

Title:

Health Record Management System.

1.Problem statement

The medical records are very crucial and important for any person and organization. Strong data protection measures are crucial for safeguarding the privacy of individuals. In the era of digital world, the privacy and security of the medical records are very crucial. There is high chance of data breaching in centralized systems.

It needs a decentralized system that can provide privacy and protection. Blockchain has that potential which can make a big impact in the area of privacy and security of the data. Decentralized and immutability of the blockchain technology can provide a robust and secure architecture for the medical industry. This technology can prevent the hacker or attackers to misuse the medical records of any individual or organization.

2.Proposed model

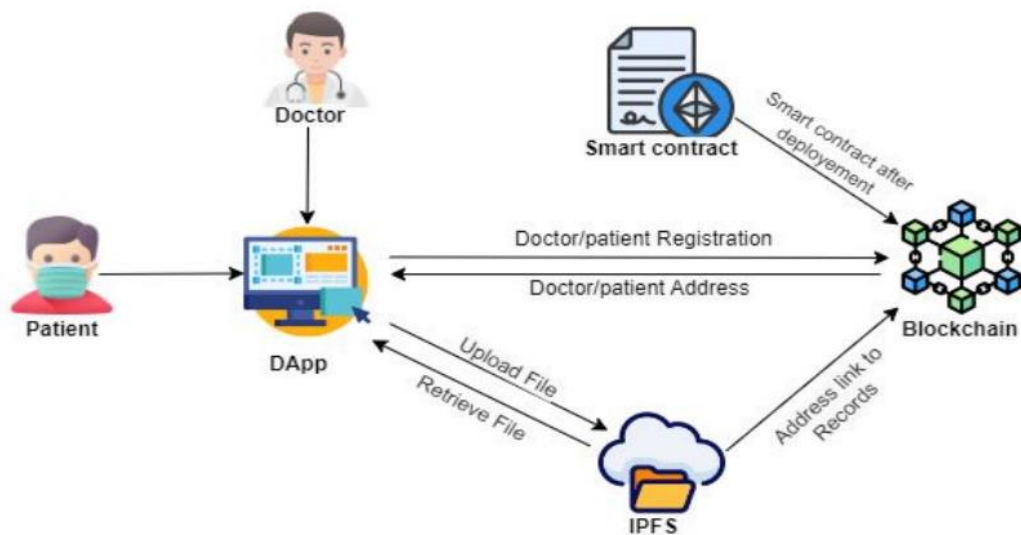
The proposal model is designed and developed to provide medical consultant services to the users. It provides the secure communication channel for the communication between the users and store the user's data on the blockchain and IPFS.

The Ethereum blockchain is used in the proposed model. The proposed model works in the decentralized manner and provide the more security and privacy to the digital records as compare to centralized systems. Medical records can not change or modify after uploading on the blockchain. Because of the immutable feature of the blockchain.

The proposed model has the different portals and functionality for the different users.


3. Architecture and workflow of model

Architecture:



The decentralized application is designed and developed to make easy and fast user experience. The proposed model has the 2 portals one is for the patient and another for the user as a doctor.

Sign-up for Doctor:



Welcome to Medi-Records

Login
SignUp

Register As:

Sign Up as Doctor

Name

Email

Please select your gender

- ☐ Male
- ☐ Female

Specialization


Registration Number

Consultation Fee (in INR)

Wallet Address

Sign Up

Sign-up for Patient:



Welcome to Medi-Records

Register As:

Sign Up as Patient

Name

Email

Please select your gender


☒ Male

☐ Female

Phone Number

Wallet Address

Log-in page:



Welcome to Medi-Records

Register As:

Login

1. Doctor portal

The doctor can register using the MetaMask address and other required details. After successful sign-up, the doctor is re-directed to the portal where the user can see his profile and can see the patient's appointment in the appointment portion. The doctor can talk to the patient on the phone number given in the patient details and prescribe the medicine based on the discussion. After the successful appointment, the doctor can upload the prescription and test reports to the blockchain, and documents will be stored on the IPFS.

Profile of Doctor:

Welcome Doctor

Profile
Patients
Reports
Sign Out

Profile

Name

krishan

Email

krishan@gmail.com

Gender

Male

Specialization

heart

Registration Number

123

Consultation Fee (INR)

150

Update

Wallet Address

0x232FF94B6F38eFf40814F28892bDA3Dd523A0865

Patient Details on Doctor's Portal:

Welcome Doctor

Profile
Patients
Reports
Sign Out

Patients

9876543210

ashutosh

ahu@gmail.com

pain in the left side of the chest and feeling mild pain in heart

0x436Ea982EcB1bF1A9B7747724E091344dbC3a8C

View Records

Complete Consultation

Prescription Details on Doctor portal:

The screenshot shows a web browser window with the URL `localhost:3000/DocDashboard.html`. The page is titled "Upload Reports" and features a sidebar with the following links: "Welcome Doctor", "Profile", "Patients", "Reports", and "Sign Out". The main content area contains the following fields:

- CID**: `QmcSQ6oFK5CxtJpBEKyvowPEkoKlaybd4CYJPa4ThquU9M`
- FileName**: `Blank Prescription Template.pdf`
- Patient Id**: `0x436Ea982EcB1bF1A9B7747724E0f91344dbC3a8C`
- Please upload PDF file only**: A red text label above a file input field.
- Choose File**: A button next to the file input field.
- Blank Prescription Template.pdf**: The filename of the selected file.
- Upload File**: A green button.
- Upload Report**: A green button.

Overlaid on the right side of the browser window is a MetaMask notification window. It shows a transaction to `0x2e16...aC8b1` for `0.00049086 ETH`. The notification includes a "Reject" button and a "Confirm" button.

2. Patient portal

The patient needs to sign up in the portal using the MetaMask address and other require details. After successful registration the patient can see the list of doctor and specifications. Patient can select the based on the his/her requirement and doctor's specialization.

Patient can take the appointment through the portal and provide the necessary details of decease. The selected doctor will get the notification of appointment of patients on his/her Portal and can consult the patient.

After the successful consultation the patient will get the prescription on his Portal and patient can download the prescription.

Profile of Patient:

Welcome Patient

- Profile
- Doctors
- Appointments
- View Reports
- Sign Out

Profile

Name
ashutosh

Email
ahu@gmail.com

Gender
Male

Ailment
pain in the left side of the chest and feeling mild pain in heart

Phone Number
9876543210

Wallet Address
0x436Ea982EcB1bF1A9B7747724E0f91344dbC3a8C

Doctor List on Patient's Portal:

Doctor's List

Doctor's Id	Name	Speciality	Fees	
0x232FF94B6F38eFf40814F28892bDA3Dd523A0865	krishan	heart	150	Consult

Appointment List on Patient's Portal:

Welcome Patient

- Profile
- Doctors
- Appointments
- View Reports
- Sign Out

Appointments

krishan

krishan@gmail.com

heart

123

0xe20a22cebe92AB81aE44bAb789A1BCEACeF561F5

Prescription after doctor appointment:

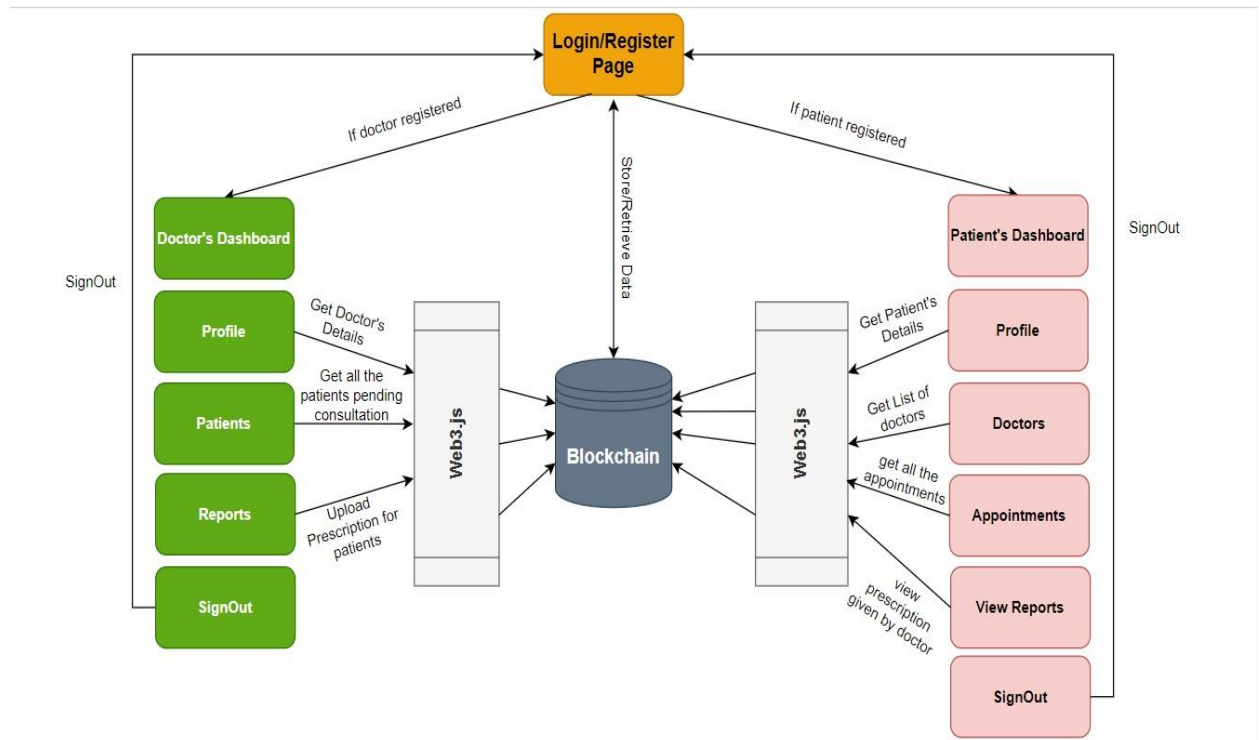


Transaction Details on Sepolia Test Network:

Table showing transaction details on the Sepolia Test Network, including transaction hash, method, block, age, from, to, value, and fee.

Sepolia Testnet								
Search by Address / Txn Hash / Block / Token								
Etherscan								
Contract 0xB23bc2764aF82F10503Ed2F882d874C3B7Bc345								
Source Code								
Overview			More Info			Multichain Info		
ETH BALANCE 0 ETH			CONTRACT CREATOR 0x232FF94B...d523A0865 at txn 0x32e6e158a9...			N/A		
Transactions								
Latest 11 from a total of 11 transactions								
Transaction Hash	Method	Block	Age	From	To	Value	Txn Fee	
0x8189af7078c...	Add Record	5708948	5 hrs ago	0x232FF94B...d523A0865	0xB23bc276...C3B7Bc345	0 ETH	0.00049119	
0x0adda944efe...	Pay Doctor	5708875	6 hrs ago	0x96483FE1...45A3ffCeB	0xB23bc276...C3B7Bc345	0.00078679 ETH	0.00010956	
0x998e37c4e3...	Pay Doctor	5708868	6 hrs ago	0x96483FE1...45A3ffCeB	0xB23bc276...C3B7Bc345	0.00078679 ETH	0.00011218	
0x3b1c6a3921...	Add Record	5708859	6 hrs ago	0x232FF94B...d523A0865	0xB23bc276...C3B7Bc345	0 ETH	0.00052822	
0x4388b18dfbc...	Pay Doctor	5708848	6 hrs ago	0x96483FE1...45A3ffCeB	0xB23bc276...C3B7Bc345	0.00078679 ETH	0.00013729	

The flow of the application is depicted in the flowchart below:



5. Testing results

The smart contract testing is carried out using the hardhat framework which includes mocha and chai. The following are the test cases the dapp is tested for

1. We have tested if the contract is deployed successfully by checking if the owner of the deployed contract is the one who deployed the contract.
2. We have tested for the events emitted by the addDoctor, addPatient and addRecords functions of the smart contract. We have checked if the events emitted are with the same name and arguments as declared in the contract.
3. We have tested for the correctness of the data stored in the blockchain. This is done by checking individual input data with the data stored in the blockchain.
4. In total there are test cases written to verify correctness of data and all of them have passed. Below is the screenshot for the same executed and its result


```
PROBLEMS  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS

Singhal@DESKTOP-5GTQ9DT MINGW64 ~/Desktop/Medi-Records
$ npx hardhat test

MediRecords Contract deployment
  ✓ The contract should deploy successfully (20137ms)

MediRecords Contract Events
  ✓ Adding Doctor should emit Doctor Added Event
  ✓ Adding Patient should emit Patient Added Event
  ✓ Adding Patient Records should emit Record Added Event
  ✓ Testing Add Records if Doctor not present

MediRecords Contract Stored Values
  ✓ Testing Doctors Stored Value (683ms)
  ✓ Testing Patients Stored Value (97ms)

7 passing (21s)
```

6. Future scopes & enhancement:

- The present proposal model does not have the inbuilt calling feature which can be added in future.
- In the future enhancement the feature of video calling can be added which will make the consultation process easier and fast.
- The transaction cost of the model is little high which can reduce in future.
- Two factor authentication can make the proposed model more secure and robust which can enhance in future.
- The banking network system is not available in the prototype model which can be added in future.