Patient Care Management using QR Code: Embracing Blockchain Technology

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***Abstract*—The emergence of QR has opened a vast variety of possibilities in the technology sector which made accessing, retrieving and viewing information and data from anywhere with great speed and low fault. It is a captivating way of accessing anything from a website or an application. Nowadays due to the ample use of mobile devices, using QR code technology we can easily establish connections and communicate with people and share information. It is also a secure way to share information because without the correct tool retrieving of data for someone else who is not intended to view is impossible. Introducing blockchain with QR code will increase this security one more level further. In this paper, we introduce MediQuick which is a Patient management app that uses both Quick Response (QR) code technology and Blockchain technology to create a secure electronic soft database of each individual hospital and access those data in a secure and fast manner. It also can be used by patients to schedule appointments for doctor consultation and retrieving their medical records and doctor-prescribed medicines.**

I. INTRODUCTION

Nowadays the Quick Response (QR) code system has been widely used by all sectors including medical, educational, and industrial because of its high confidentiality and ease of access. A unique QR code is given to all individuals which can be used to identify and verify the individuals and can be used to retrieve their information from the secure database. The individuals here are the patients, a unique QR code is given to all the patients who will be using the hospital services and during each visit, the respective consulting doctor will access and retrieve their information from the hospital database using the patients QR code and use those information/ medical records for future consultation of the patients. Then the doctor can add more consulting results and information about the patient's medical condition into the database which can be accessed later by any other doctor or nurse working in that hospital. The doctor can also prescribe medicines for that patients and those prescriptions can be also be accessed by doctors and nurses and also those information will be sent to the hospital pharmacy so that the medicines will be readily packed by the pharmacist when the patients reach there and collect those drugs which will reduce the waiting time in the queue to collect the medicines and which will effectively reduce the time spent by a patient at the hospital and will reduce the surge of patients at the hospital. This database is created by using blockchain which will increase its security. A blockchain database cannot be easily changed and these databases are immutable.

II. OBJECTIVES AND SCOPES

Most of the hospitals in India currently use the outmoded method of file management. That is, they use the pen and paper method. Room after room in a hospital filled with paper files this method is not a productive way of database management. There are a lot of threats that can be faced by using this method. It even includes security breaching. This method is so time-consuming and will reduce the productivity of the hospital organization. The main objective of MediQuick is to increase productivity, reduce the time taken by a patient at the hospital, reduce the time taken for documentation of medical records, protect the data from perils and provide security for the data.

There is so much need for increasing the speed at hospitals because of the increasing rush. A good hospital must be able

to efficiently manage incoming patients and do it as fast as possible. It can do so by using the MediQuick app. Digitally storing the data using blockchain will help to increase the confidentiality of the stored data and thus increase its security

III. PROPOSED SYSTEM

The proposed system includes developing an android app named "MediQuick" which can be used by both patients and doctors. Here in this system, all the medical reports associated with a particular patient are stored in the blockchain, a secure real-time database. At first, when a new patient registers at the hospital, he/she is given a unique QR code id, which will be printed on the patient registration card. So, when they approach the doctor, the doctor scans the QR code and can view and access the patient's details like previous reports, scan reports, lab reports, etc. The doctor can also upload the latest medical prescriptions and diagnosis details into the blockchain. Thus, the sensitive medical details of a patient are stored in a securely without the fear of loss of their private data.

IV. EASE OF USE

A. Single application for all

There is only a single application needed. No separate applications are provided to doctors, nurses, and patients. All users can use the same applications for their specific needs and a different User Interface (UI) is provided to each user. The services and access control provided to each of them are disparate so that unwanted usage and modifying of the data are hindered.

Fig. 1. Start Screen

B.User-friendly User Interface (UI)

The hospital services are used by all kinds of people starting from kids to elderly people. And each of these people may have different difficulties using a mobile device. The app user interface (UI) is created such that it can easily learn and be used by most patients.

C.Self-helping hand at hospitals

There will be helping services at hospitals to help elderly people who come to hospitals without any companion to use the application

D.Simple storage and access of large databases

Due to the use of the Quick Response (QR) code, the storage of large information and data is easy. A simple unique QR code can be used to access and store a very huge amount of information. This helps to retrieve the required information in a faster and smarter way.

V. SYSTEM DESCRIPTION

A. Architecture

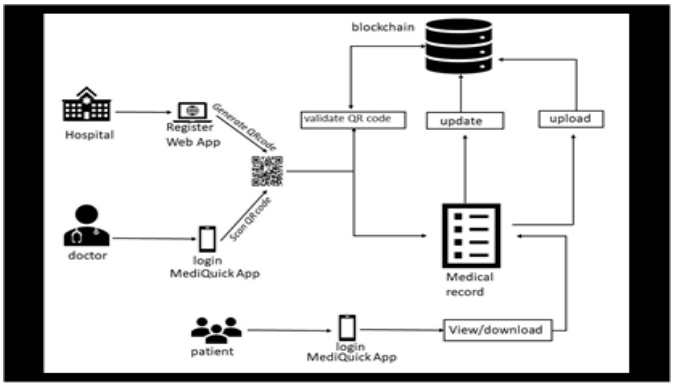

Fig. 2. Architecture

B.Classification of User Interface

The user interfaces of the app are designed to be used for two types of users. One for the doctors and the other for the patients. A web interface is developed for the hospital for the initial registration of the patients by accessing the relevant details.

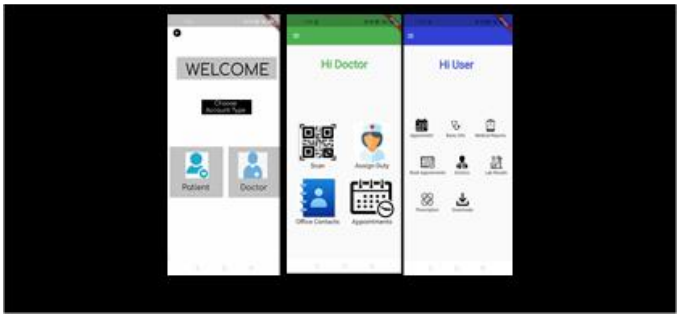

Fig. 3. Home Pages

C.Classification of Modules

In this system, there are mainly five modules

- Registration
- Medical Databases
- App Development
- Medical Block Updation
- Report Generation

The registration of the new patient with the hospital is done in the registration module. The required details of the patients are gathered and entered into the database using a web application. The details include name, address, age, any medical complications etc. After collecting the details, a unique QR code-printed smart op card is given to the patients for future use.

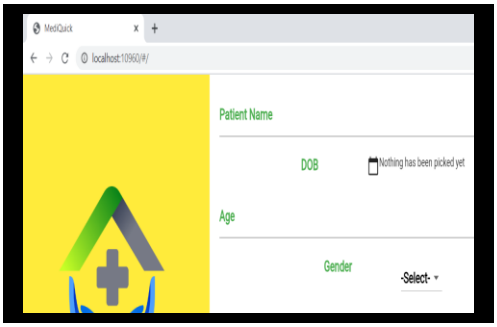

Fig. 4. Patient Registration

A medical database is created with patient's information with a unique access ID. The steps include deploying smart contracts, a code that executes on its own when both the parties agree on the set of protocols. Here we consider the Hospital admin as one end-user and the patient as another party. Invoking, Record creation, and Validation are the three main steps during the execution of the smart contract. The access level of different participants is defined and governed by the admin.

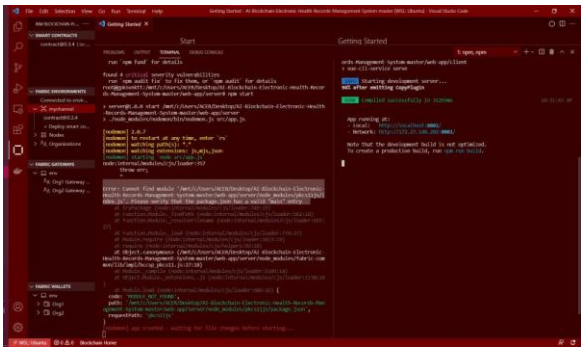

Fig. 5. IBM Blockchain Platform on VS code

The patients can log into the MediQuick app and can download or view medical records, prescriptions and lab reports. They don't have access to modify or delete any of their information.

Medical block updating can be done by the doctor. The doctor, after scanning the QR code, can view previous medical reports and can update the medical records and prescriptions.

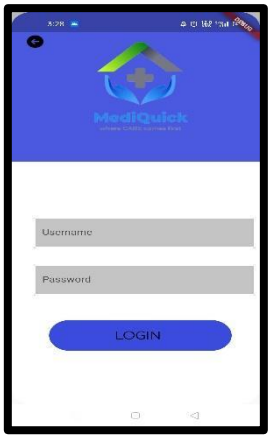

Fig. 6. Login Screen

VI. SYSTEM REQUIREMENTS

A.Software Requirements

- Docker Desktop – it is a computer application available on both Mac operating system and windows which is used to build and share containerized applications and microservices.

- Visual Code editor - It is a computer application used to develop mobile applications and web applications for the system. It can be used to create user interfaces and establish their connections. The mobile application is created using Flutter using the DART programming language.
  Visual code is used for creating the blockchain part of this system. IBM blockchain platform extension on Visual Code editor will help to create a blockchain which is used to store data in the system

B.Hardware Requirements

The hardware which is needed for the development of the system is a computer with an intel core i5 11th gen processor and 8gb of RAM. These are required for the effective designing of the software. Also, a minimum hard disk space of 256gb is required.

VII. RELEVANCE

- This system will securely store patients' data records
- This system can easily retrieve patients' information from the database
- It will save lots of time and resources that was wasted during maintaining physical offline health records
- Doctors can utilize their time for better and efficient treatment of patients
- QR code can aid healthcare providers in effective patient identity management
- Reduce medical errors and enhance administration

VIII. FUTURE SCOPE

- Expanding the application for a network of hospitals
- Licensing EHR to pharmaceutical companies for research
- Developing the app for other platforms
- Scheduling appointment for the future month

IX. CONCLUSION

Our system uses a secure blockchain method to store a patient's medical records which can be accessed by authorized parties, that is, the patient himself, or the doctor, and can only be modified by a doctor or the admin. All the data stored in the blockchain is secure against any human error and hacking. Complete confidentiality is provided to the patients by our system. Using our system will effectively reduce the waiting time of the patients for doctor's appointments. In the future, The patients can

easily walk in for a doctor's consultation just by taking appointments in his/her mobile app.

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