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A Literature Survey on Vaccine safe Health Tracker based on blockchain technology

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***Abstract*— We present a method for immutability and data integrity of vaccination registration using blockchain technology, preventing identity theft and impersonation. Using this project, a vaccination system is designed to connect healthcare providers' vaccination records with each other for data storage purposes. Anyone with authorization to participate in the network could access the data of beneficiaries, including colleges funded by both the federal and state governments.**

Vaccine producers define safe handling rules and Smart Contracts are used to monitor and trade-off those rules in accordance with the distribution conditions. Network labels are used to identify the networks involved as well. There are transparent and tamper-proof solutions for self-reporting side effects of vaccine administration, taking into account both the beneficiary and the administrator.

***Keywords*—(Blockchain, Vaccine, Distribution system, smart Contract, Networks, Medical Records)**

I. INTRODUCTION

In spite of these long-standing benefits, immunization levels remain low. Twenty million children are not vaccinated every year. As a result, many of the most vulnerable and poorest children - often those most in need of vaccinations - remain largely unvaccinated. Some live in remote areas, in countries affected by conflict, or in countries where polio still exists.

We present a method for immutability and data integrity of vaccination registration using blockchain technology, preventing identity theft and impersonation. Using this project, a vaccination system is designed to connect healthcare providers' vaccination records for data storage purposes. Anyone with authorization to participate in the network could access the data of beneficiaries, including colleges funded by both the federal and state governments.

By storing information on the blockchain, it is very difficult or impossible to hack, change, or cheat the system. In essence, a blockchain is a distributed ledger of encrypted transactions that is duplicated across the networks of computers on the blockchain, and available to the public.

Vaccine producers define safe handling rules and Smart Contracts are used to monitor and trade-off those rules under the distribution conditions. The networks involved are also identified using network labels. There are transparent and tamper-proof solutions for self-reporting side effects of vaccine administration, taking into account both the beneficiary and the administrator.

II. BACKGROUND AND MOTIVATION

Getting the right vaccines into the right people at the right time is, unsurprisingly, proved to be a challenge. The recent pandemic gives the ground check about this harsh reality. Common issues to be tackled in Vaccine Distribution are Vaccine wastage, Mixing of doses, and No proper track of side effects. Vaccine wastage is one of the expected outcomes for any large vaccination drive held. But vaccine wastage also fuels unneeded procurement over here.which can also eventually inflate the demand of vaccines.

III. LITERATURE SURVEY

[1] Blockchain Technology in Healthcare by Matthias Mettler

Although most projects have been focused on financial services. mainly the projects are in healthcare and other service-related areas. Blockchain has many potential applications in healthcare, e.g., in managing public health, medical research typically based on personal patient data, and drug counterfeiting. Existing technology shows the need for third parties to run the market. Blockchain holds the potential to disrupt the healthcare market and significantly affect power balances between players. With the ability to eliminate data intermediaries, new possibilities emerge when it comes to integrating the healthcare market.

[2] A Blockchain-based Electronic Medical Health Records Framework using Smart Contracts by Vardhini B, Shreyas N Dass, Sahana R, and Dr.R.Chinnaiyan

The country's medical services have been plagued by issues pertaining mostly to referrals from doctors, interoperability of medical data, and patient access to medical records. All stakeholders participated in the development of the Electronic Health Record Framework for Blockchain, which addressed these issues. This paper examines how medical records are kept secure and how they are linked. In the past, healthcare interoperability focused mainly on the sharing of data between businesses, such as different hospital systems. By deploying the EHR through the Blockchain, access and authority issues are mitigated. It may be possible to determine who is involved in the transactions, which could jeopardize their confidentiality. By making it possible to quickly access medical records during an emergency, the system could be improved. Several disease-specific structures could be modeled on established standards or modified to fit specific conditions.

[3] A Secure and Scalable Data Source for Emergency Medical Care using Blockchain Technology by Shirin Hasavari, and Yeong_Tae Song

Factors such as the time it takes for emergency patients to reach hospitals and the inability to access critical patient data are related to the death rate of emergency patients. As part of the patient care cycle, many different healthcare settings collect lots of medical information using disparate record management systems. During patients' move between clinics and medical facilities, this paper describes secure file transfer methods and blockchain technology, which collect Emergency relevant medical data, documenting that patient's medical history and providing a continuous data source. Prehospital care can be provided at a high level by ambulance crews. As part of efforts to create a comprehensive view of emergency medical data, they have combined FTPS file transfer tools with a hyper ledger Fabric blockchain. Patients' data is stored using chains as they move between clinics. Only the doctor or relevant clinical staff can make changes to the data.

[4] A Study of Blockchain Technologies and Health Care Systems by Dr. B. Arunkumar, Mr. T. Mohanraj, Mr. S. Shahul Hammed, and Dr. R. Santhosh.

With blockchain, both end-users can have a sense of trust between each other. Blockchain technology is becoming increasingly popular in management value creation through decentralized approaches. A major advantage of BC is that it can track errors; it's the nature of the application. Blockchain technology being new, it must be molded to match the user or organization or enterprise needs. Surely, Blockchain will lead to a buzzing future in which the world will be transformed. Certainly, it will take time for many of them to adopt this new technique, but it will take some time for the Blockchain technique to gain popularity among individuals and enterprises around the world.

[5] Sharing Health and Wellness Data with Blockchain and Smart Contracts by P. Rangel, and J. Kleinschmidt.

Increasing longevity and concern about aging well has increased the availability of health and wellness data. It is not possible to ensure the application of existing standards due to their complexity and the lack of adherence by the agents involved. Blockchain technology offers an alternative for unifying standards and implementing them through a consensus algorithm, which takes into account the validation and secrecy of insertion of each block. Architecture for blockchain-based consensus is proposed in this paper that includes data collected in the health and wellness ecosystem, including data collected by IoT devices which are later stored in middleware platforms.

[6] Optimizing Vaccine Distribution for Different Age Groups of Population Using DE Algorithm by Xiao-Min Hu, and **Jun Zhang**

In terms of stopping epidemics, vaccination protects the most vulnerable populations and reduces the number of susceptible populations with non-Vaccinated that are exposed to the virus. Aiming to reduce the number of infectious people by distributing vaccines to different populations is important for public health. In this paper, an algorithm known as DE is proposed for finding the optimal distribution strategy. It helps in distributing the limited vaccines to different age groups. In the literature, there are various approaches to prioritizing the problem. This paper states the DE algorithm can achieve the best result. In order to test the DE algorithm and prove its best

place, a series of simulations were run. DE algorithm to solve the vaccine distribution problem was found to be very promising.

[7] Blockchain-Based Solution for Distribution and Delivery of COVID-19 Vaccines by AHMAD MUSAMIH, RAJA JAYARAMAN, KHALED SALAH, HAYA R. HASAN, IBRAR YAQOOB, and YOUSOF AL-HAMMADI

Platforms and systems currently used to manage data about COVID-19 vaccines' distribution and delivery fail to provide transparency, track ability and traceability, immutability, auditability, and trustworthiness. Due to the storage centralization, there is also the possibility of a single point of failure. COVID-19 vaccine distribution and delivery processes are hindered by these limitations. Developing an Ethereum blockchain-based distribution and delivery management system for COVID-19 vaccines is the focus of this paper. To deal with large and non-critical data, they tried to integrate the Ethereum blockchain with the following off-chain storage. Data provenance and recording of events related to COVID-19 vaccine distribution and delivery were made possible by smart contracts. Checked the smart contract for security vulnerabilities to make sure that it is robust. Diverse blockchain solutions built on different platforms can cause interoperability problems.

[8] Blockchain Technology towards Identity Management in Health Care Application by Marc Peter Deisenroth

Over the past decade, there has been a growing interest in automated learning in control and robotics, because data-driven learning drastically reduces the requirement for engineers. RL approaches are practical limitations of autonomous reinforcement systems, such as robotics systems where many interactions are time consuming or impractical. When addressing this issue, a typical learning approach would include expert demonstrations, realistic simulators, pre-shaped policies, or in-depth knowledge of the dynamics involved. This paper takes a different approach to speed up learning by using data mining to extract more information from data. A nonparametric probabilistic model of system transitions based on the Gaussian transition theory is derived. Model errors, a major concern in model-based learning, are significantly reduced by explicitly incorporating model uncertainty into long-term planning and controller learning. In contrast to state-of-the-art RL, our model-based policy search method achieves an unparalleled speed of learning. In order to demonstrate how the method can be applied to autonomous learning, it is applied to real robots and control tasks.

[9] A Consent Model for Blockchain-Based Health Data Sharing Platforms by VIKAS JAIMAN AND VISARA UROVI

Modern healthcare systems rely on electronic health records to provide quality care and facilitate a wide range of health services. By creating a distributed network of trust, the blockchain facilitates data sharing by enabling individuals to consent to the sharing of their health data. Information is accessible without requiring the time or resources of specific actors (such as the health services).Data governance mechanisms are of utmost importance on blockchain-based platforms because of the necessity to define and monitor data sharing and use conditions. To enable data requesters to search and access health data using smart contracts, the article presents a model of controlling access to individual health data based on blockchain technology. This paper proposes a new individual consent model to facilitate health data sharing using the Ethereum blockchain. Various scenarios for data sharing are tested using this technology. We were able to demonstrate that data requesters could make flexible decisions over the use of their data by following this model as it respects each individual's consent. Our experimental evaluation of the model showed that it is efficient and adaptable to a variety of data-sharing scenarios.

[10] "Secured Inter-Healthcare Patient Health Records Exchange Architecture" by Oluwaseyi Ajayi, Meryem Abouali, and Tarek Saadawi

The number of cyberattacks on healthcare providers has increased drastically in recent years, notably breaches of electronic health records (EHRs). Researchers have proposed using firewalls, cryptography, and cloud antivirus to secure health records. Health systems are planning to create consortium repositories of EHRs in the coming years. It becomes crucial to maintain integrity and consistency in shared EHRs despite the effectiveness and practicality of these approaches for protecting EHRs. Separate blockchain networks maintain the records of each healthcare provider. We propose a secure and scalable EHR exchange for inter-healthcare. Detect and prevent malicious activity on electronic health records in

transit and at rest with the proposed architecture. The results showed that healthcare systems are vulnerable to both external and internal threats. This architecture is used to detect potential insider threats and to prevent them from uploading compromising EHRs to the blockchain.

[11] "Sharing Medical Questionnaires based on Blockchain" by Min Gyu Kim.

Questionnaires provided by hospitals play an important role in evaluating a patient's health.Through the use of blockchain characteristics, we propose a method to ensure the integrity of medical questionnaires by using a system based on the blockchain. Since this system is based on health level 7 interoperability resources, its data can be accessed by other systems. As well as improving the quality of healthcare services, this study focuses on improvement of patient lifelong health from the results of medical questionnaires, as well as improving the security of patient medical records.

[12] "A Blockchain-based Architecture Framework for Secure Sharing of Personal Health Data" by Sandro Amofa.

Researchers have been studying and analyzing health information exchange's advantages for years. Despite their utility in increasing provider efficiency and decreasing administrative costs, data owners' inability to control data after transmission has long been a challenge. Health and medical institutions would be limited in their participation if technical mechanisms did not exist to control patient health data on networks, Simultaneously insulate data from inherent benefits by using silo-based data management. Patients' quality of life is also adversely affected by the lack of data for research and analysis. The HIE uses a blockchain-based architecture framework to control personal data in addition to user-generated acceptable use policies. We discuss the system's strengths and its user-centric design, as well as the results of experiments and potential directions for future research. The framework ensures minimal risk to data by having a mechanism for controlling data after it is shared. Health care providers can benefit by adopting our framework by gaining a stronger guarantee for data management.

[13] "Identity Verification and Management of Electronic Health Records with Blockchain Technology" by Yiheng Liang.

We have designed a blockchain network that can verify an individual's identity and share electronic health records. These systems facilitate the authentication of patients' identities, ease of access to electronic health records, and easy sharing of information so as to protect the information of their clients.

[14] "Blockchain for 5G Healthcare architecture" by Khalimjon Khujamatov

This article discusses the prospects for introducing 5G and blockchain technology to the healthcare system.

Modern technology is transforming all aspects of life, including healthcare. This study examines the major shortcomings in the healthcare system, the benefits of integrating 5G, blockchain, and related technologies, and the barriers to achieving these benefits. A blockchain-based 5G healthcare architecture is what we propose based on our findings.

[15] Utilization of the Blockchain Network in The Public Community Health Center Medicine Supply Chain" by Hartanto Kumiawan

Despite the establishment of official distribution channels for medicines, counterfeit medicines continue to circulate within the community. A variety of factors contribute to the spread of counterfeit medicines, including marketing strategies, consumer behavior, and distribution oversight. Blockchain technology has shown powerful breakthroughs for overcoming these problems thanks to its immutability, transparency, and decentralization. We describe in this paper a new way of managing the supply of medicines to public community health centers in Indonesia based on blockchain. By using JMeter, we measured the transaction rate, latency, and resource utilization of the proposed system.

[16] "Health Monitoring and Analysis using IPFS and Blockchain" by Harshit Sunilkumar Singh.

In India, there is currently no system in place that provides a secure and systematic platform for citizens to store their medical records. In this study, we develop a system that can be used both for storing records, as well as for performing analyses and producing output via data mining, which can be used by multiple agencies, including government agencies, pharmaceutical companies, and

academic institutions. Blockchain and IPFS have the potential to revolutionize the medical field. When these two technologies are combined with the architecture model in this paper, the problem of security breaches can typically be overcome by most countries' health record systems.

[17] "Converging Blockchain and Machine Learning for Healthcare" by Sonali Vyas.

In numerous fields, Machine Learning has shown its importance for making accurate predictions and decisions based on data patterns. To gain insights into data patterns, make accurate decisions, and understand them, there is a requirement for sufficient data.Decentralized databases are integral to machine learning, as they facilitate data sharing as well as providing reliable data. Blockchain technology ensures that data is securely and legitimately recorded due to consensus. In this paper, we demonstrate how using the combination of blockchain technology and machine learning can improve healthcare by producing highly accurate results.

[18] "Bitcoin: A Peer-to-Peer Electronic Cash System" by Satoshi Nakamoto.

Paying directly to counterparts could become possible through peer-to-peer electronic cash transactions without involving a financial institution. When a trusted third party is absent, digital signatures offer partial relief from double-spending, but their benefits are not fully realized. According to the authors, peer-to-peer networks may help prevent double-spending. Exchange records are hash-hash, so reworking proofs of work is not feasible since exchange records are hash-hash. By calculating the chain's length, we can also determine the computing power being used to determine when each event occurred. Nodes leave and rejoin the network at any time, as long as they broadcast messages over the network and accept the longest proof-of-work chain as evidence that something took place while they were away.

[19] "Ethereum: A secure decentralized generalized transaction ledger" by Dr. Gavin wood

According to this paper it is an introduced, explained and formalized protocol that underlies Ethereum. It describes how to become a node on the network of Ethereum and become a member of a decentralized, secure social network. Rules of interaction can be specified algorithmically and autonomously via contracts.

[20] "How blockchain timestamped protocols could improve the trustworthiness of medical science" by Greg Irving, and John Holden

It is suggested that time-stamped blockchain protocols can be used to describe a protocol's exact language in the present. Many predefined outcomes are capable of being automatically verified while maintaining very high reliability. Providing proof of prespecified endpoints within-trial protocols can be achieved by using blockchain. A protocol for switching outcomes was employed in this study after conducting studies empirically on such an approach. In this study, the author discusses how blockchain can be used for auditing and ensuring the credibility of scientific studies in a cost-effective, independently verifiable way.

[21] "An Overview of the Emerging Technology: Blockchain" by Rishav Chatterjee, Rajdeep Chatterjee.

An overview of blockchain is presented in this paper. Hence, it looks as though it will have benefits for both the financial and non-financial sectors. The system also solves security, reliability, and shared knowledge problems, as well as facilitating knowledge sharing. Since its inception, this technology has proved popular. Further research in this area is indicated in the paper. In order to improve the efficiency of the system, it must be examined and the weaknesses minimized.

[22] "Supply Chain Management based on Blockchain: A Systematic Mapping Study" by Rishav Youness Tribis, Abdelali El Bouchti, Houssine Bouayad

An analysis of Supply Chain Management applications that utilize blockchain technology is presented in this paper. A set of research questions guided this study, which aimed to examine research trends, open topics, and improvement gaps within this discipline. Among the findings was the importance of digital identity tracking systems.

Blockchains are used to trace supply chains. Supply Chain Management subjects include agricultural supply chains, supply chain quality management, product ownership management, and purchasing and supply management. The topics are chosen to study, address current

challenges and provide solutions.

Developing blockchain-based solutions to supply chain challenges. Although many framework-based solutions have been proposed, few provide true performance evaluation.

[23] "Secure Attribute-Based Signature Scheme With Multiple Authorities for Blockchain in Electronic Health Records Systems" by RUI GUO, HUIXIAN SHI , QINGLAN ZHAO, AND DONG ZHENG.

A blockchain-based electronic healthcare record system aims to preserve patient privacy. In this paper, an Effective Attribute-Based Signature scheme is proposed that ensures anonymity and immutability of transactions while meeting the needs of the blockchain structure. In addition to communicating keys between authorities, private keys must also be provided to patients. Privacy is provided by protocols that cannot be forged. The comparison analysis demonstrates that the performance and therefore the cost of this protocol increases linearly with the number of authorities and patient characteristics.

[24] "MedRec: Using Blockchain for Medical Data Access and Permission Management" by Asaph Azaria, Ariel Ekblaw, Thiago Vieira and Andrew Lippman.

The paper uses block chain technology to develop MedRec. This illustrates how decentralization can be applied to data management in an EMR system. Authors demonstrated that interoperability, and accessibility to medical records can be achieved by using a comprehensive log. Designed for record flexibility and granularity. MedRec enables the sharing of data and incentive systems to encourage researchers to sustain medical research. In addition to exploring the economics of mining medical research data, the authors are enthusiastic about providing an onboarding procedure for medical research "miners.". Local healthcare organizations could partner and simulations of aspects of system efficiency could be conducted in the wild.

[25] "A Blockchain-based Medical Data Sharing and Protection Scheme" by XIAOGUANG LIU, ZIQING WANG, CHUNHUA JIN, FAGEN LI, and GAOPING LI.

Blockchain technology has many characteristics that make it ideal for protecting and sharing medical data, such as decentralization and tamper-resistance. Using blockchain technology to share medical data, this proposes a lightweight scheme. The scheme is based on blockchain technology. Doctors can access historical patient records using proxy encryption technology. This ensures security in the proposed scheme since ciphertext communicates the inquired information. A better algorithm is suggested because this consensus mechanism is lightweight and reliable. Lastly, their scheme offers several benefits. Patients with identical symptoms may communicate about their illnesses using the symptoms-matching mechanism. This scheme satisfies a number of requirements and is low cost in terms of communication and computation.

IV. CONCLUSION

As we have dealt with various papers, we came across very important issues related to vaccines on tracking-tracing, monitoring the distribution and delivery of vaccines. Ethereum will facilitate the distribution and delivery of vaccines by providing a decentralized, traceable, transparent, reliable, auditable, secure, and trustworthy platform. The provenance of data was assured by smart contracts that automate the process of recording and logging vaccine distribution and delivery events.

Using our solution, we compared it to existing blockchain and non blockchain based solutions. The solution discussed is generic and can be adapted to any type of vaccines ordering, traceability and monitoring scenario. Additionally, the public Ethereum blockchain utilizes the Proof of Work consensus algorithm, which is limited by its scalability. Furthermore, using different blockchain platforms and solutions can create interoperability problems.

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