Configuration Manual

MSc Research Project
Cybersecurity

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MSc Project Submission Sheet

School of Computing

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Programme:	MSc in Cybersecurity	**Year:**	2023-2024
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I hereby certify that the information contained in this (my submission) is information pertaining to research I conducted for this project. All information other than my own contribution will be fully referenced and listed in the relevant bibliography section at the rear of the project.
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Configuration Manual

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1. Introduction

This guide offers detailed instructions for setting up an Electronic Health Record (EHR) system that is blockchain-based and decentralized. System requirements, installation methods, setting up a blockchain network, and security parameters are all covered. It is intended for IT professionals working in the healthcare industry and guarantees the safe, effective, and legal handling of patient data in a private blockchain setting.

2. Configuration

Python	3.11.5
Flask	2.2.2
Web3.py	6.20.0
Truffle	V5.11.5
Ganache	7.9.1
Node.js	20.15.1

3. Implementation

1) Create a virtual environment and activate the environment.

2) Install the required packages using pip.[1]
   - Flask = 2.2.2
   - Flask-SQLAlchemy = 2.5.1
   - Flask-Migrate = 4.0.4
   - web3 = 6.2.0
   - parsimonious = 0.8.1

3) Create Solidity Smart Contracts: Create smart contracts for the following essential features: data retrieval, medical history updates, patient and physician registration, and patient registration.
   To assemble and launch these contracts on a local blockchain emulator (Ganache), use Truffle Suite.

4) Deploy Contracts on Local Blockchain using Truffle and Ganache.

5) Create Flask Application: Set up a Flask application to serve as the backend for the EHR system.

6) Configure SQLite Database.

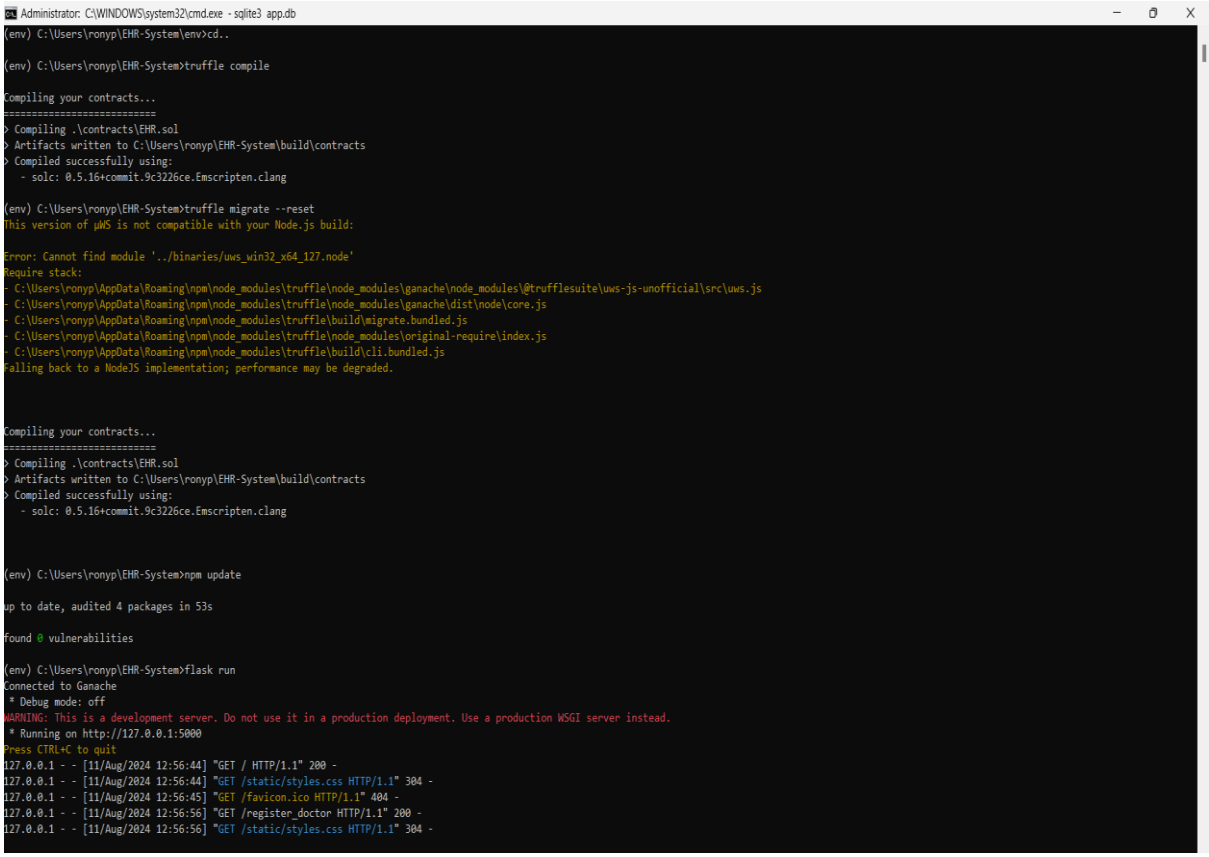
7) Design API Endpoints: To enable communication between the database and smart contracts, provide API endpoints.
   Add endpoints for patient and physician registries, dashboard access, and medical record editing.

8) Develop a simple Frontend Interface: To create HTML templates, use the render_template method in Flask.
   To create an interface that is easy to use, incorporate input forms and employ certain CSS styles.
9) Integrate Web3.py with Smart Contracts: To communicate with the deployed smart contracts, use Web3.py. Allow features like utilizing private keys to sign transactions and upload them to the blockchain.

10) Testing and Validation by Conducting many functional tests to verify that every aspect of the program functions as intended and verify the legitimacy and immutability of the transactions on the local Ganache blockchain. [2]

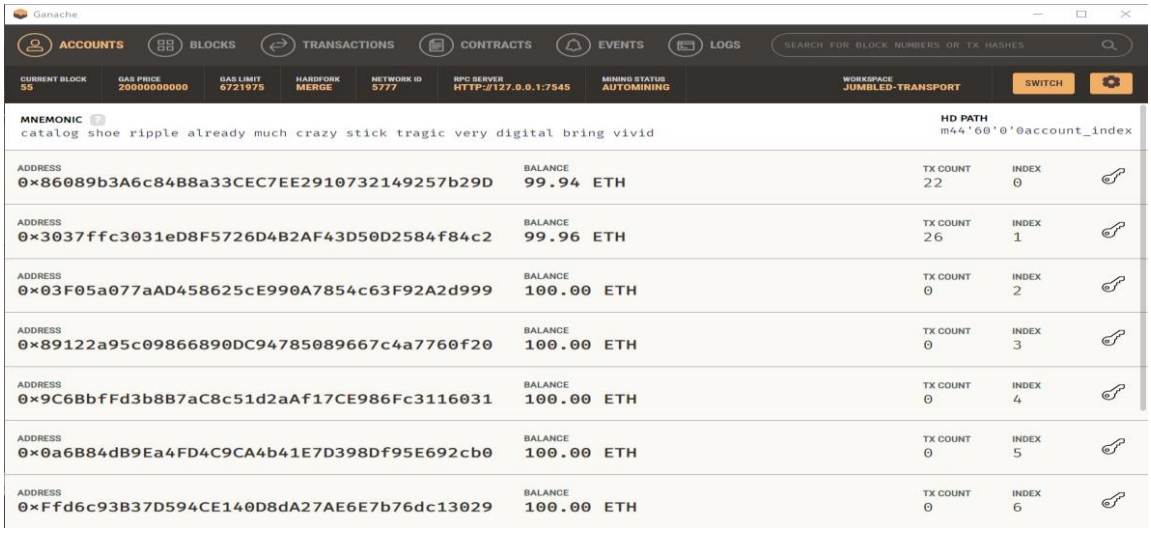
4. Procedure and Screenshots

I. This image displays the complete environmental setup and command codes required to compile, deploy, and host the project

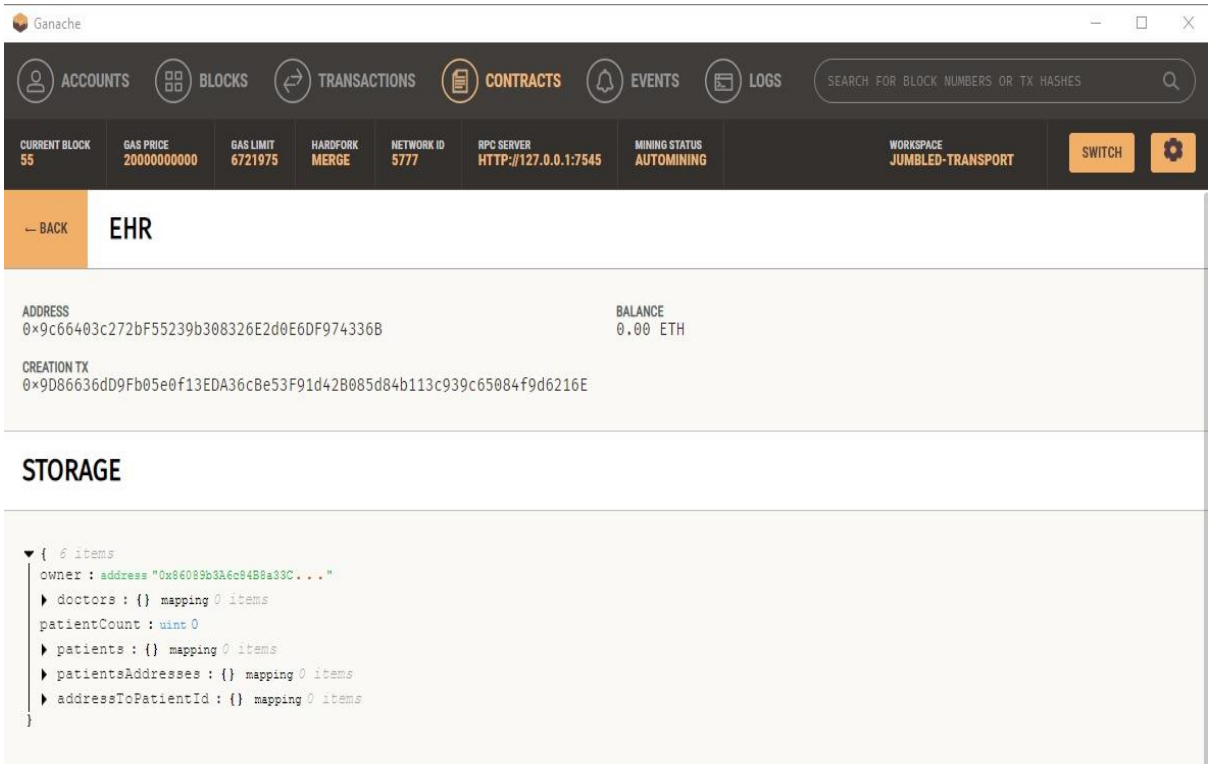


```
Administrator: C:\WINDOWS\system32\cmd.exe - sqlite3 app.db
(env) C:\Users\ronyp\EHR-System\env>cd..

(env) C:\Users\ronyp\EHR-System>truffle compile

Compiling your contracts...
===========================
> Compiling .\contracts\EHR.sol
> Artifacts written to C:\Users\ronyp\EHR-System\build\contracts
> Compiled successfully using:
   - solc: 0.5.16+commit.9c3226ce.Emscripten.clang

(env) C:\Users\ronyp\EHR-System>truffle migrate --reset
This version of µWS is not compatible with your Node.js build:

Error: Cannot find module '../binaries/uws_win32_x64_127.node'
Require stack:
- C:\Users\ronyp\AppData\Roaming\npm\node_modules\truffle\node_modules\ganache\node_modules\@trufflesuite\uws-js-unofficial\src\uws.js
- C:\Users\ronyp\AppData\Roaming\npm\node_modules\truffle\node_modules\ganache\dist\node\core.js
- C:\Users\ronyp\AppData\Roaming\npm\node_modules\truffle\build\migrate.bundled.js
- C:\Users\ronyp\AppData\Roaming\npm\node_modules\truffle\node_modules\original-require\index.js
- C:\Users\ronyp\AppData\Roaming\npm\node_modules\truffle\build\cli.bundled.js
Falling back to a NodeJS implementation; performance may be degraded.


Compiling your contracts...
===========================
> Compiling .\contracts\EHR.sol
> Artifacts written to C:\Users\ronyp\EHR-System\build\contracts
> Compiled successfully using:
   - solc: 0.5.16+commit.9c3226ce.Emscripten.clang


(env) C:\Users\ronyp\EHR-System>npm update

up to date, audited 4 packages in 53s

found 0 vulnerabilities

(env) C:\Users\ronyp\EHR-System>flask run
Connected to Ganache
 * Debug mode: off
WARNING: This is a development server. Do not use it in a production deployment. Use a production WSGI server instead.
 * Running on http://127.0.0.1:5000
Press CTRL+C to quit
127.0.0.1 - - [11/Aug/2024 12:56:44] "GET / HTTP/1.1" 200 -
127.0.0.1 - - [11/Aug/2024 12:56:44] "GET /static/styles.css HTTP/1.1" 304 -
127.0.0.1 - - [11/Aug/2024 12:56:45] "GET /favicon.ico HTTP/1.1" 404 -
127.0.0.1 - - [11/Aug/2024 12:56:56] "GET /register_doctor HTTP/1.1" 200 -
127.0.0.1 - - [11/Aug/2024 12:56:56] "GET /static/styles.css HTTP/1.1" 304 -
```

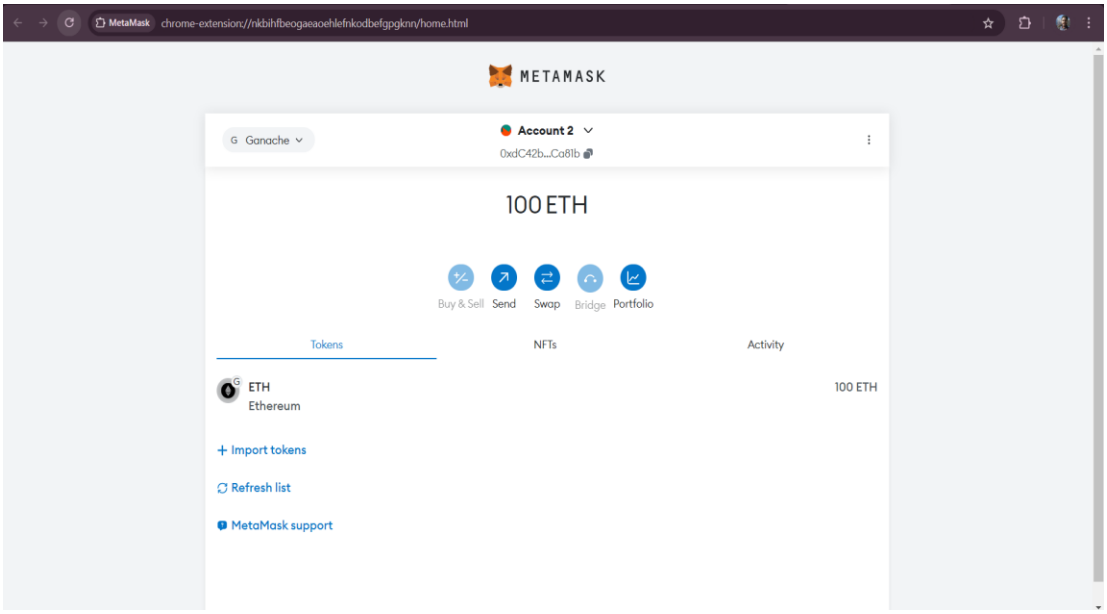
II. This image shows the Ganache interface which was used for testing blockchain as it provided crypto ETH with its address and private key.



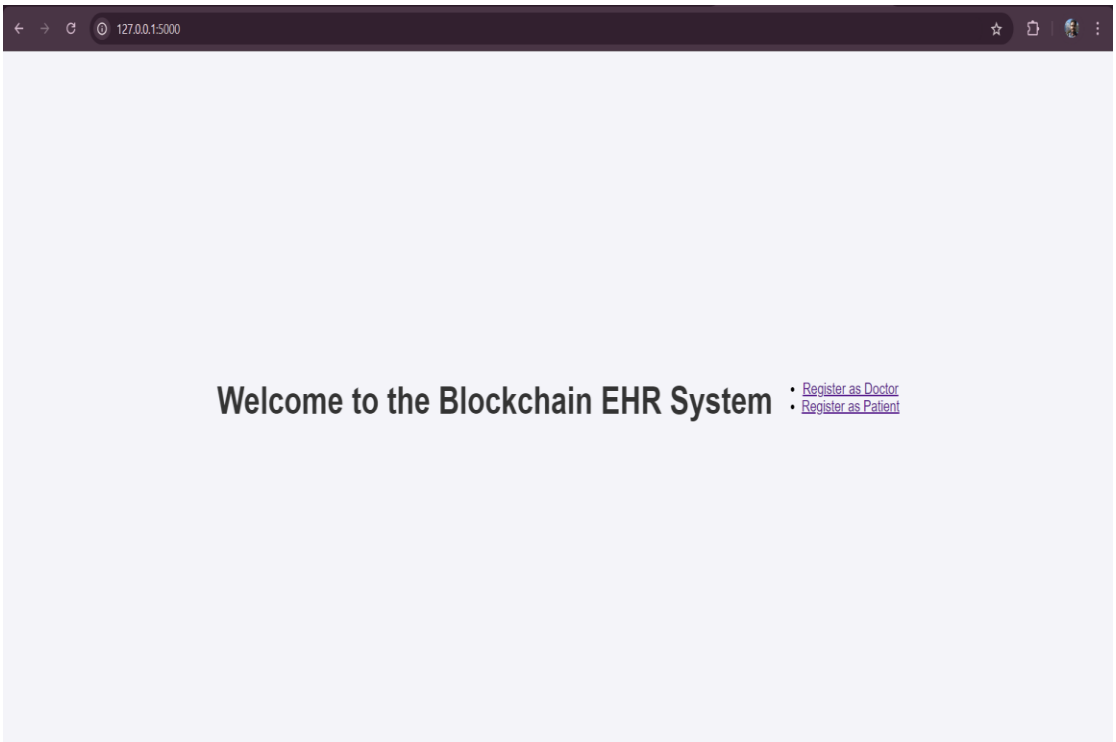
III. This interface shows the details of the owner after the successful deployment of the contract to the blockchain environment. Here address, storage, and mapping of the data can be monitored.



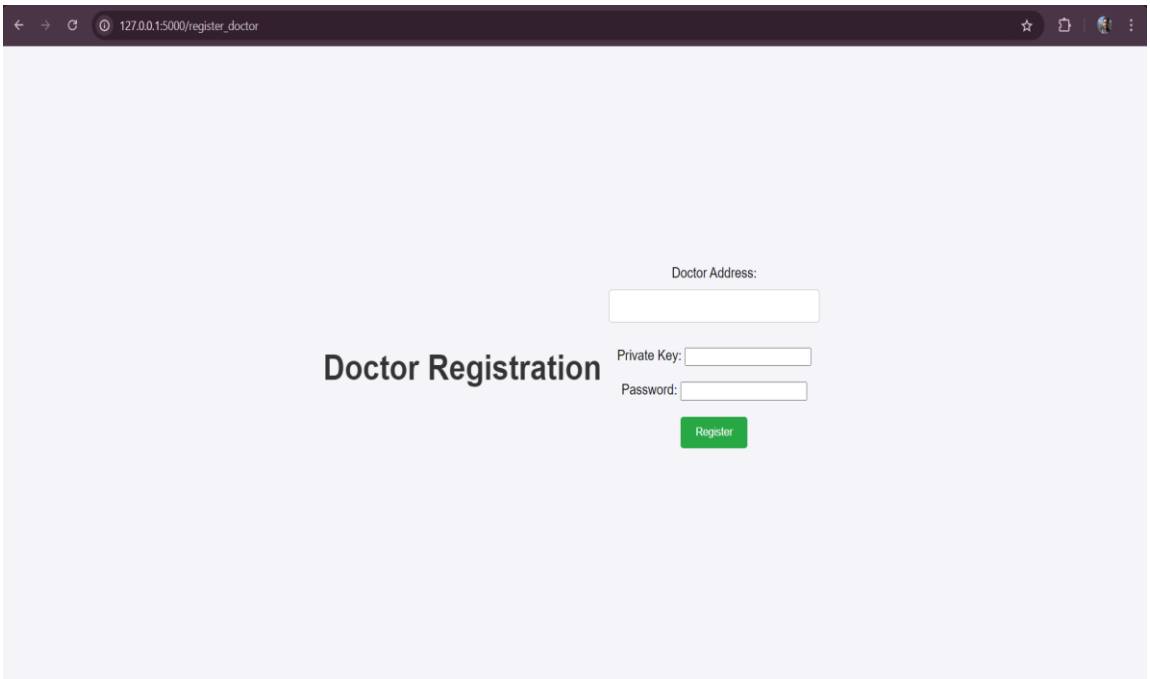
IV. Make sure your MetaMask is connected to Ganache and is linked to the local host network.



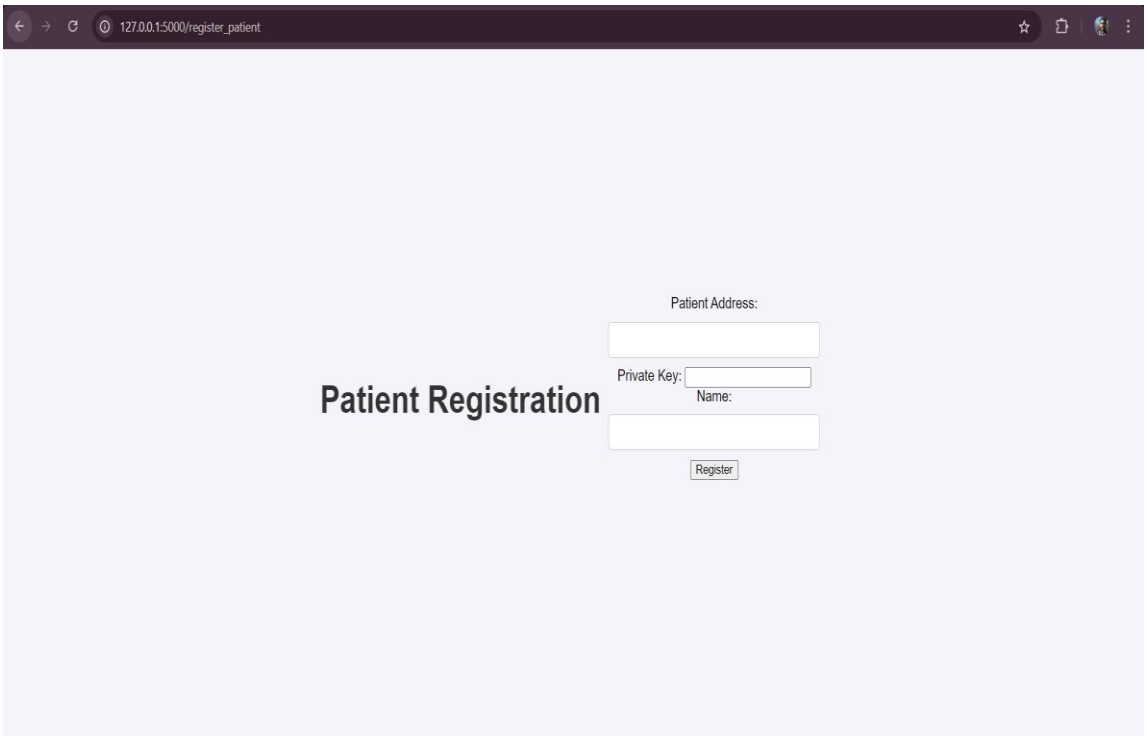
V. Frontend of the Project where Admin/owner could handle this page and insert, update, and delete the doctor's and patient's details.



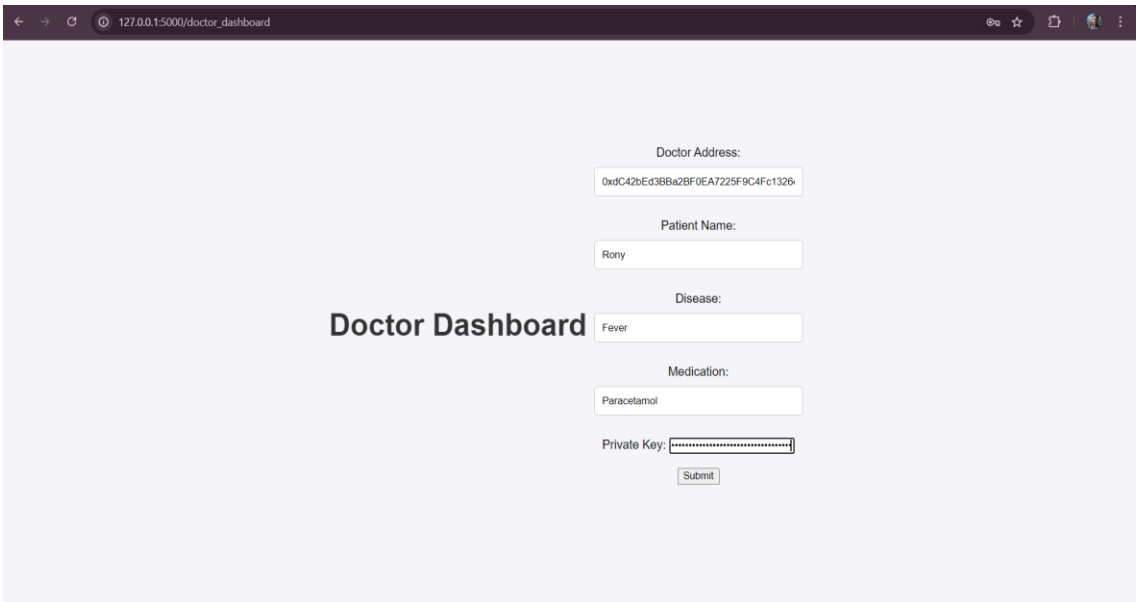
VI. The Doctor’s Registration interface and its form to insert a doctor's detail:

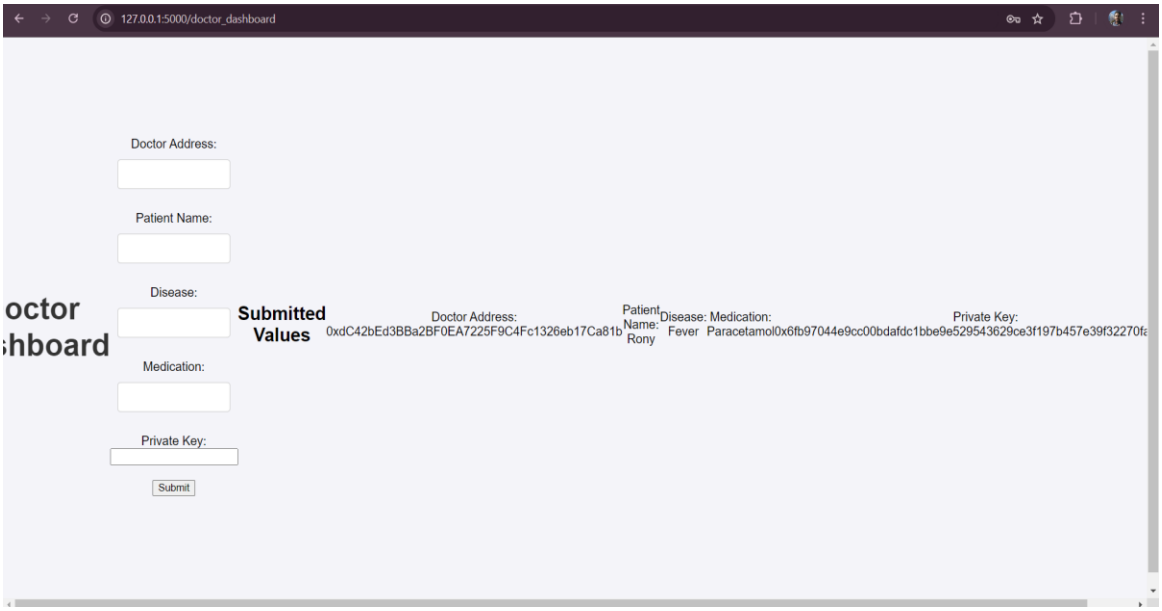


VII. The Patient’s Registration interface and its form to insert a patient's details:

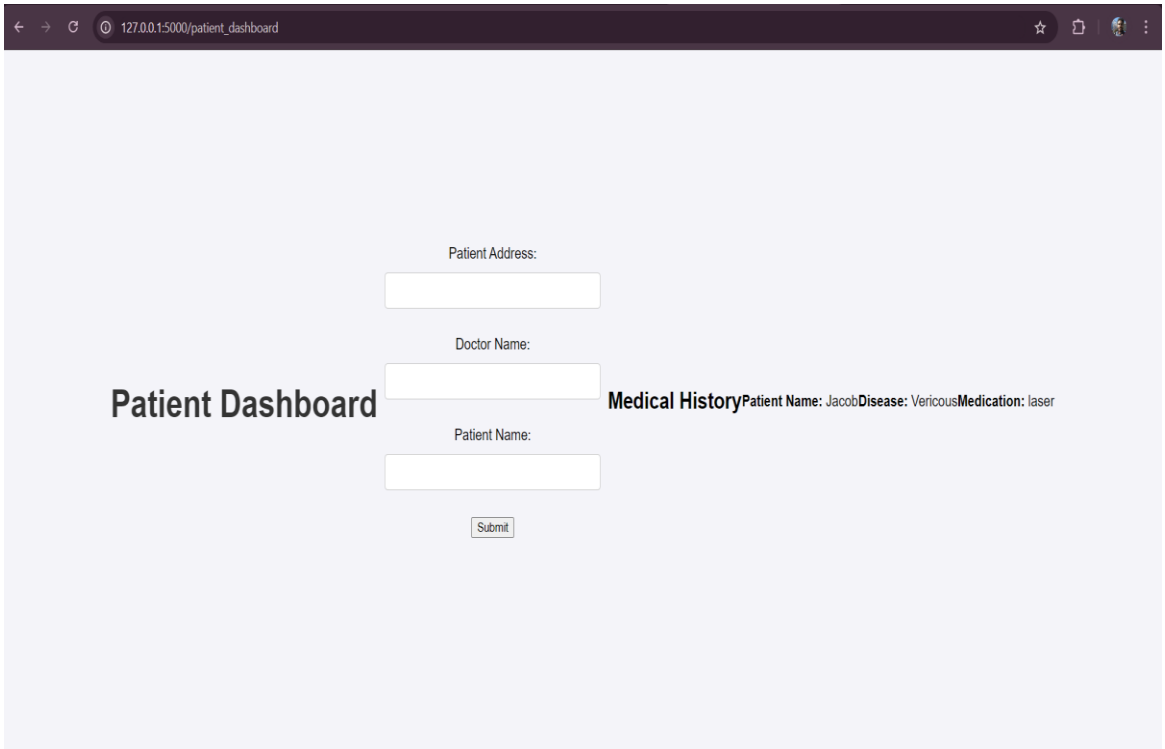


VIII. Doctor’s Dashboard where a doctor can detail a patient's disease and prescriptions and pass the private key. Submitted values with the key will be displayed, this is only viewed by the owner and doctor.





IX. The Patient can view the disease details and prescription, they just need to know the doctor's name and the patient's address at which mapping is done.



X. The patient data is getting stored in the database using SQLite.

```
(env) C:\Users\ronyp\EHR-System>sqlite3 app.db
SQLite version 3.46.0 2024-05-23 13:25:27 (UTF-16 console I/O)
Enter ".help" for usage hints.
sqlite> select * from patient;
1|Sam|Asthma|Inhaler|0x3037ffc3031eD8F5726D4B2AF43D50D2584f84c2
2|Daniel|Cough|Syrup|0x3037ffc3031eD8F5726D4B2AF43D50D2584f84c2
3|Samuel|Heart Disease|Deplat|0x3037ffc3031eD8F5726D4B2AF43D50D2584f84c2
4|Denson|Fever|Paracetanol|0x3037ffc3031eD8F5726D4B2AF43D50D2584f84c2
5|Mitchel marsh|Asthma|Inhaler|0x3037ffc3031eD8F5726D4B2AF43D50D2584f84c2
6|Pamela|Cancer|CART CELL|0x3037ffc3031eD8F5726D4B2AF43D50D2584f84c2
7|Rony|Fever|Dolo|22233717
8|Philip|Lung Conjestion|Cough syrup|22233717
9|Rony|Fever|Paracetamol|22233717
10|Ann|Stomach pain|Glucose|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
11|Ashik|Diabetes|Roseday 50mg|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
12||||
13|Jithin|BP|Meditation|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
14|Rahul|Allergy|citric|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
15|Francis|KK|Adi|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
16|Dani|Fatigue|Exercise|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
17|Geoshin|Vein|Adi|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
18|Anand|Sleepillness|Gastric|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
19|Anand|Sleepillness|Gastric|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
20|Frank|Fever|Syrup|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
21|David|Covid|Rest|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
22|Jacob|Vericous|laser|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
23|Shannan|Alcoholic|deaddiction|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
24|Shannan|Alcoholic|deaddiction|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
25|George|Flew|mask|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
26|Ram|Allergy|Soap|0xdC42bEd3BBa2BF0EA7225F9C4Fc1326eb17Ca81b
sqlite> Program interrupted.
```

5. Reference

[1] "The Python Standard Library," Python documentation. Accessed: Aug. 12, 2024. [Online]. Available: https://docs.python.org/3/library/index.html

[2] N. Satrio, S. Sukaridhoto, U. Al Rasyid, R. Putri Nourma Budiarti, I. Al-Hafidz, and E. Fajrianti, "Blockchain integration for hospital information system management," *Bali Med. J.*, vol. 11, pp. 1195–1201, Sep. 2022, doi: 10.15562/bmj.v11i3.3540.