NearestDoctor

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I. Introduction

In this century, AI techniques have greatly expanded in the wake of significant advances in computing power, the capability of managing large amounts of data, and increased theoretical understanding of AI. Increasingly, AI techniques have become an essential part of today's technological tools, helping to solve many challenging societal issues.
In recent years, there has been an amplified focus on the use of artificial intelligence (AI) in various domains to resolve complex issues. Likewise, the adoption of artificial intelligence (AI) in healthcare is growing while radically changing the face of healthcare delivery.
AI is being employed in many areas including hospitals, clinical laboratories, and research facilities. Yet, The technical challenges of health services pose new problems including :

- difficulty to find doctors available anytime.
- difficulty to get an appointment based on the nearestdoctor.
- difficulty In choosing the right specialist according to the symptoms.

II. Study of the existing

NATIONAL:

A. ***Med.tn :*** *Med.tn is a medical management service that optimizes organizations and saves time. Med.tn allows doctors to share their availability in real-time with their patients according to their criteria while keeping control of their medical agenda. Med.tn allows doctors to get in direct contact with patients and answer their questions.*

Fig1 . Logo of Med.tn solution

B. ***tobba.tn :*** *Tobba.tn is an online platform that connects patients to qualified doctors with video consultation. It also an generate online medical records that includes patients analyzes, radios, treatments, the weight, allergies.*

Fig.2 . Logo of tobba.tn solution

INTERNATIONAL :

C. ***allodocteur :*** *allodocteur is a complete medical management service that optimizes organizations and saves time.*

Fig.3 . Logo of allodocteur.fr solution

D. ***RocketDoctor.io :*** *With Rocket Doctor you will see an online doctor in few minutes. Virtual licensed doctors will do online consultations for medical advice.*

Fig.4 . Logo of RocketDoctor.tn solution

E. ***BestDoctors.com*** *: Best Doctors was founded on the ideal that a person's location should not limit the quality of their care.They provide expert medical opinion service and allows doctors to get in direct contact with patients and answer their questions.*

Fig.5 . Logo of BestDoctors

F. *Critic of the existing*

TABLE I.

Solutions	Features				
	Record Security	***Appointment scheduling based on nearest doctor***	***Card ID Verification***	***FaceID Login***	***Specialist Guidance***
Med	-	x	-	-	x
Tobba	x ISO Certified	- Online Consultation	-	-	-
AlloDocteur	-	+/- not based on nearest doctor	-	-	-
RocketDoctor	-	- Online Consultation	-	-	-
BestDoctors	-	x	-	-	x
NearestDoctor	x	x	x	x	x

Fig.6 Feature table of the existing solution

After this comparative study of the most relevant solutions used in healthcare assistance, we notice that med.tn, allodoctor, rocketdoctor, and bestdoctors are facing many problems related to records security. Indeed, tobba and bestdoctor do not provide the feature of appointment scheduling since their appointments are held online. At the end of our research, NearestDoctor seems to be the only interesting application as it provides all the mentioned features above.

III. Proposed Solution

The solution we are proposing is to build an AI healthcare assistant to improve patient experience and appointment scheduling. Patients will be able to find the nearest doctor to their location, ask about illness symptoms, and schedule an appointment with a doctor based on their availability. Immediate responses will be provided by a chatbot to redeem the needs of our patients using Artificial Intelligence techniques for decision making. Also, our solution offers a very unique concept of developing patient records using Blockchain.

A. *Actors*

Patients and Doctors.

B. *Main features:*

- Records Security using blockchain technology.
- Specialist guidance using symptoms detection.
- Appointment scheduling based on the nearest doctor's criteria.
- Card ID verification using prediction based on models.
- Face recognition is based on deep learning and using a pre-trained face model.
- Mental health test followed with results and suggested articles.
- XRAY quick diagnosis to predict three lungs diseases (covid , tuberculosis pneumonia) .

C. *Added value*

- Patients will get help to find the right doctor who specializes in their condition.
- Doctors will have organized and secured electronic records which will lower costs as there will be no use of papers.
- Doctors get to verify their identity using their card id to avoid fake doctors' identities.
- Doctors will optimize their availability which will decrease patients waiting time.

IV. Technical Requirement

• **Performance requirement**: The web application shall allow several medical record downloads to be made at the same time without downgrading performance.

• **Security requirement**: The web application shall use the encryption and security of user credentials and personal private information within an online storage base. Also, it shall use encrypting of highly classified information as well.

• **Availability requirement:** The web application shall be available at any time even if the server is down, the client should be able to connect to our application. This requirement is guaranteed by a backup server :

If the first web server is active, the second server is down.

If the first web server is down, the second server is active.

• **Interoperability requirement:** The web application shall work on all the major operating systems, web browsers, and technical devices.

A. *Archietctures*

Physical and logical architecture :

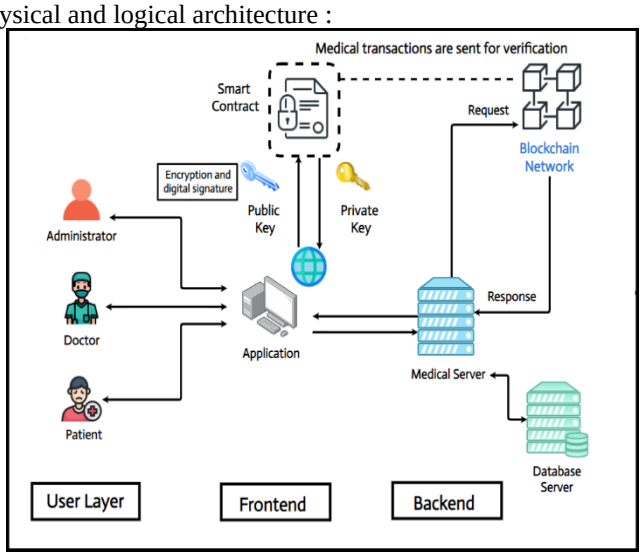


Fig.7 Physical Architecture

B. Technologies (langauges + frameworks)

ReactJS (v 18) **:** A library used to develop the frontend part.
MongoDB (v 5.9.1) **:** Used as our project NoSQL document database.
ExpressJS (v 4.17.1) **:** Used to develop the backend part of our medical server.
NodeJS(v 16.13.1) **:** Used to develop the backend part of our medical server.
Flask(v2.1): Python web framework used to create web applications in Python easier
Used languages: JavaScript, Python, HTML5, CSS.

C. Advanced Technologies (external API … algorithms….)

TensorFlow used for face recognition with deep learning pre-trained model to predict the identity of the user.
AI-based intelligent document processing "**Nanonets API "**.that automate data capture from ID cards using self-learning OCR.
Dialogflow used to set a interactive chatbot for symptoms detection and appointment scheduling.
Pretrained model for illness detection based on a XRAY scanner.
Google maps API for appointments scheduling.
Web Scrapping used as a search engine based
Blockchain technology for medical records storage using smart contracts.
AI voice Assistant **ALAN SDK** to help the user to get to a specific page using his voice.
TensorFlow used for XRAY models.
LinkedIn Oauth for user authentication.
Stripe API to allow patients and doctors to pay the platform.

V. Implemented Solution

First of all, a user should select a role : "patient" or a "doctor". We will show the registration scenario of a doctor .

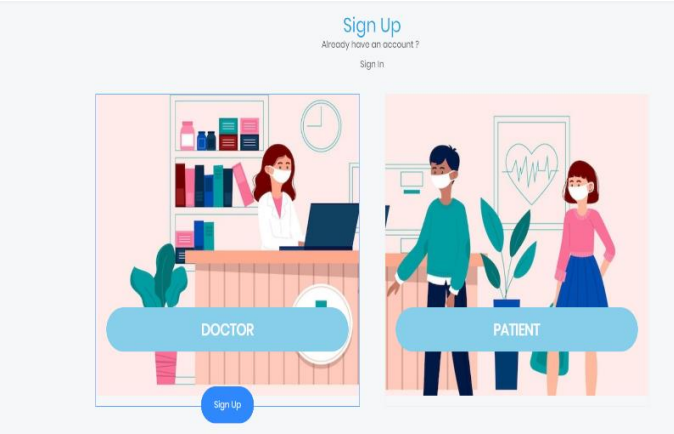


Fig.8: Choose the user role

Before getting to the registration details, the doctor should verify his identity using his card id as shown below:
Case 1: Real Card ID ➔ Success

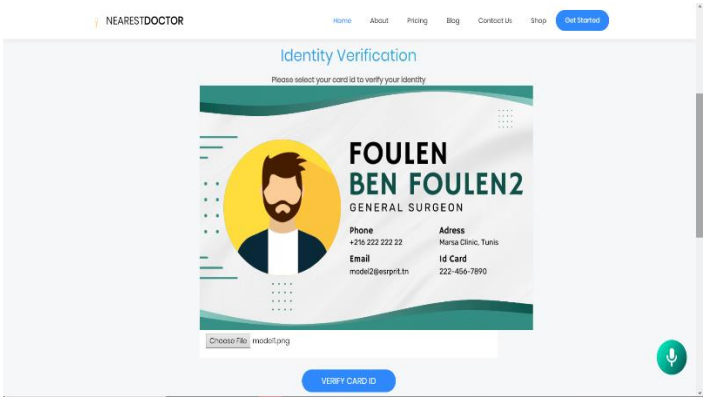


Fig.9: Identity verification case1

Verification Result :

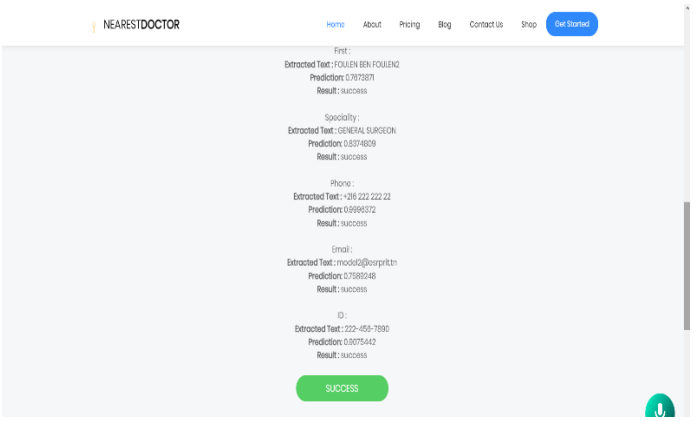


Fig.10: Identity verification case1 Results

Note: *We don't have real doctors ID Cards so we designed examples of card Id and trained them.*

Case 2 : Made up Card ID (not real) ➔ failure

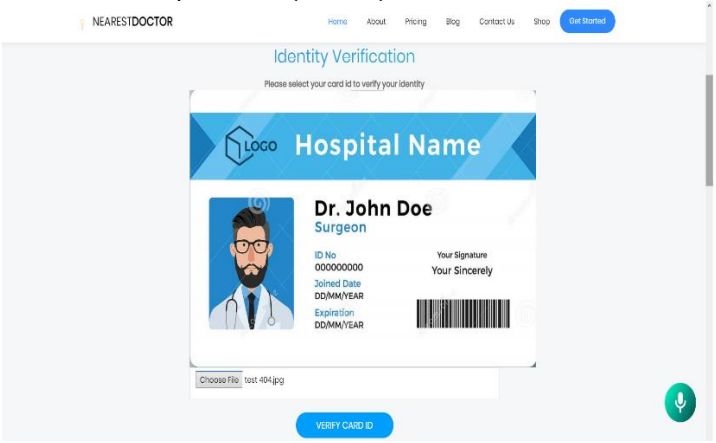


Fig.11: Identity verification case2

Verification Result :

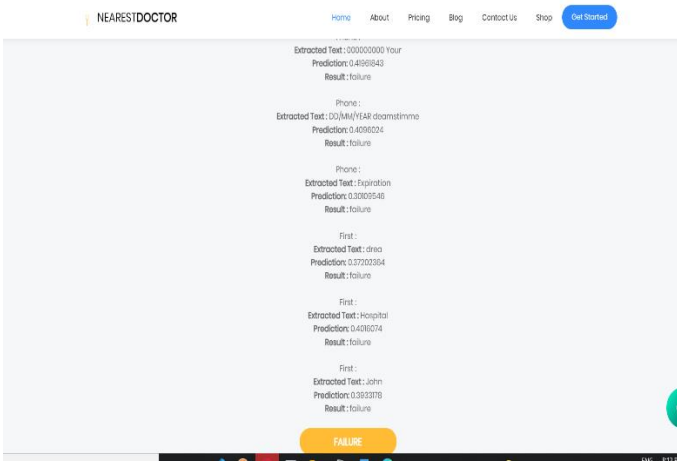


Fig.12: Identity verification case2 Results

After the verification process, the doctor shall continue.
Now we will pass to the registration process :
1. First of all you need to register your face id :

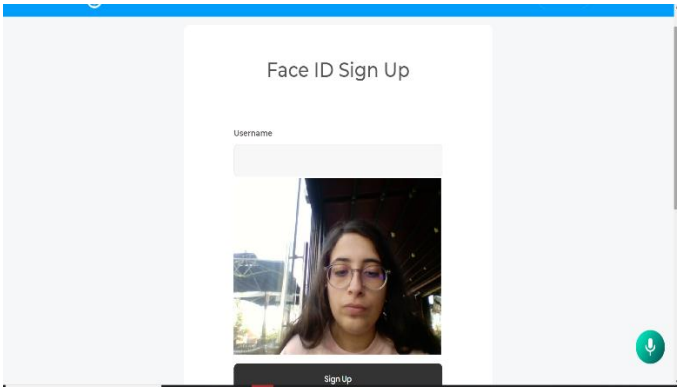


Fig.13: Face ID Registration

2. Then you have to type all your information such as the full name, the email, birthday …
Then you have to choose a payment plan and pay the platform :

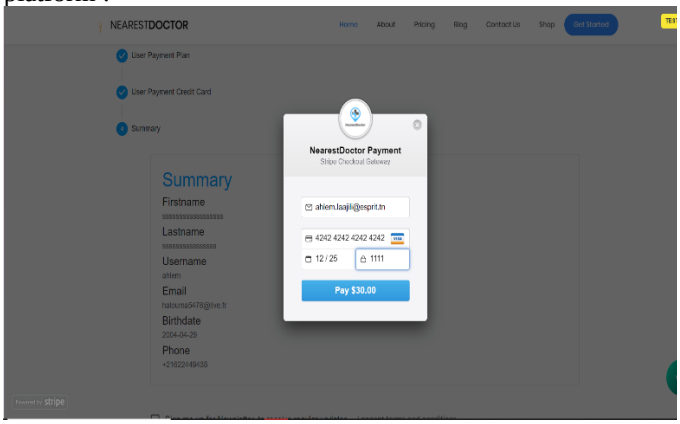


Fig.14: User Payment Gateway

Finally, you can login. So you three options :
Option 1 : Linkedin authentication
Option 2 : Enter your username and password
Option 3 : Face ID authentication

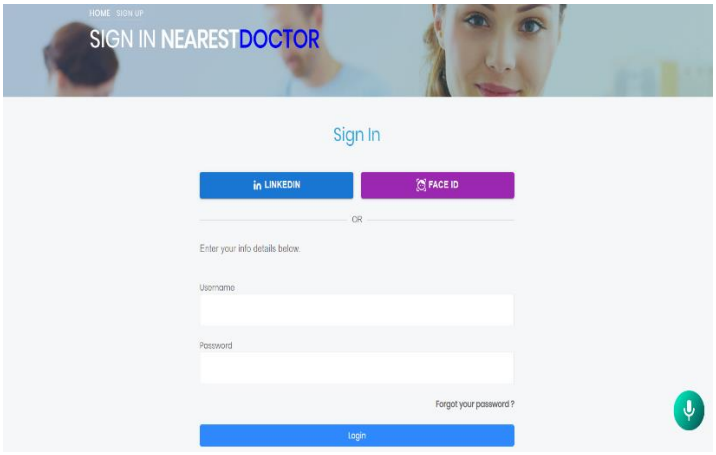


Fig.15: User login interface

For the face ID authentication, you just have to place your face in front of your laptop camera and click sign in .

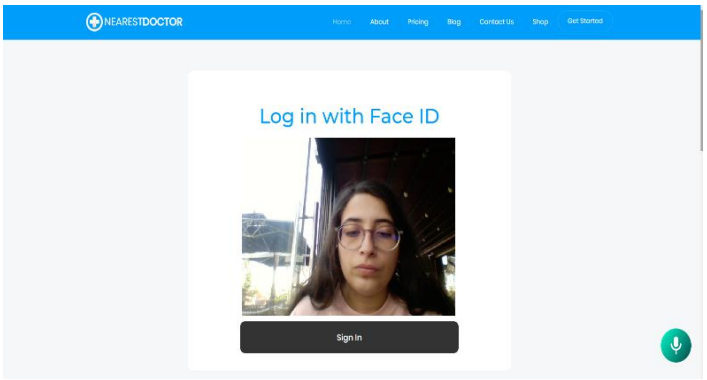


Fig.16: User Face ID Login

Finally, you will get to your dashboard.
As a doctor you have a quick XRAY diagnosis to predict three lungs' diseases (covid , tuberculosis pneumonia).
This diagnosis aims to help a doctor to make decisions about a lung diagnosis.
Upload X-RAY:

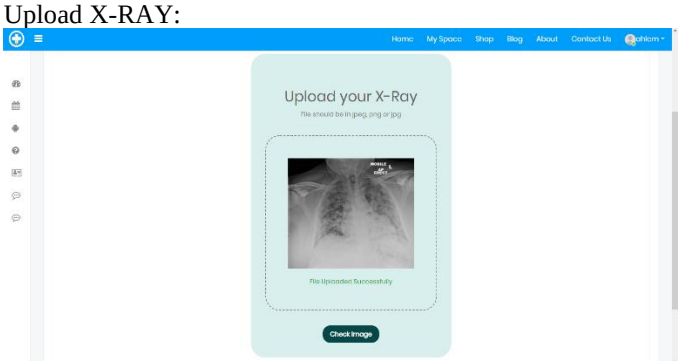


Fig.17: Xray Scanner Upload

Diagnosis Result :

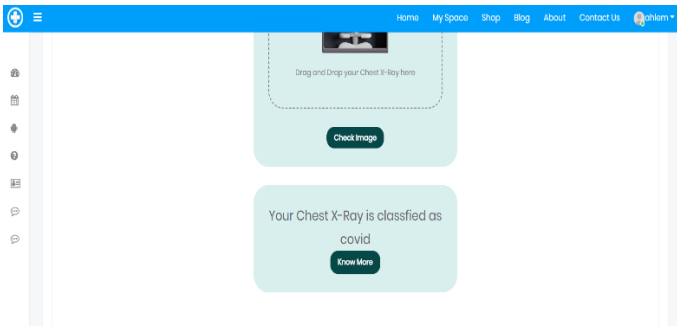


Fig.18: Xray Scanner Result

Also, the doctor can add his own blogs.

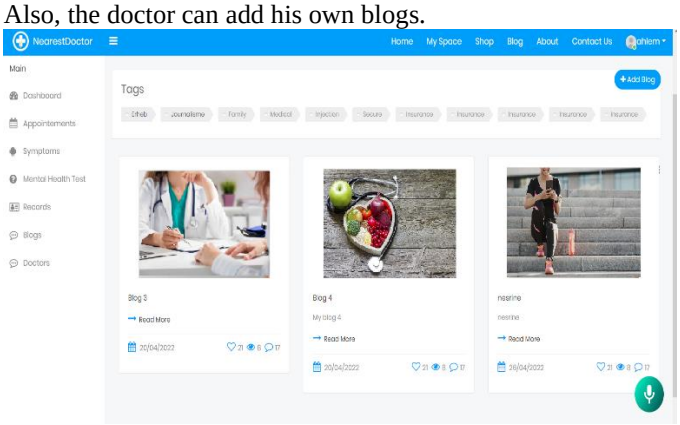


Fig.19: Blogs Interface

And can search for other any blogs thanks to web scrapping.

Search Example : Healthy food

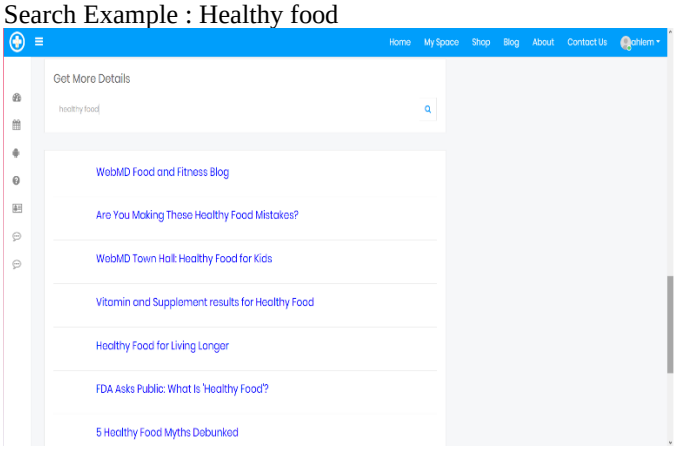


Fig.20: Blogs Web Scrapping search 1

Search Example : Covid

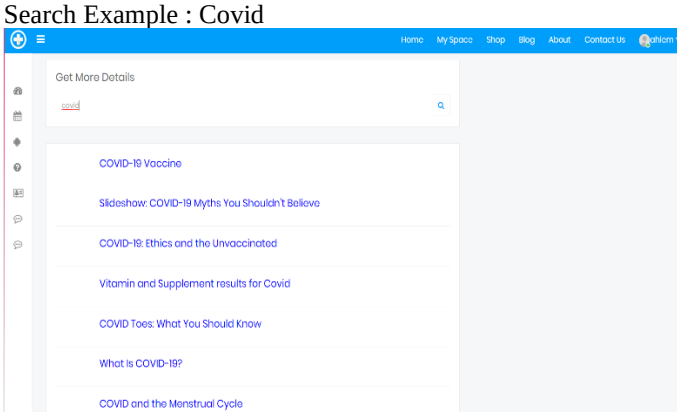


Fig.21: Blogs Web Scrapping search 2

Also the doctor can check the patient's records securely thanks to blockchain.

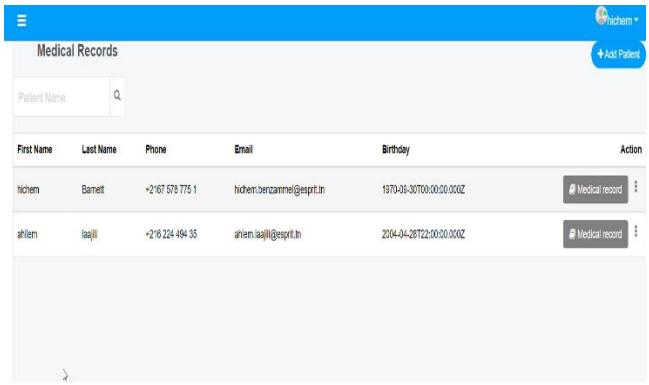


Fig.22: Blogs Web Scrapping search 3

And he can view each patient records details as shown below :

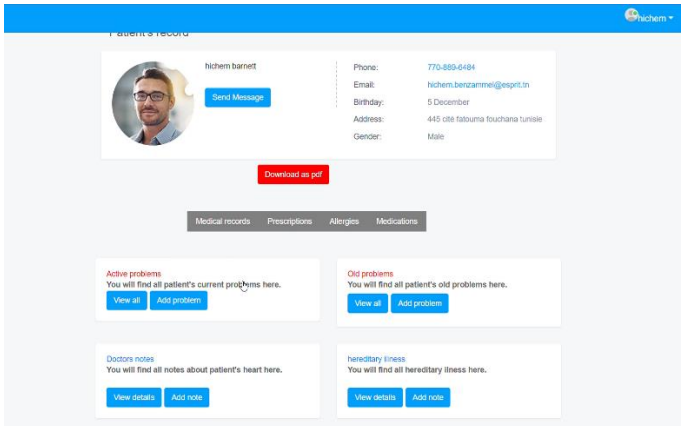


Fig.23: Medical Records

For the blockchain part, we will take the example of adding a note. So, if a doctor adds a note, a transaction will be created and the note will be stocked securely in the blockchain network. And as result you create a block by mining .

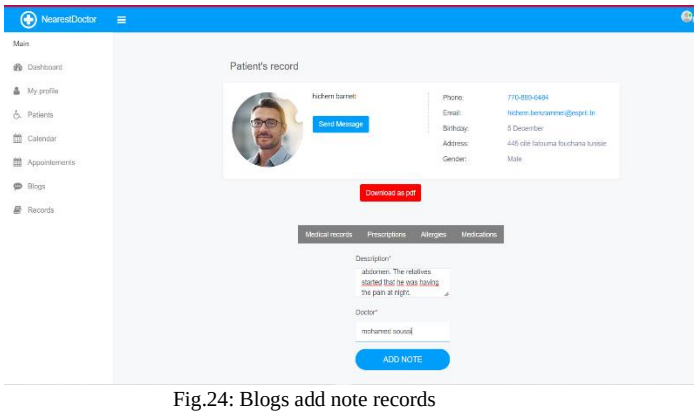


Fig.24: Blogs add note records

Transaction :

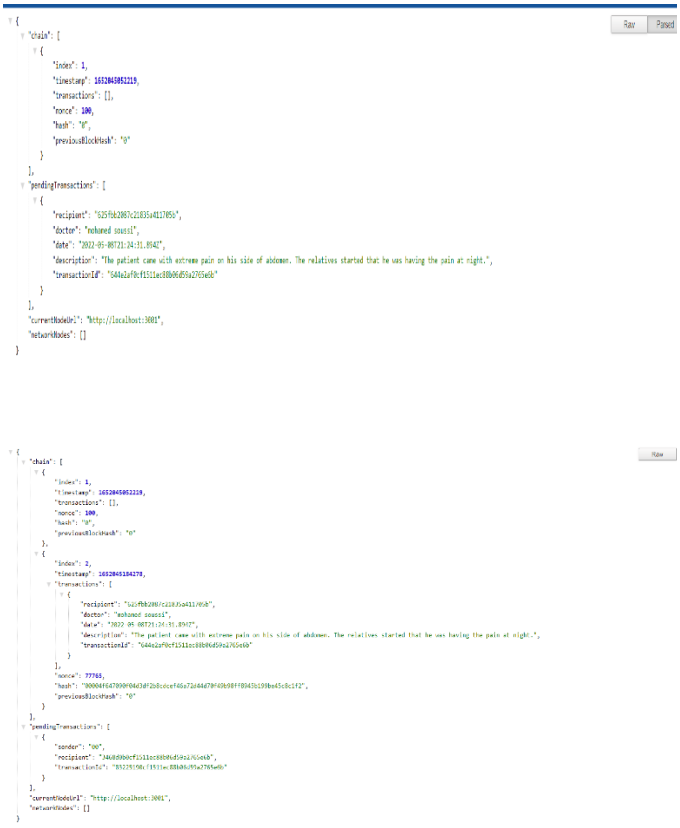
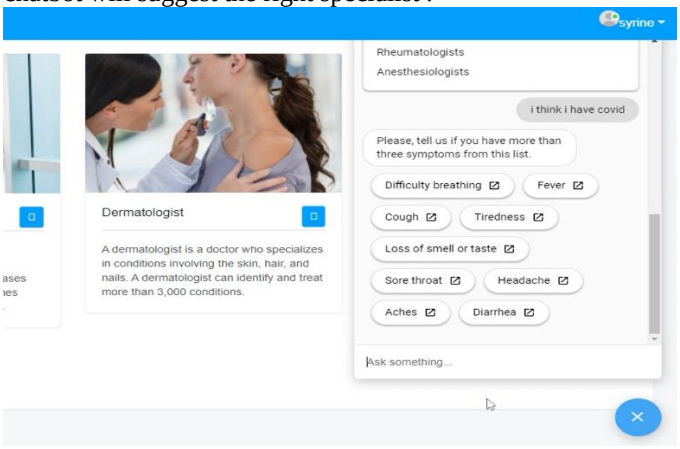
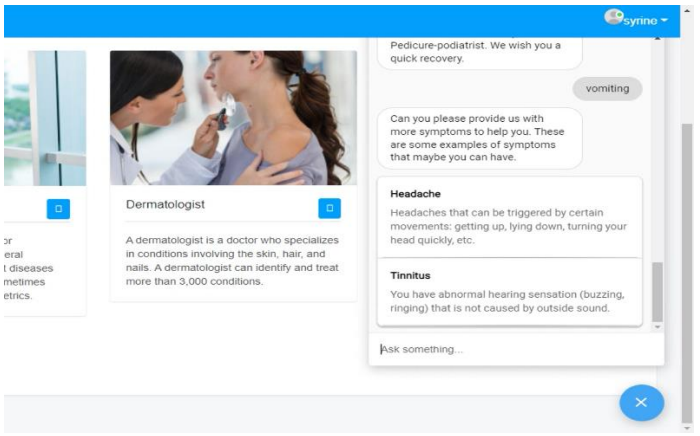
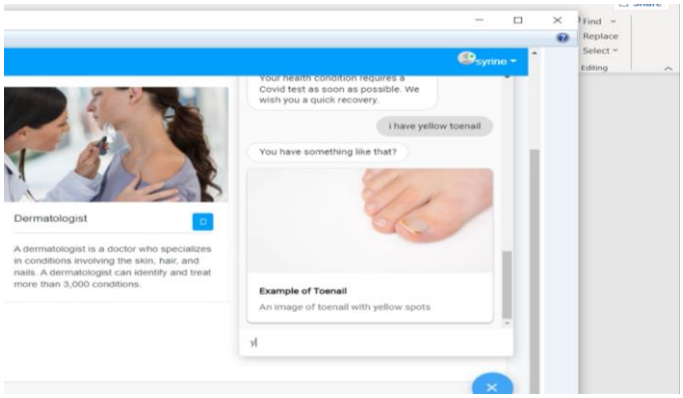


Fig.25: Blockchain Transactions

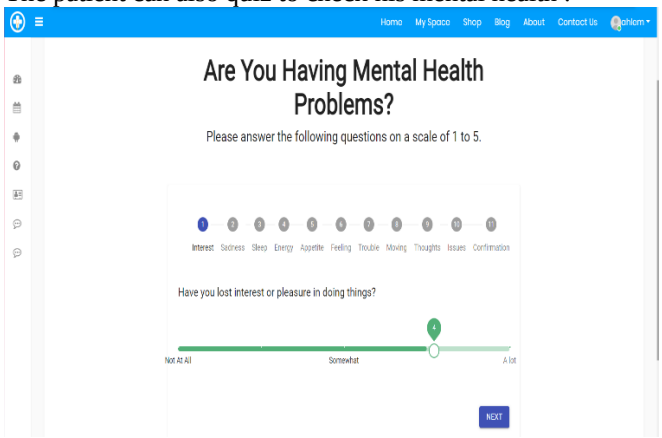
As for the patient, he can have a conversation with a chatbot to find the right specialist for his case and the chatbot will suggest the right specialist .



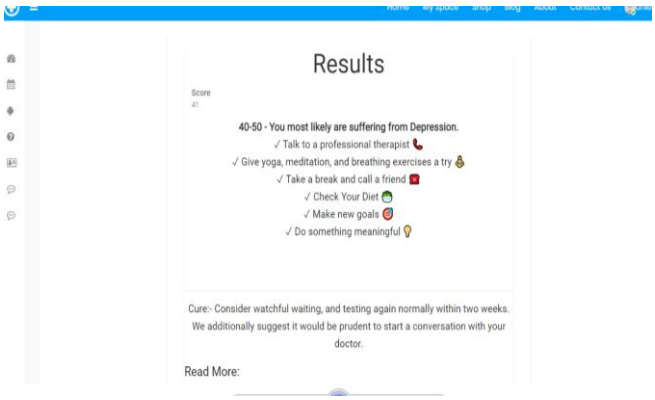




The patient can also quiz to check his mental health :

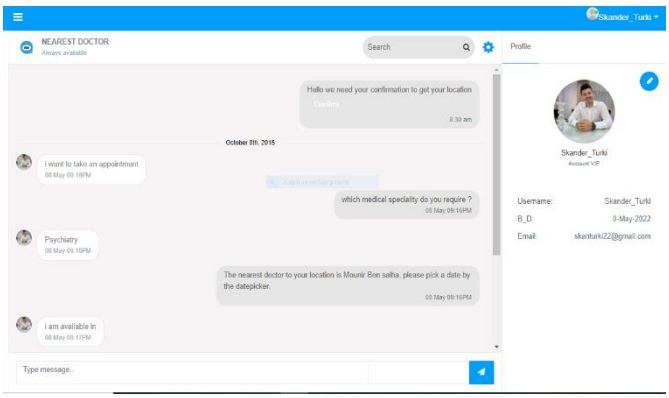


Result :

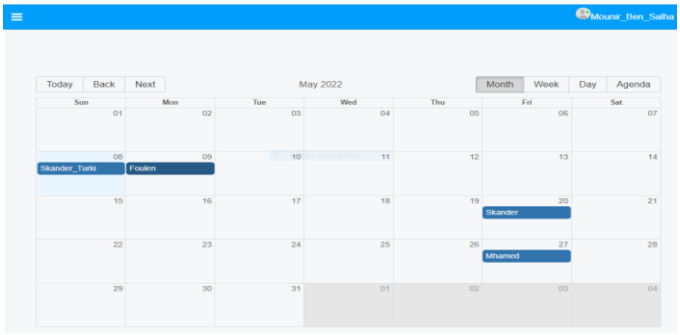


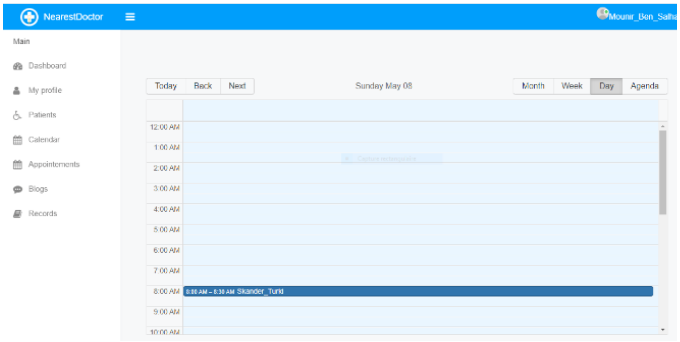
The patient can have a conversation to get an appointment with ;

- the nearest doctor
- the first available doctor



Patients can also view their appointments as shown below :





CONCLUSION

In conclusion, a chatbot may prove beneficial to its patients as it may help them to figure out the issues by interacting with the bot and giving the appropriate specialist according to the symptoms. In such a hectic schedule, it is not viable for a person to visit hospitals regularly for check-ups. The chatbot can standalone and give quick remedies for small issues. Also, it can help both patients and doctors to save time and avoid waiting times. Scanning functionality would help doctors gain better knowledge of the lung diseases Also, we provided the functionality of getting an appointment with the nearest doctor and secured records using blockchain technology.