jena, Debasish & Panda, Soumyashree & Sobhanayak, Srichandan. (2019). Blockchain Technology: A Survey on Applications and Security Privacy Challenges. 8. 100107. 10.1016/j.iot.2019.100107.

[33] D. A. Wijaya, "Extending asset management system functionality in bitcoin platform," 2016 International Conference on Computer, Control, Informatics and its Applications (IC3INA), Tangerang, 2016, pp. 97-101, doi: 10.1109/IC3INA.2016.7863031.

[34] K. Saito and H. Yamada, "What's So Different about Blockchain? — Blockchain is a Probabilistic State Machine," 2016 IEEE 36th International Conference on Distributed Computing Systems Workshops (ICDCSW), Nara, 2016, pp. 168-175, doi: 10.1109/ICDCSW.2016.28.

[35] G. Hurlburt, "Could Blockchain Outlive Bitcoin ?," in IT Professional, vol. 18, no. 2, pages 12-16, Mar.-Apr. 2016, i-doi: 10.1109 / MITP.2016.21.

[36] Lei Xu, Nolan Shah, Lin Chen, Nour Diallo, Zhimin Gao, Yang Lu, and Weidong Shi. 2017. Enabling the Sharing Economy: Privacy Respecting Contract based on Public Blockchain. In Proceedings of the ACM Workshop on Blockchain, Cryptocurrencies and Contracts (BCC '17). Association for Computing Machinery, New York, NY, USA, 15–21. DOI:https://doi.org/10.1145/3055518.3055527.

[37] LS Sankar, M. Sindhu and M. Sethumadhavan, "A study of compliance procedures regarding blockchain applications," 2017 4th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, 2017, pages 1- 5, doi: 10.1109 / ICACCS .2017.8014672.

[38] Tien Tuan Anh Dinh, Ji Wang, Gang Chen, Rui Liu, Beng Chin Ooi, and Kian-Lee Tan. 2017. BLOCKBENCH: A Framework for Analyzing Private Blockchains. In Proceedings of the 2017 ACM International Conference on Management of Data (SIGMOD '17). Association for Computing Machinery, New York, NY, USA, 1085–1100. DOI:https://doi.org/10.1145/3035918.3064033

[39] C. Khan, A. Lewis, E. Rutland, C. Wan, K. Rutter and C. Thompson, "A Distributed-Ledger Consortium Model for Collaborative Innovation," in Computer, vol. 50, no. 9, pp. 29-37, 2017, doi: 10.1109/MC.2017.3571057.

[40] S. Dutta, (2020), Sealed Envelope Exchange in Autonomous Decision Making. Clemson Tech ID 2021-016.

[41] A. Rahman, "A framework for decentralised trust reasoning," Ph.D. dissertation, Department of Computer Science, Univ. College London, London https://discovery.ucl.ac.uk/id/eprint/1444477/ (accessed Oct. 29, 2020).

[42] Associated Press, "Not Just VW: A Long History of Cheating Car Companies," CBS News, Sep. 29, 2015.

[43] S. R. H. Barrett et al., "Impact of the Volkswagen emissions control defeat device on US public health," Environ. Res. Lett., vol. 10, no. 11, p. 114005, Nov. 2015, doi: 10.1088/1748-9326/10/11/114005.

[44] K. Krukow, M. Nielsen, and V. Sassone, "Trust models in ubiquitous computing," Phil. Trans. R. Soc. A., vol. 366, no. 1881, pp. 3781–3793, Oct. 2008, doi: 10.1098/rsta.2008.0134.

[45] Lin, T., H. Rivano, and F. Le Mouël. 2017. "A Survey of Smart Parking Solutions." IEEE Transactions on Intelligent Transportation Systems 18 (12): 3229–53. https://doi.org/10.1109/TITS.2017.2685143.

[46] X. Zhou and X. Tang, "Research and implementation of RSA algorithm for encryption and decryption," in Proceedings of 2011 6th International Forum on 87 Strategic Technology, Aug. 2011, vol. 2, pp. 1118–1121, doi: 10.1109/IFOST.2011.6021216.

[47] "What are automated forklifts | Washington and California," Oct. 30, 2014. https://raymondhandling.com/learn/faqs/what-are-automated-forklifts/ (accessed Nov. 06, 2020).

[48] 24/7 Staff, "The Economic Impact of the Industrial Lift Truck - Supply Chain 24/7." https://www.supplychain247.com/article/the_economic_impact_of_the_industrial _lift_truck/lift_trucks (accessed Oct. 27, 2020).

[49] "Supply Chain Shout Out: Forklift Power - Inbound Logistics." https://www.inboundlogistics.com/cms/article/supply-chain-shout-out-forkliftpower/ (accessed Oct. 27, 2020).

[50] J. Lilford, "8 Things Your Competitors Could Teach You About Site and Forklift Safety." https://www.remaxdoors.com/warehouse-management-blog/8-thingsyour-competitors-could-teach-you-about-site-and-forklift-safety (accessed Nov. 06, 2020).