

SMART HEALTH CONSULTING ONLINE SYSTEM

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ABSTRACT :

Telehealth has gained a huge traction during the Coronavirus (COVID-19) pandemic. Tele- health enables physicians and medical care providers to remotely care for patients and monitor their symptoms. Today's telehealth systems fall short in providing transparent, immutable, traceable, auditable, secure, and trustworthy services. In addition, they are centralized and subject to the single point of control and failure. In this paper, we propose a private blockchain-based solution to overcome the aforementioned challenges. We demonstrate how specifically three important telehealth services; namely, teleconsultation, drug administration, and medical testing can be enhanced using blockchain technology. Our proposed solution also ensures integrity, immutability, accountability, and non-repudiation for telehealth transactions initiated by multiple actors. For storing and keeping track of large-size digital content, such as images and audio and video recordings of telehealth service sessions, our proposed solution is integrated with off-chain storage systems including cloud storage or a decentralized storage system as that of the Interplanetary File System (IPFS). The registered participants are provided with access privileges based on their roles to ensure that restrictions are enforced on-chain. Smart contracts are developed to maintain data provenance and generate reliable alerts and notifications. The implementation and testing details of the algorithms are presented. We discuss, compare, and analyze the security features of our solution

INTRODUCTION

The Coronavirus (COVID-19) outbreak has begun in late 2019. It is confronting and challenging the existing healthcare systems. Recently, many doctors living in the U.S. felt the urge to step in during the COVID-19 Indian crisis [1]. This was made possible through telehealth services and remote consultations. Although telehealth is not a new

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technology, the spread of the pandemic urged the healthcare industry to work around the hurdles and expedite its adoption world- wide [2]. Telehealth has proven to be a practical, convenient, and beneficial tool in many healthcare services (e.g., during pregnancy and for aiding diabetic and psychiatric patients) [3]–[5]. Shifting from face-to-face to remote and The associate editor coordinating the review of this manuscript and approving it for publication was Sedat Akleylek . virtual interactions can help to maintain ongoing care and treatment despite travel restrictions and geographic boundaries. The unprecedented challenges posed by the pandemic have led to redesign the healthcare model to triage and timely deliver services while reducing the risk of contamination and transmission of COVID-19 [6]. Technology and expense are important factors that can play a major role in curbing and limiting the integration and interoperability of telehealth into the healthcare mode

LITERATURE SURVEY

Perspective: What a difference a disaster makes: The telehealth revolution in the age of COVID- 19 pandemic

J. R. Maese, D. Seminara, Z. Shah, and A. Szerszen

Despite the existence of telemedicine since the late 1950s and early 1960s, it took a pandemic to bring this technology mainstream. The critical urgency of the pandemic drove an auspicious alignment of policy, economics, and technology to facilitate the widespread implementation of telehealth. It is imperative that this synchronicity be maintained in the post-COVID era in order to optimize our health care system to be ready for the next threat to the health of the United States.

Telehealth lifestyle interventions are gaining increasing popularity for use in pregnancy for management of complications such as gestational diabetes¹ and for monitoring of blood pressure.² Telehealth has also been used in trials in low-income and middle-income countries, particularly in rural communities where access to antenatal care is challenging.³ The option of using telehealth in antenatal care has been brought sharply into focus with the coronavirus disease 2019 (COVID-19) pandemic. Pregnant women are considered a vulnerable group and are therefore advised to be stringent with public health measures such as social distancing and self-isolation to

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lower their risk of exposure to the virus. This advice has led to recommendations to limit face-to-face consultations and for rapid implementation of remote access to antenatal care throughout the UK.⁴ The methods and outcomes of the GLOW randomised controlled trial done by Assiamira Ferrara and colleagues⁵ and published in The Lancet Diabetes and Endocrinology are therefore of interest and are particularly relevant during the current COVID-19 pandemic.

EXISTING SYSTEM :

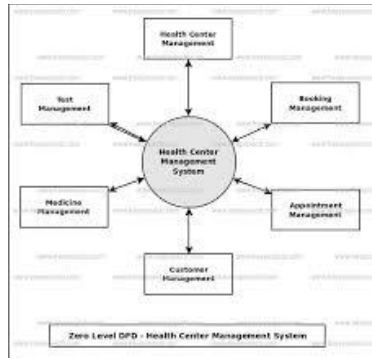
This section describes the details of our system design. It explains the breakdown of our solution and presents the sequence of events in the smart contracts and solidity code. Figure 1 shows the components of the proposed blockchain- based solution. The system depends on the doctors and the medical practitioners who aim to provide in-home treatment services remotely. The doctors rely on teleconferencing calls to see and hear the patients and assess their needs. Medical drugs are administered as needed as well as medical tests are carried out when necessary. Courier services are also used to make treatment and testing possible. The video calls are all recorded and uploaded on a cloud storage or a decentral- ized storage platform such as IPFS. The system is managed, traced, and tracked through blockchain. The role of each part in the system is also explained below in further detail.

PROPOSED SYSTEM

We propose a blockchain-based decentralized solution for telehealth services, which does not depend on third parties or centralized servers. • We show how to integrate our decentralized on-chain framework with off-chain storage systems such as cloud storage or a decentralized storage system as that of the Interplanetary File System (IPFS). Off-chain storage is used for storing and keeping track of large-size digital content such as video calls of telehealth sessions. • We develop four smart contracts along with six algo- rithms to register the participating entities and offer the patients different telehealth services in a manner that is transparent, traceable, auditable, private, secure, and trustworthy. • We implement and test the developed smart contracts for three different telehealth services: teleconsultation, drug administration, and medical testing. We make the code publicly available on GitHub.¹ • Our proposed blockchain-based

telehealth solution is generic enough to be adapted into different use case scenarios with minimal efforts and modifications.

SYSTEM ARCHITECTURE :

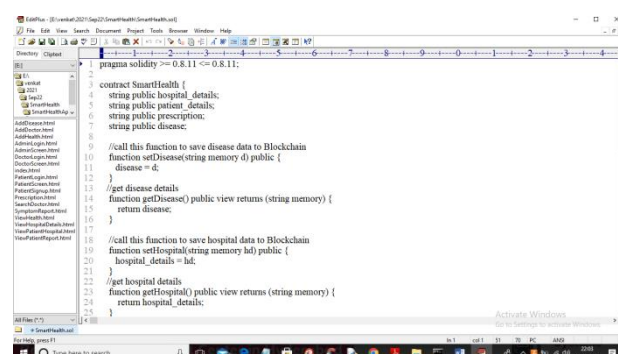


IMPLEMENTATION:

MODULES:

- 1) Admin: admin can login to application by using username and password as 'admin' and 'admin'. After login admin will add doctors and hospital details and can add disease details, medicine and symptoms details.
- 2) Doctor: doctor can login to application by using username and password given by admin and then can view all appointments from patients and prescribe medicines
- 3) Patient: patients can signup with the application and then login and then search disease and its medicine details and can take appointments and can view prescription from doctors.

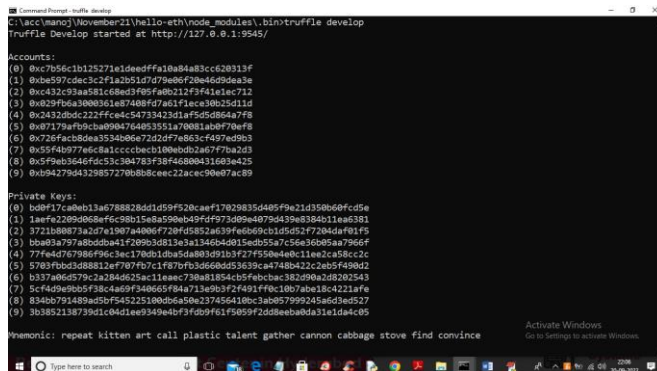
To store data in Blockchain we need to design SMART CONTRACT which contains functions to store and retrieve details from Blockchain. We have designed following Contract for this project.



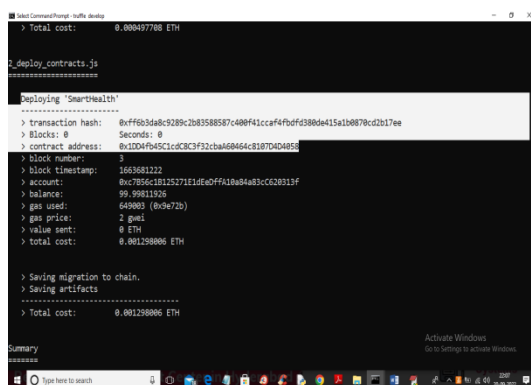
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In above Smart Contract screen for different data storage we have defined different Blockchain functions and to deploy this contract on Blockchain Ethereum tool we need to follow below steps

Go inside 'hello-eth/node_modules/bin' folder and then double click on 'runBlockchain.bat' file to start Ethereum tool and get below screen



In above screen Ethereum generated some default account and private keys and now type command as 'truffle migrate' and press enter key to deploy contract and get below contract address

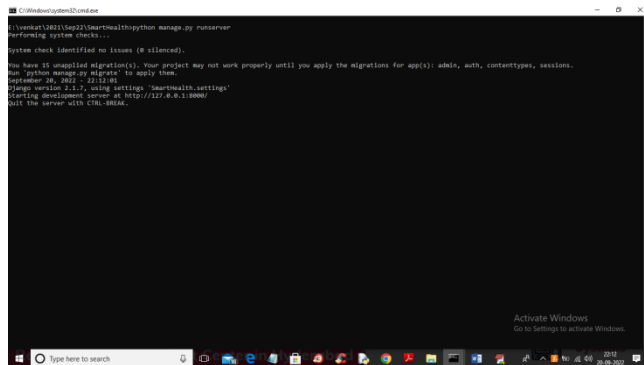


In above screen in white colour text we can see ‘SmartHealth’ contract deployed and we got contract address also and this address we need to specify in python program to store and read data from Blockchain. In below screen showing python code calling Blockchain Smart contract



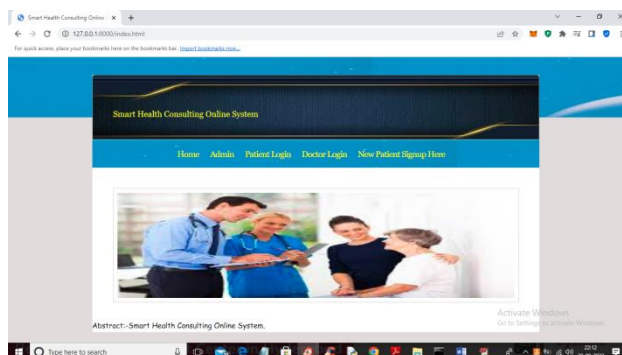
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In above screen read red colour comments to know about Smart Contract calling from python code. Now contract deployed and now double click on 'run.bat' file to start python Django web server and get below screen

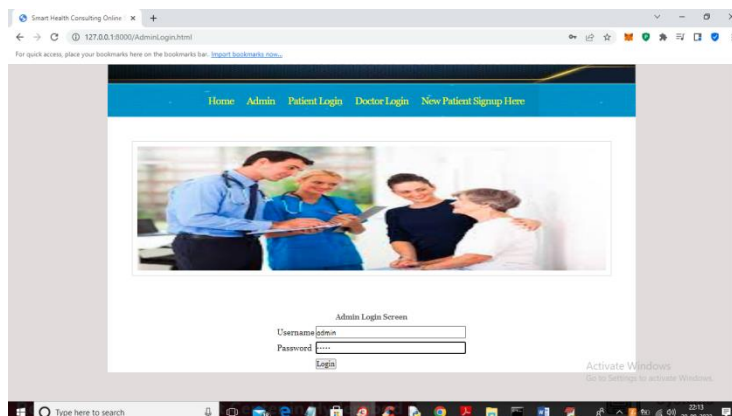


```
C:\Windows\system32\cmd.exe
C:\Users\pat123\OneDrive\Desktop>python manage.py runserver
Performing system checks...
System check identified no issues (0 silenced).
You have 11 unapplied migration(s). Your project may not work properly until you apply the migrations for app(s): admin, auth, contenttypes, sessions.
Run 'python manage.py migrate' to apply them.
September 26, 2023 - 17:10:00
Django version 3.1.7, using settings 'smarthealth.settings'
Starting development server at http://127.0.0.1:8000/
Quit the server with CTRL-BREAK.
```

In above screen python server started and now open browser and enter URL as 'http://127.0.0.1:8000/index.html' and press enter key to get below page



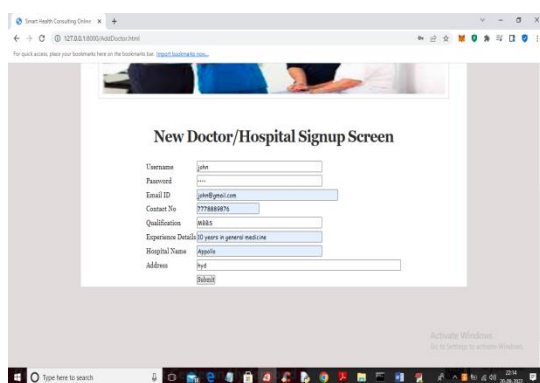
In above screen click on 'Admin' link to login as admin and get below screen



In above screen admin is login and after login will get below screen



In above screen admin can click on ‘Add Doctors/Hospital Details’ link to add doctor details and get below screen



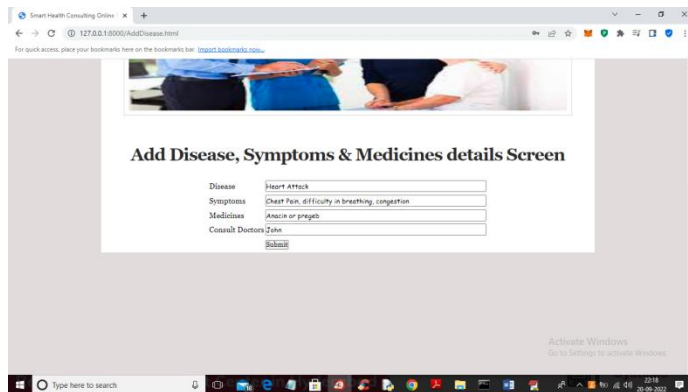
In above screen admin is adding doctor details and giving username and password and now press ‘submit’ to save record and get below output



In above screen doctor details saved in Blockchain and now click on ‘View Hospital Details’ link to view all doctor details



In above screen we can see doctor details and now click on ‘Add Disease’ link to add disease and symptom details



Smart Health Consulting Online

127.0.0.1:8000/AddDisease.html

For quick access, place your bookmarks here on the bookmarks bar: <http://localhost:8000/>

Add Disease, Symptoms & Medicines details Screen

Disease:

Symptoms:

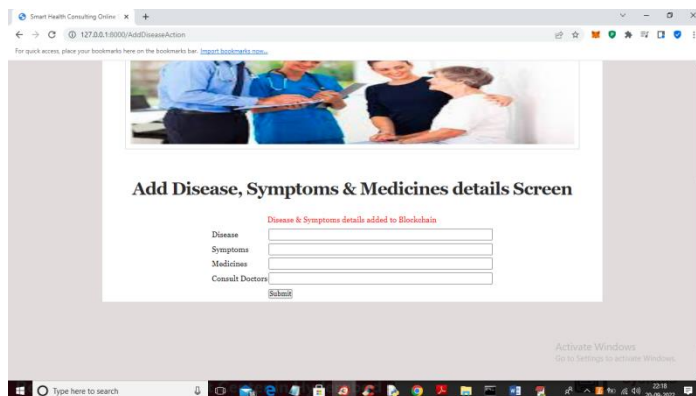
Medicines:

Consult Doctors:

Activate Windows
Go to Settings to activate Windows.

Type here to search

In above screen admin adding disease and symptoms and medicine details and then press button to get below output



Smart Health Consulting Online

127.0.0.1:8000/AddDiseaseAction

For quick access, place your bookmarks here on the bookmarks bar: <http://localhost:8000/>

Add Disease, Symptoms & Medicines details Screen

Disease & Symptoms details added to Blockchain

Disease:

Symptoms:

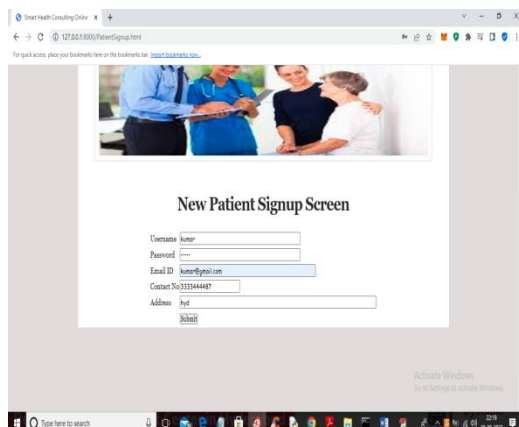
Medicines:

Consult Doctors:

Activate Windows
Go to Settings to activate Windows.

Type here to search

In above screen disease details saved in Blockchain and now logout and signup patient to book appointment



Smart Health Consulting Online

127.0.0.1:8000/PatientSignup.html

For quick access, place your bookmarks here on the bookmarks bar: <http://localhost:8000/>

New Patient Signup Screen

Username:

Password:

Email ID:

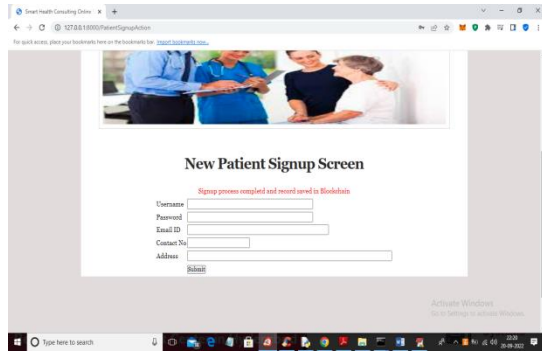
Contact No:

Address:

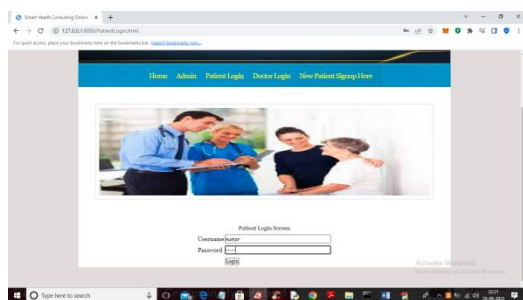
Activate Windows
Go to Settings to activate Windows.

Type here to search

In above screen patient is entering signup details and then press button to get below output



In above screen signup details saved in Blockchain and now click on ‘Patient Login’ link to login as patient



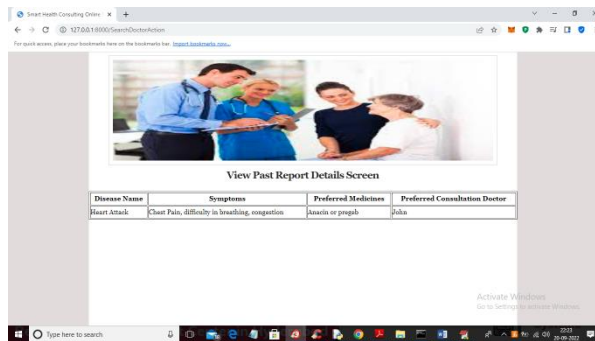
In above screen patient is login and after login will get below screen



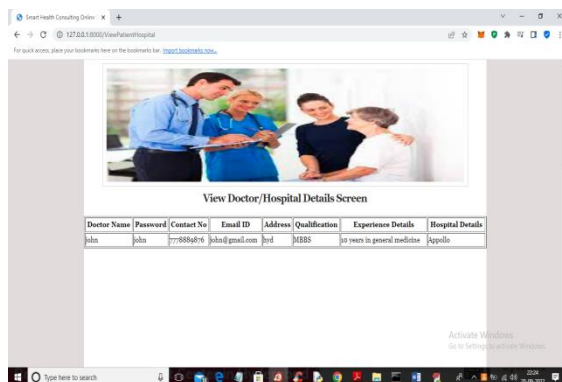
In above screen patient can click on ‘Search Doctor’ link to search disease and doctor details



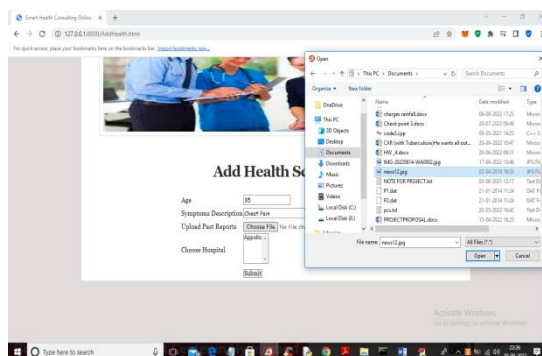
In above screen patient enter some symptoms details and then press button to get consultation doctor, medicines and disease name



In above screen patient can view all symptoms and medicine with doctor details to consult and now click on 'View Hospitals' to view list of hospitals and doctors like below screen



In above screen patient can view all registered hospitals and doctor details and after verifying all details and now patient can click on 'Take Appointment' link to take appointment like below screen



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In above screen patient will enter AGE and symptoms and then upload any document of TEST reports and then select hospital name and press button to confirm appointment like below screen



In above screen we can see report and appointment confirmed with Appollo hospital and now click on 'View Health Report' to view prescription like below screen

CONCLUSION

In this paper, we have presented a private blockchain-based telehealth solution. The proposed solution ensures traceability, integrity, and availability of the telehealth transactions and records related to medical care, diagnostics, and monitoring for remote and at-home patients. Our proposed solution leveraged private blockchain intrinsic features to ensure trust, accountability, integrity, transparency, and privacy. This research contributes in paving the way towards facilitating better medical care for people in rural and inaccessible areas. It also expedites medical attention to remotely ill patients. Using the permissioned blockchain network, we were able to maintain the patient's privacy and medical information securely. We showed how our system can be integrated with cloud and IPFS storage systems to facilitate the secure accessibility and traceability of immutable large-size digital content and video calls associated with telehealth service sessions. Our proposed system along with its implementation details, as well as smart contracts and their algorithms are given and studied in this paper specifically for COVID-19 patients; however, all can be tailored and extended in general for remote patients. In the future, we plan to deploy the full system in a real Ethereum blockchain main network (Mainnet) and build the relevant end-user Decentralized Applications (DApps)

REFERENCES

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