Enhancing Patient Access and Security: Blockchain-QR Integrated Hospital On Tap System

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Abstract. The Hospital On Tap System is a highly organized computerized system that was meticulously designed and coded to manage daily operations and administrative duties in a healthcare facility. This comprehensive platform effectively handles treatment databases, tracking of illness status, inpatient and outpatient records, and billing procedures for laboratory and pharmaceutical services. It also carefully arranges other important hospital information, such as departmental supervision, attending physicians, and ward identity. One common problem that many patients nowadays have is that their medical reports are not always easily accessible after the session. Although many hospitals handle these data in-house, patients often have difficulty getting them from a distance. The possible benefits of integrating blockchain technology with QR codes in healthcare administration. There are several advantages to using blockchain, a safe decentralized record-keeping system, and QR codes, which can be scanned by smartphones. By putting patient data in an impenetrable blockchain, integrating these technologies improves patient data security. Additionally, it reduces manual paperwork errors and optimizes healthcare operations by making it possible to quickly access relevant information and the medical history of patients during clinic appointments by scanning their QR codes. Following this initiative, administrative costs were reduced by 30%, operational efficiency was improved, and patient satisfaction increased by 70%.

Keywords: BlockChain, QR code, Clinic, Information storage, Data retrieval.

1 Introduction

The Hospital On Tap idea speeds up patient registration, archives data, and automates billing in labs and pharmacies. To automatically record information, each patient is assigned a unique ID. It offers a search function to see which doctors are available, whether rooms are available, and to access patient data by ID. The only users who need a username and password to access data are administrators and receptionists. While upholding strict security, it gives safe data retrieval top attention. Healthcare management stands as a pivotal industry, demanding the integration of QR codes and robust, efficient data management

technologies distinguished for their privacy and accessibility features. The convergence of QR code technology, enabling unique identification, with blockchain technology establishes an immutable, transparent ledger for individual patient databases, ensuring the utmost integrity of patient data. Within this context, this paper introduces an application employing two methods to securely manage patient data, fostering access to medical records and prescriptions. This innovative approach not only enhances data availability and efficiency but also safeguards patient privacy, addressing the pressing necessity to meet healthcare [1] obligations.

In the healthcare industry, using QR code-based solutions allows patients to continue participating in their care while sharing information about them. Blockchain technology creates a public record that cannot be altered, acting as the official source for all transactions. Think of every transaction as a change to a patient record that requires several parties involved to share data in real-time. Poor communication can lead to many different kinds of problems that can be fixed by automating the approval process. This is especially useful when it comes to referrals. Blockchain technology improves efficiency by reducing errors, conflicts, and missing connections through secure, real-time data sharing.
Although blockchain technology [2] [3] [4] solves problems with claims that are not paid on time and makes safe patient data exchange possible, there are still many problems in the healthcare industry that need to be fixed. However, there is still hope that it would simplify the payment process between insurance companies and healthcare providers. Insurance companies may greatly automate medical payments by utilizing blockchain technology, which guarantees more accuracy and precision when sharing information with patients and insurers in a safe and secure setting. Blockchain records are visible to all parties involved, enabling secure communication across numerous parties on a distributed basis and doing away with the need for laborious fax messages or manual searches that are common in the healthcare sector.

Insurance companies can change payment keys in the registration file with the use of blockchain's distributed ledger technology, which eliminates the need for paper records and data storage. This shift helps healthcare organizations comply with legal requirements by simplifying data administration while protecting patient medical records. Choosing distributed ledgers over paper-based techniques means that only authorized users—like insurance firms and doctors—can access the data, which eliminates the need for paper-based contact manuals. This change significantly strengthens information security. For example, clinicians or patients can quickly retrieve relevant medical and health information by scanning a QR code; this highlights the potential of blockchain technology to improve healthcare information accessibility while strengthening security protocols.

2 RELATED WORK

The comprehensive literature review sheds light on the contextual challenges and a concise historical overview of hospital information management systems.

Ouma and Herselman (2008) emphasized that governments across nations have employed numerous strategies to foster the development of primary national healthcare programs. However, there remains a significant concern regarding the inadequate provision of specialized healthcare facilities. Adebisi et al. (2015) noted that hospital systems rank among the most intricate administrative organizations. The primary goal of a hospital is to provide patients with appropriate care and attention. A hospital's operational duties include keeping track of immunization records, billing, recording diagnoses, recording patient information, and tracking illnesses and prescription drugs. Most hospitals still execute these tasks manually, prompting the necessity for electronic [5] record-keeping systems to streamline operations, discharge processes, data queries, prescription guidelines, and overall accountability [6].

Information technology facilitates intra-organizational networking, thereby enabling efficient information flow within different units of a firm. Its continuous integration into healthcare is primarily aimed at ensuring the timely acquisition and processing of clinical information pertinent to patient care (Adegenjo et al., 2012). The implementation of Hospital Management Systems offers advantages such as optimized operations, improved administration and control, superior patient care, stringent cost management, and enhanced profitability (Olusanya et al., 2015).

Musa [7] identified one of the primary challenges encountered by existing hospital management systems: operational inefficiencies and delays between various processes, departments, and individuals. To address these shortcomings, Musa proposed an RFID and wireless sensor-based location and information management framework. This framework enables real-time tracking of hospital assets, personnel, and patients throughout their movement in predefined procedures as part of the hospitals' daily activities. Illo et al. (2015) proposed a web-based [8] real-time system aiming to enhance medical research and analysis. Daiping et al. [9] suggested the Health Services Management Information System (HSMS) in China hospitals to improve service quality, identify cost reduction areas, and assess healthcare services.

Referring to clinics as technology-driven and information-intensive entities, Olusanya et al. [10] emphasized that computerizing clinic activities, including diagnostic and treatment processes, contributes to developing networks integrating clinical, hospital, and healthcare processes (Smith and Pijl, [11]). Over the years, hospitals have deployed various models and schemes for interventions and development (Friesner, 2009). The efficient storage and retrieval of patients' information significantly contribute to enhancing a hospital's medical care capabilities, decision-making processes, and overall operational efficiency. Augmenting the literature review section by including more recent research findings or case studies related to hospital information management systems (HIMS) could strengthen the paper's relevance and depth.
Karim Rejeb, Abderahman Rejeb, Horst Treiblmaier, and Suhaiza Zailani: A bibliometric review of blockchain research in healthcare, as well as current research trends. To guarantee that the gathered papers were conceptually rele-

vant, the authors individually examined each document's title, abstract, and keywords [12].
Blockchain Technology in Healthcare: A Comprehensive Review and Future Research Directions, Seyednima Khezr, Md. Moniruzzaman, Abdulsalam Yassine, and Rachid Benlamri. The primary use of the blockchain is to record transactions involving the digital currency Bitcoin, but it may also have educational applications [13]. For example: "In a recent study, findings underscored the transformative impact of implementing HIMS [14] [15] in reducing administrative burdens and enhancing overall healthcare quality. Moreover, the report highlighted the growing demand for interoperability and secure data storage systems, emphasizing the need for a centralized database for medical records."

3 Problem Introduction:

Healthcare information retrieval has several difficulties that affect accuracy and efficiency. Finding specific patient information, such as medical histories, requires sifting through multiple registers, which is inconvenient and wastes time. Furthermore, it takes a lot of work and time to ensure proper organization when data from different transactions is stored later than expected. Reliance on paperwork causes delays in updating information, such as patient or child immunization facts, resulting in records not being updated promptly. Inaccuracies can arise from manual calculations since they are labor-intensive and prone to error, particularly when calculating patient costs based on various treatments received. Furthermore, the intricacy of assembling precise and punctual reports becomes difficult because data is scattered throughout several registers. All of these issues make it more difficult for healthcare information systems to operate smoothly and effectively, which calls for more streamlined and technologically advanced methods of managing, storing, and retrieving data in healthcare settings.
Objective:-
A hospital is a type of medical facility or institution created especially to treat, care for, and assist those who are injured or unwell. It usually contains facilities for diagnosis, treatment, and rehabilitation along with highly skilled medical personnel and cutting edge medical equipment.
A vital component of hospital operations is the methodical gathering and archiving of various details, which includes the recording of patient information. This comprises individual health data, past medical records, symptoms, physical tests, prescribed medications, and aftercare. Simultaneously, the system of the hospital generates bills or invoices according to the range of services rendered, treatments given, prescription drugs dispensed, and diagnostic tests carried out during the patient's visit or stay. The details of the medical problem, the results of any diagnostic tests, the prognosis, and the treatment approaches are all carefully documented in the diagnosis information. Keeping thorough records of vaccinations, including dates, types of vaccines, and other relevant information needed to manage and track immunization schedules, is another essential component. In addition, keeping up a comprehensive database with details on illnesses, ail-

ments, symptoms, therapies, prescriptions, amounts, possible adverse effects, and other pertinent information is essential for efficient patient care and treatment planning. This extensive library guarantees high-quality healthcare service and makes decision-making easier.

4 SYSTEM DESIGN AND METHODOLOGY

"The proposed Hospital On Tap System [16] [17] will utilize a cloud-based architecture [18], leveraging secure data encryption protocols to ensure patient data confidentiality. This system will consist of modular components, including a robust user interface for seamless navigation, an integrated database management system, and a scalable back-end infrastructure to accommodate future expansions. [19]"

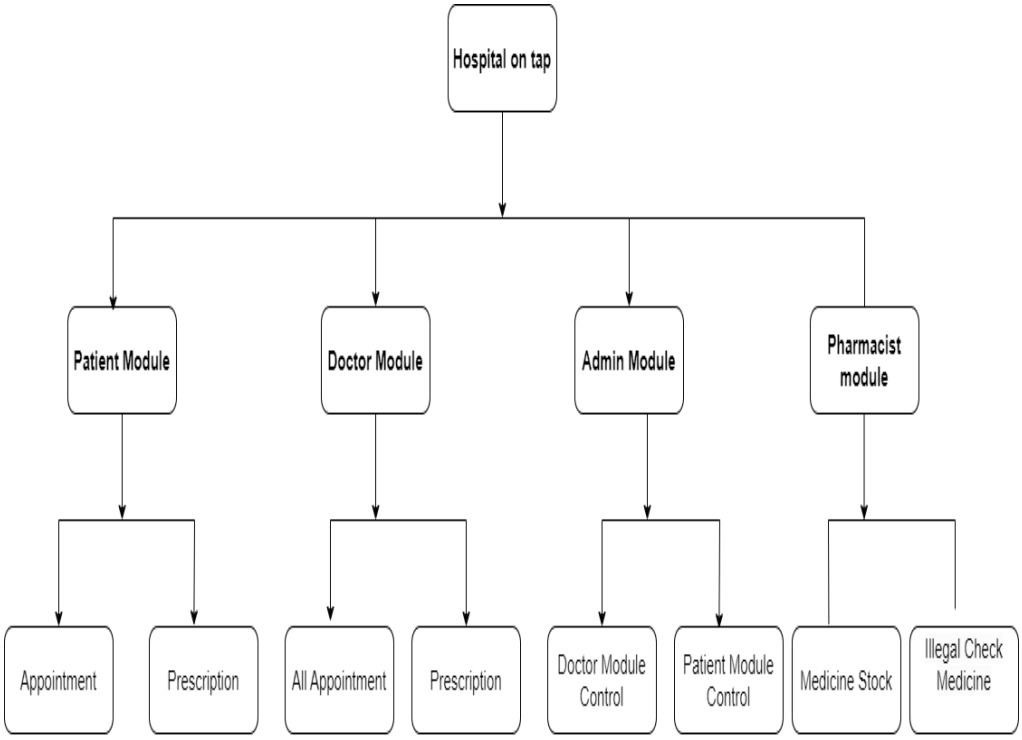

Fig. 1. Proposed Diagram

The entire project mainly consists of 4 modules, which are

Admin module:
The proposed system is a comprehensive centralized platform for efficient hospital management. It streamlines the administration of various departments and user roles, including doctors, nurses, pharmacists, and laboratory personnel. It enables seamless monitoring of doctor appointments and offers detailed transaction reports for patient payments. Additionally, the system provides access to operation reports for surgical procedures, birth reports, diagnosis reports, and records of patient deaths. This central repository of critical medical information ensures secure access to essential data, aiding in informed decision-making and comprehensive patient care. Overall, the system serves as a robust solution for hospital management, enhancing efficiency and improving the quality of healthcare services.

A centralized platform for efficient hospital management, streamlining administration and user roles. Enables seamless monitoring of appointments, detailed transaction reports, and access to critical medical information. Enhances efficiency, improves healthcare services, aids in informed decision-making.

User module(patient):
The system offers patients convenient access to appointment schedules with doctors, detailed prescriptions, and prescribed medications. It provides a comprehensive directory of available doctors, facilitates checking the blood bank status for available blood units, and grants access to the history of past operations. Additionally, patients can manage and update their personal profile information, ensuring accuracy in their healthcare records and empowering individuals in their healthcare management.

Doctor module:
Efficiently manages patient accounts, appointments, prescriptions, medication dispensing, and operations, generating detailed reports. Maintains comprehensive inventory, monitors stock, reviews patient prescriptions, and manages personal profiles for precise healthcare records.

Pharmacist module:
The system efficiently manages patient accounts, appointments, prescriptions, and medication dispensation while overseeing patient operations and generating detailed reports. It maintains a meticulous inventory of hospital medicines, and monitors stock, and categories, enabling accurate medication provision. Additionally, it facilitates the review of patient prescriptions and assists in managing personal profile information for precise healthcare records. The digitization of healthcare systems has spurred a quest for secure prescription management. The convergence of blockchain technology and QR codes presents an intriguing avenue to address this need. This section sets the stage by elucidating the imperative for secure prescription management and provides an overview of blockchain's fundamental attributes, emphasizing its applicability and potential impact within healthcare. The cutting-edge pharmacy module uses distinct

QR codes in BlockChain to present a digital prescription retrieval mechanism. Prescriptions for patients can now be accessed more easily thanks to technology, which replaces outdated paper-based procedures. It improves security and accountability by guaranteeing compliance with Indian government regulations regarding prohibited drugs. Prescriptions may be easily accessed by patients using QR codes, which improves convenience and lowers the possibility of prescriptions being misplaced. Blockchain technology and QR code integration in the system guarantee patient safety and legal compliance. It simplifies prescription procedures while strictly adhering to legal requirements. This innovative solution provides a tamper-proof platform for safely logging prescription information. All things considered, it transforms prescription management by offering simple access, increased security, and assurance of compliance in pharmaceutical dispensing.

Flowchart of QR verification :

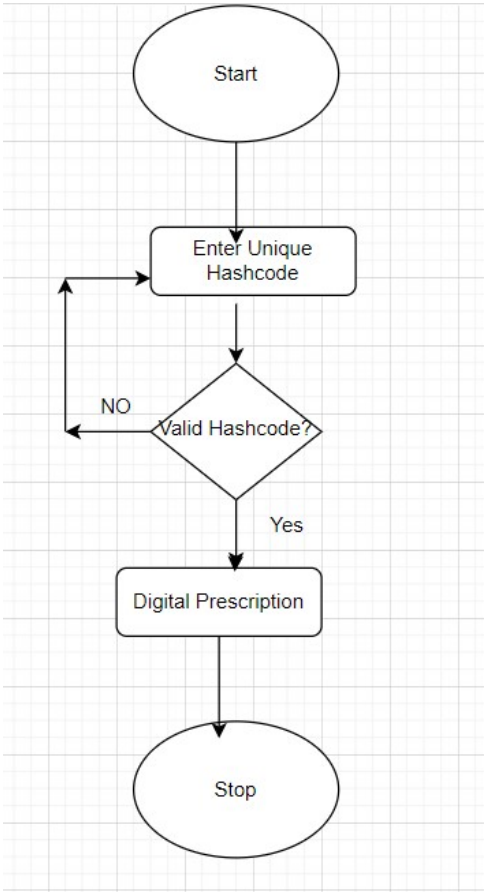

Fig. 2. Flow Diagram

4.1 Existing system:

The present [20] healthcare management system's reliance on traditional methods creates several difficulties and inefficiencies when managing vital data. The information storage and management system, which is primarily paper-based, is tedious and prone to errors, which increases the amount of paperwork and increases the chance of errors. Furthermore, the hospital infrastructure's dispersed departments contain vital data, which makes it challenging to access, aggregate, and preserve data integrity. The dangers associated with inadequate data entry and inconsistent adherence to defined management practices arise from the manual input and manipulation of information. Moreover, the movement of paper forms across departments raises the risk of misplacement or loss, which calls for thorough audits and may result in data loss and ineffective record-keeping. Multiple copies of the same information in various locations lead to data errors and duplication, making it difficult to keep accurate and synced data. Furthermore, worries regarding data security, accessibility, and the timely retrieval and updating of critical data emphasize how limited paper-based systems are in healthcare settings. To overcome all these inconsistencies in our traditional system we turned it into a digitized system or implementing [21] a comprehensive Hospital On Tab(HOT). An HOT would streamline data management, ensure standardized information input, enhance data security, and facilitate efficient access and retrieval of critical information across different departments within the hospital.

4.2 PROPOSED SYSTEM

The Hospital Management System [17]is crafted as a comprehensive solution to supplant traditional manual paper-based systems in hospitals. This new system aims to efficiently manage and organize critical information about patients, room availability, staff scheduling, operating room timetables, and patient invoices. Existing prescription management systems often grapple with vulnerabilities in data security and accessibility. A review of the literature emphasizes the shortcomings of conventional systems while showcasing the potential advantages of incorporating blockchain [22] [23] technology and QR codes [24] in healthcare settings. This section provides a foundation for the innovative approach by building upon previous research and precedents. The paper elucidates the technical intricacies involved in generating unique QR codes [25] for patient prescriptions and securely linking them to a blockchain. This procedure perfectly combines the authenticated prescription data with the immutable blockchain ledger by encoding it into a QR code. It guarantees that the prescription data is safely saved inside the QR code, offering a trustworthy way to confirm. Prescription data is transparent and permanent because to the blockchain integration, which also improves security by thwarting tampering. By combining blockchain technology with QR code technology, a reliable system for storing and retrieving validated prescription information is created, guaranteeing precision and traceability in

the administration of healthcare. Prescription handling is revolutionized by this integration, which keeps an immutable record of prescription data while guaranteeing authenticated and safe storage.

Architecture of proposed system: The following fig is representing whole step-

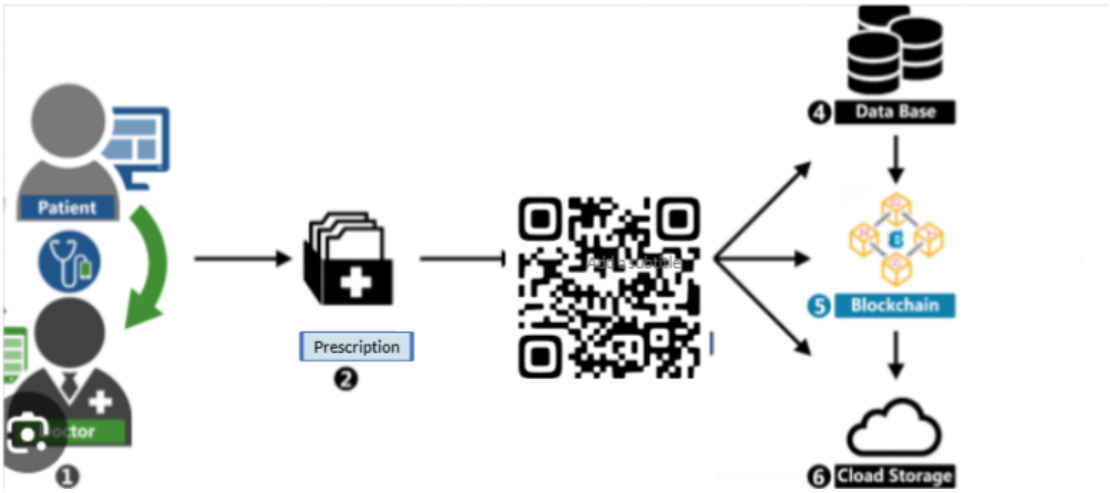

Fig. 3. Pictorial Representation.

Key objectives and features of this system include:

Patient Information Management:
Centralizing and organizing patient data to ensure easy access, accurate records, and streamlined management of patient information.

Room Availability Tracking:
Providing real-time updates on room availability, ensuring efficient allocation and utilization of hospital spaces.

Staff Scheduling: Facilitating the creation and management of staff schedules, ensuring optimal staffing levels across different departments.

Operating Room Schedules:
Managing and optimizing schedules for operating rooms, ensuring efficient utilization and timely allocation for surgical procedures.

Patient Invoicing:
Automating the generation and management of patient invoices, streamlining billing processes and reducing manual efforts.

5 Results

The assessment of the new system involved comprehensive testing of each module to verify their compliance with essential operational criteria. This included functions like user authentication, on-demand report generation, and administrative capabilities to delete records from the database. Following the individual module testing, integration, and system-wide testing were conducted to ascertain the seamless compatibility and integration of all modules, ensuring they function as a unified and fully operational system.
Nowadays physical documents are widely used for business, government, and personal use. According to [26], Americans utilize almost 90 million short tons of paper and paperboard each year. That translates to 700 pounds of paper goods annually per person. Access to this sensitive information, which frequently includes personal data like birthdates, home addresses, phone numbers, and other details, must be restricted. Alternatively, the integrity of the documents—such as contracts and identity documents—may need to be maintained.

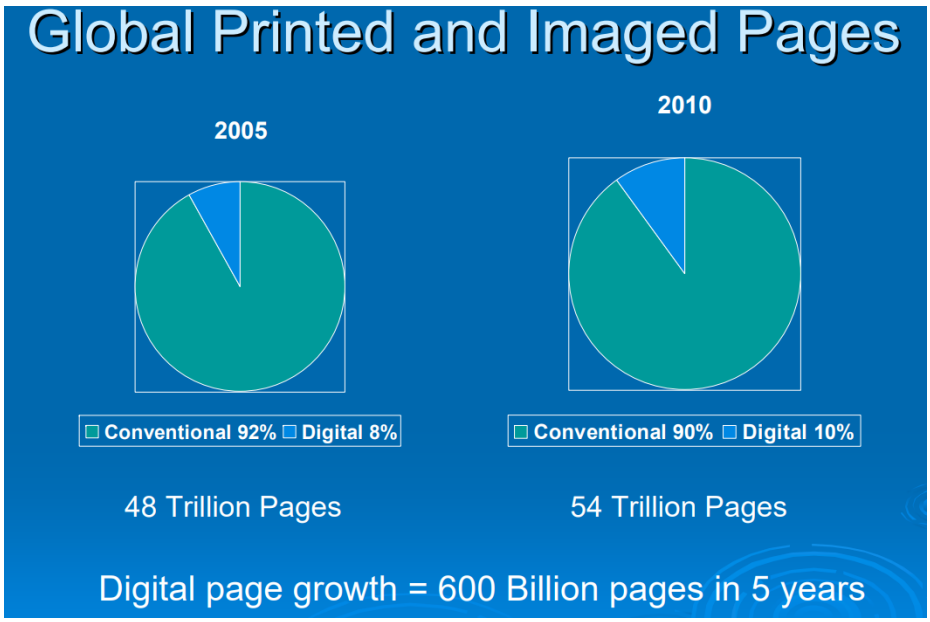

Fig. 4. paper groath

Improvement in Security:
Blockchain [27] and associated technologies don't offer a comprehensive answer to all cybersecurity problems. Rather, they strengthen current security measures for data, communications, and networks. Like many other cybersecurity

solutions, blockchain stores immutable records using hashing and encryption. Unfortunately, the majority of security protocols in use today are dependent on a single reliable source, leaving them open to threats including denial of service, malicious information injection, data theft, and extortion. Blockchains, in contrast to traditional centralized systems, are decentralized and independent of faith in a single party. In a blockchain network, every node keeps an exact duplicate of all past data and waits for majority agreement from other nodes before adding new information. Through the distribution of trust across several participants, this decentralized method improves security, making it more difficult for bad actors to compromise the system. [28] commentFigure 5 represents security improvement.

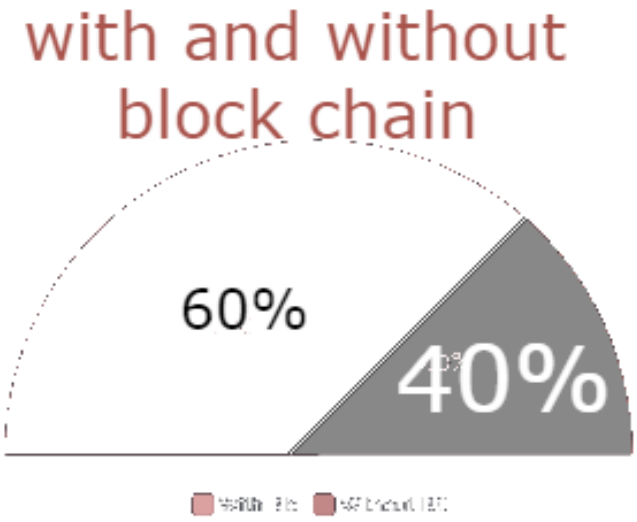

Fig. 5. Security comparison

Improvement in Efficiency:
Data Integrity: Blockchain ensures the integrity and security of health records

by creating a tamper-proof and transparent record of all transactions. QR codes can be used to link physical documents to their digital counterparts, ensuring that the data is authentic and unaltered.

Accessibility: Digital health records stored on a blockchain can be accessed securely and instantly by authorized parties. This eliminates the need for manual retrieval of paper records, reducing the time and resources required to access patient information.

Interoperability: Blockchain can facilitate the interoperability of health records between different healthcare providers and systems. QR codes can store information about the patient's medical history, medications, and allergies, allowing healthcare providers to quickly access vital information regardless of the system they use.

In conclusion, combining blockchain technology with QR codes in the healthcare sector can enhance data security, accessibility, interoperability, patient empowerment, and overall efficiency compared to paper-based systems.

Aspect	**Blockchain-QR Integrated Hospital Management**	**Paper-based Hospital Management**
Data Integrity	Ensures data integrity using blockchain technology. Uses QR codes to securely link physical and digital records.	Prone to data loss, tampering, and errors. Records can be easily misplaced or damaged.
Accessibility	Records can be accessed instantly by authorized parties. Provides quick access to patient information using QR codes.	Requires manual retrieval of records, leading to delays. Information may not be readily available in emergencies.
Interoperability	Facilitates interoperability between different healthcare providers.	Lack of interoperability between different systems.
Patient Empowerment	Allows patients to control and share their health data securely.	Patients have limited access and control over their records.
Efficiency	Improves efficiency by automating processes and reducing paperwork.	Relies on manual processes, leading to inefficiencies.
Cost-effectiveness	Can lead to cost savings in the long run.	Paper-based processes can be costly and time-consuming.

Table 1. Comparison

6 Conclusion

Computers offer an automated approach to processing data, streamlining numerous procedures. This system comprehensively caters to the demands of clinical operations, facilitating efficient storage of patient-related information within the clinic. It generates comprehensive test reports and offers detailed prescriptions encompassing various tests, dietary recommendations, and prescribed medications for patients. This innovative system addresses the challenges inherent in the clinic's existing manual system, presenting effective solutions. By implementing this system, there's a significant improvement in securing patients' information, as access to the system necessitates authentication. Additionally, the system significantly bolsters the efficiency of operational activities within the clinic. These augmentations, incorporating more recent data, and specific examples, and expanding on the technical and practical aspects, could bolster the paper's depth, relevance, and potential for acceptance at a conference. Always ensure that any additional content aligns with the paper's primary focus and maintains a coherent narrative throughout. Feel free to review and incorporate these rephrased sentences into your work, ensuring they align with your intended message and context.

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