Kavach

India's Leading Tele-Radiology Platform

CS 837 – HealthCare Application Development

International Institute of Information Technology, Bangalore

Under Guidance of

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&

T.A

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Contents:

Links:

Github Link:

https://github.com/Sunnidhya/HAD_Project

Figma Link:

https://www.figma.com/design/jMYhZ9n0e0vnwNa1B9y7Mz/HAD?node-id=0%3A1&t=BCg2Ea7ZjgfLUG30-1

Video Link:

https://drive.google.com/drive/folders/1y5NyWl-tC3g883Rr4yVehEGYSEj89-E1?usp=drive_link

Abstract:

In the dynamic landscape of modern healthcare, effective communication and collaboration are essential for delivering high-quality patient care. Our tele-radiology app represents a cutting-edge solution that revolutionizes the way healthcare professionals, patients, laboratories, and radiologists interact and collaborate in the diagnostic process.

At its core, our app serves as a comprehensive platform for facilitating seamless communication and collaboration among doctors, patients, and radiologists. Through intuitive user interfaces and robust messaging capabilities, healthcare providers can securely share medical images, such as X-rays, MRIs, and CT scans, with radiologists for expert analysis. Real-time interaction enables swift transmission of critical imaging data, leading to expedited diagnosis and treatment planning.

Moreover, our tele-radiology app introduces an innovative feature for assigning laboratory tests and radiology studies to designated professionals. Healthcare providers can efficiently order and manage diagnostic tests, selecting the most suitable laboratories and radiologists based on specialization, availability, and proximity. Real-time notifications and status updates keep all stakeholders informed, ensuring timely and accurate assessments of patients' medical conditions.

Data security and privacy are paramount in our app, with robust encryption protocols and compliance with regulatory standards such as HIPAA safeguarding sensitive medical information throughout transmission and storage. Centralized tracking and auditing capabilities enable healthcare providers to monitor the progress of assigned tests and studies, promoting accountability and quality assurance across the diagnostic process.

In summary, our tele-radiology app represents a transformative solution that enhances communication, collaboration, and efficiency in diagnostic healthcare delivery. By leveraging technology to streamline the diagnostic process and optimize resource utilization, we empower healthcare providers to deliver personalized and timely care, ultimately improving patient outcomes and satisfaction.

Scope:

1)Web-App (Doctor ,Patient ,Radiologist ,Laboratory):

- The admin logs in to the tele-radiology platform. The Landing page displays the number of registered doctors, radiologists, patients, and laboratories.
- Admin creates and removes doctors using basic CRUD principles. Patients register themselves with necessary credentials and can be removed by the admin.
- Registered doctors log in with two-way authentication, receiving an OTP via email. Upon login, they see assigned cases on the landing page. The doctor can create a case for a particular patient.
- The patient can Log-in with two -way authentication receiving an OTP via email. Upon login, the patient will be able to see the cases which has been assigned to them by the doctor. The patient has the ability to add laboratory and radiologists.
- After the doctor login, clicking on the created case we will be directed to the details page where we can access the chat forum between doctor and radiology.
- The Radiologist can upload DCM image into the dicom viewer and it allows them to zoom the image as well as to annotate them. There is a chat facility between the doctor and the radiologist as well.

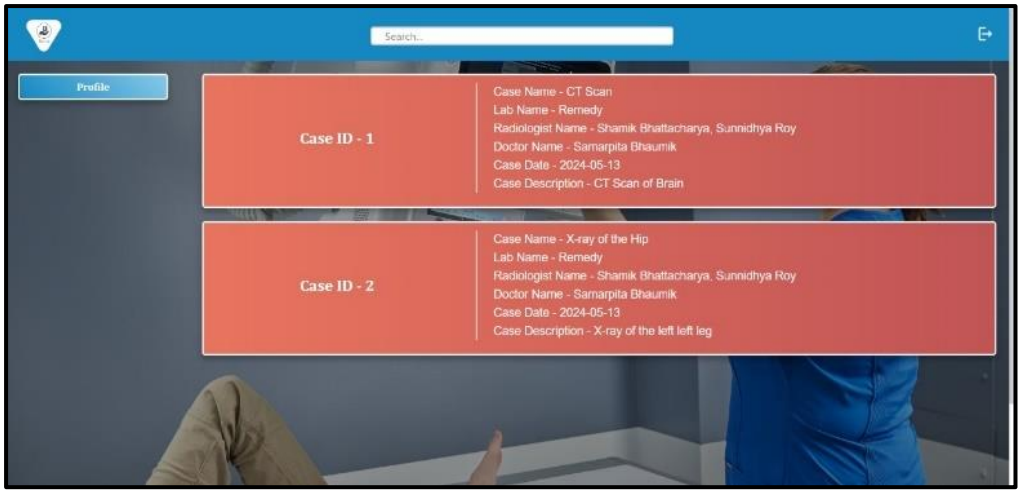
Module:

Patient:

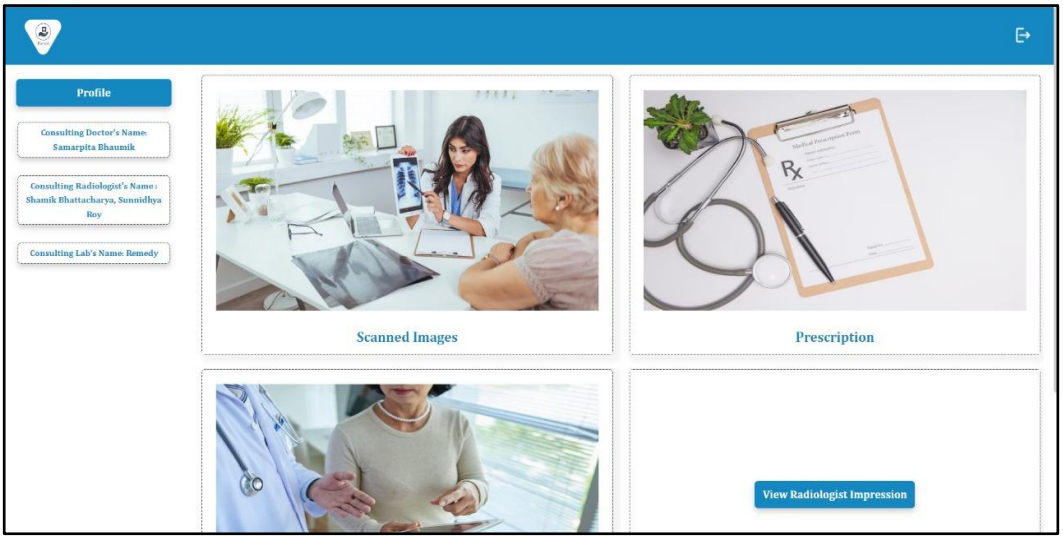
- **Patient Registration:** The patient cannot be created by the admin in this workflow. The patient in this case has to register themselves by providing the relevant information like Username, Full-name , Address , Email-ID , Contact-Number, Password. The Password has to be confirmed by the patient.

- **Login:** The patient will try to login to the portal using their valid credentials. If the credentials were wrong the patient won't be directed to the next page, and valid credentials will be asked from the patient. A two-factor authentication has been implemented in this workflow. An OTP will be sent to the registered email-id of the patient. On entering this OTP, a verification will be done and if the OTP is valid, The patient will be directed to the landing page .

- **Assignment of Lab/Radiologist:** On visiting the landing page, the patient will be able to view the cases which has been assigned under his/her name. The patient will have the option to assign their preferred laboratory and radiologist. The assigned radiologist will be able to chat with the doctor under whom the patient is assigned. The doctor may feel the need of assigning a new radiologist and he will select the same from a drop-down menu. The patient will get a notification asking for consent regarding the assignment of this radiologist, and if the patient approves the radiologist will be assigned. The Doctor while chatting will have the option to switch between radiologists, and each tab will load their corresponding chats.



- **<u>Patient Details:</u>** The patient on logging in will be directed to the patient landing page where they will be able to see the cases assigned to them. On clicking on a particular case the patient will be directed to the patient details page, where they will be able to see the scanned images, prescription, final diagnosis and the radiologist impression.

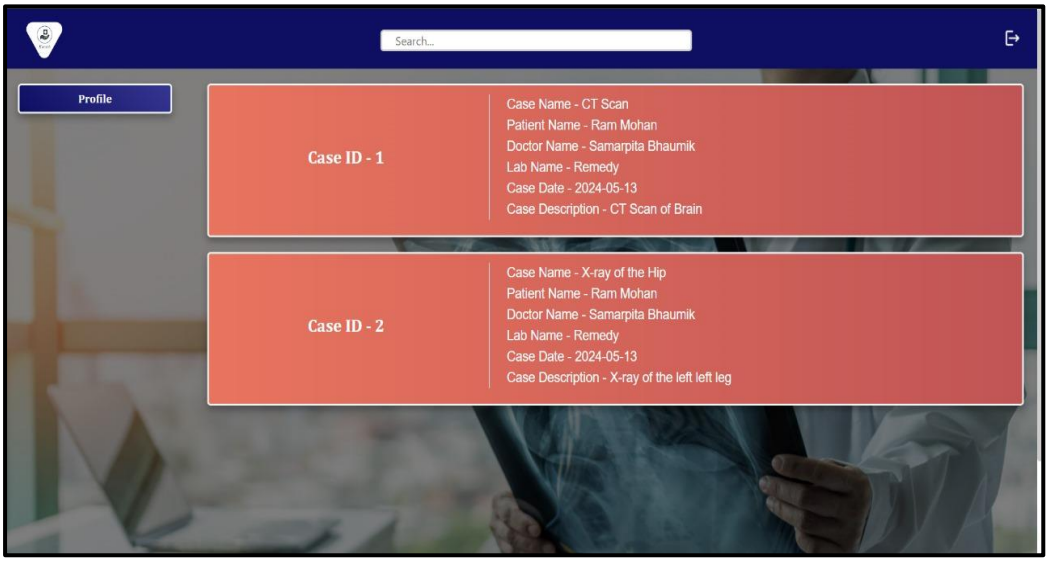


Radiologist:

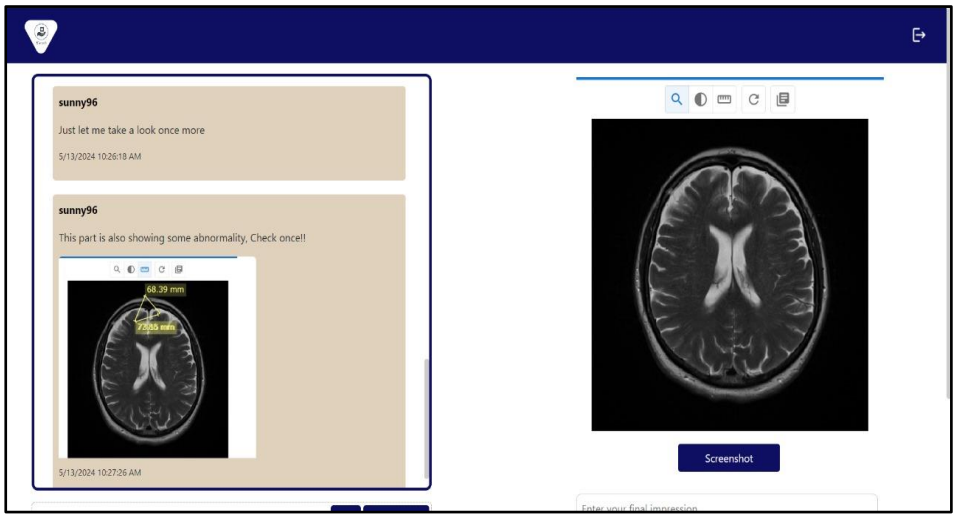
- **Registration:** The admin will be adding the radiologists to the platform. The patient has the authority to assign radiologist of their choice. Also the doctor on feeling the requirement may ask for a new radiologist and the patient will have to grant consent for the new radiologist to be assigned to the case.

- **Two-Factor Authentication**: On being added the radiologist's credentials will be sent to the corresponding radiologists. The radiologist will enter the valid credentials and will be redirected to the OTP page. If invalid credentials are added the radiologists will be barred from logging in and asked to add valid credentials. An OTP will be sent to the radiologist's email which he will use to gain access to the portal.

- **Landing Page**: On being granted access the radiologist will be directed to the landing page where all the active case under the radiologist will be visible. Clicking on any of the cases, the radiologist will be directed to the chat forum for that particular case.

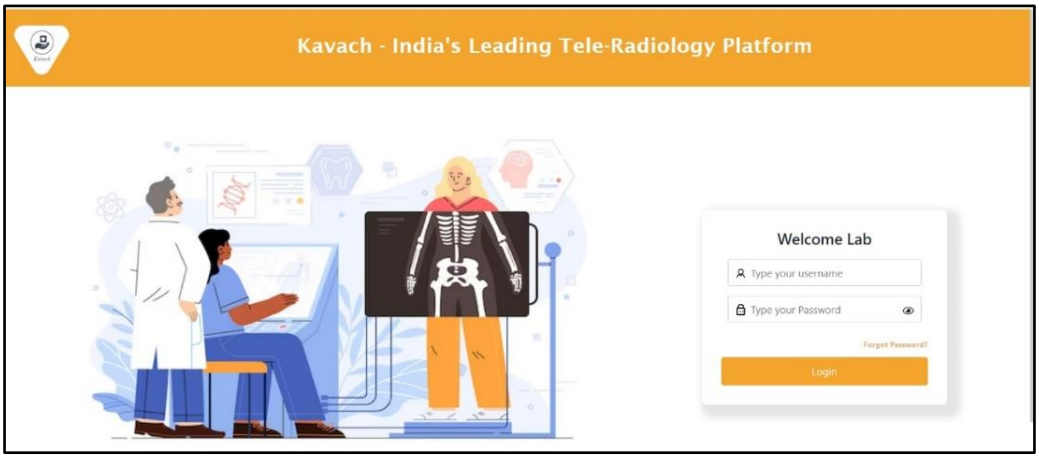


- **Case-Completion:** The Doctor and radiologist will keep on chatting in the chat forum and sharing images between themselves until and unless a final conclusion has been reached between the doctors and the radiologists. On arrival of a conclusion, the radiologist will give his final impression on the case . If the doctor is satisfied by the final conclusion,he will close the case.

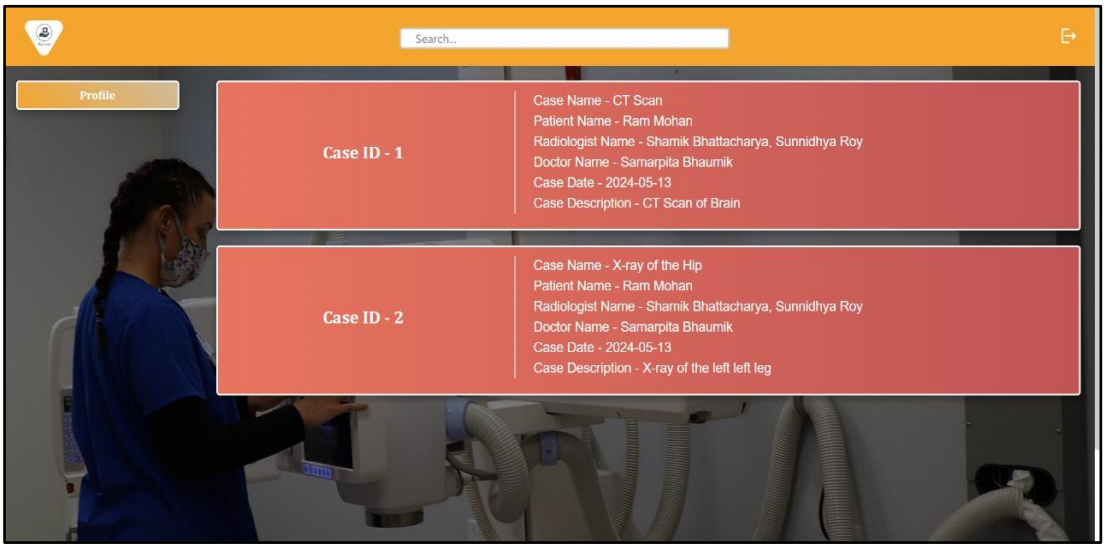


Laboratory:

- **Two-Factor Authentication**: The Two-Factor authentication is applicable here as well. Initially the lab will try to log in using the credential received by them on registration. On successful validation, the lab will be directed to the OTP page. An OTP will be sent to the laboratory's email which, on being verified, will grant the Lab access to the portal. However any invalidation on any stage of the verification process will prevent the lab from gaining access.



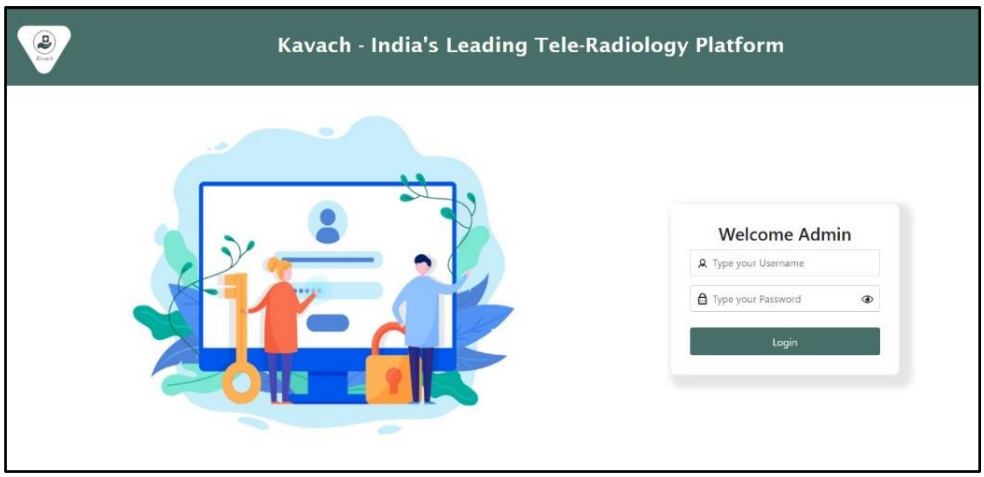
- **Image Upload:** Image uploading is the primary functionality of the lab component. If a particular case is open, on clicking the corresponding case, the lab will have the option to upload and re-upload images for that case . The primary reason for this is that the lab might be some error on the lab's part while uploading the image. Also the doctor may direct the laboratory to re-upload the image if he finds some discrepancy. However, once the case is closed the laboratory can no longer upload images for that case. If indeed there is a need for uploading a new image, a new case has to be created for that purpose.



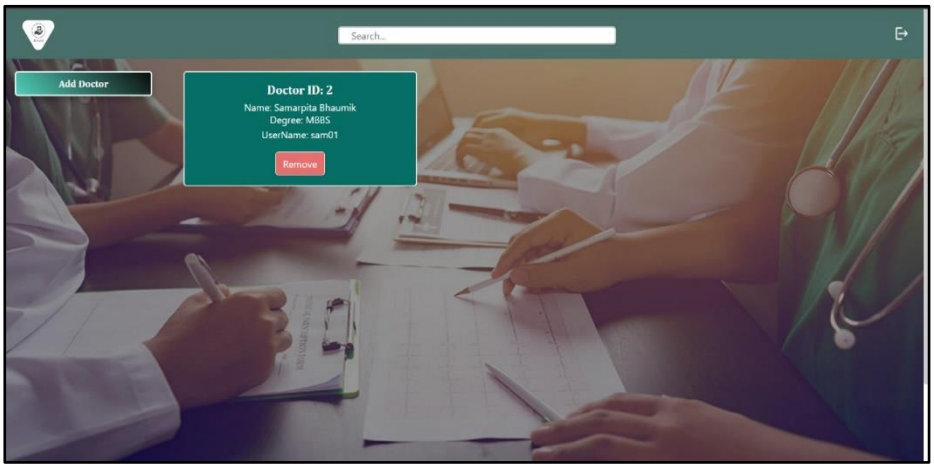
Admin:

Admin is the superuser in our project. It can add or remove other users (except registering patient).

- **Login**: In the first page for Admin, we have login page for admin. It will ask for a valid username and password. Upon providing correct credentials, it will go to admin home page. If provided wrong credentials, it won't allow the admin to go to next page and will ask for correct credentials again.



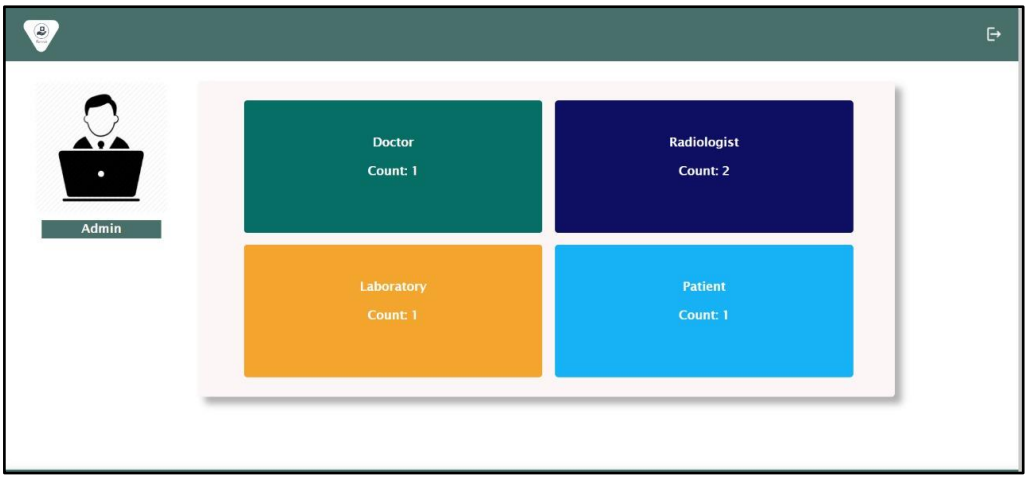
- **Admin Home Page**: The admin home page has four entites- Doctor, Radiologist, Laboratory, Patient. Each of the four entities in their respective cell will show its live count, that is, the number of instances of the particular entity currently registered in the database.
- **Admin Landing Page**: Upon clicking any entity, it will direct to admin landing page of that particular entity. It will show the registered entities in the database.
- **Doctor:** The admin landing page for doctor shows the details of each doctor registered in the database.Admin can add a doctor by clicking on 'Add Doctor'. It will show a form which the admin has to fill. Upon submitting the form, it will add the new doctor to the database and will also show the new added Doctor into the Admin Landing Page. Admin can also remove a doctor by clicking on the 'Remove' button on the particular cell of that Doctor.



- **Patient:** Admin cannot add a Patient, as Patient can only self-register. However, admin can remove a patient by clicking on the 'Remove' button on the particular cell of that Patient.

- **Lab:** The admin landing page for lab shows the details of each lab registered in the database. Admin can add a lab by clicking on 'Add Lab'. It will show a form which the admin has to fill. Upon submitting the form, it will add the new lab to the database and will also show the new added Lab into the Admin Landing Page.Admin can also remove a lab by clicking on the 'Remove' button on the particular cell of that Lab.

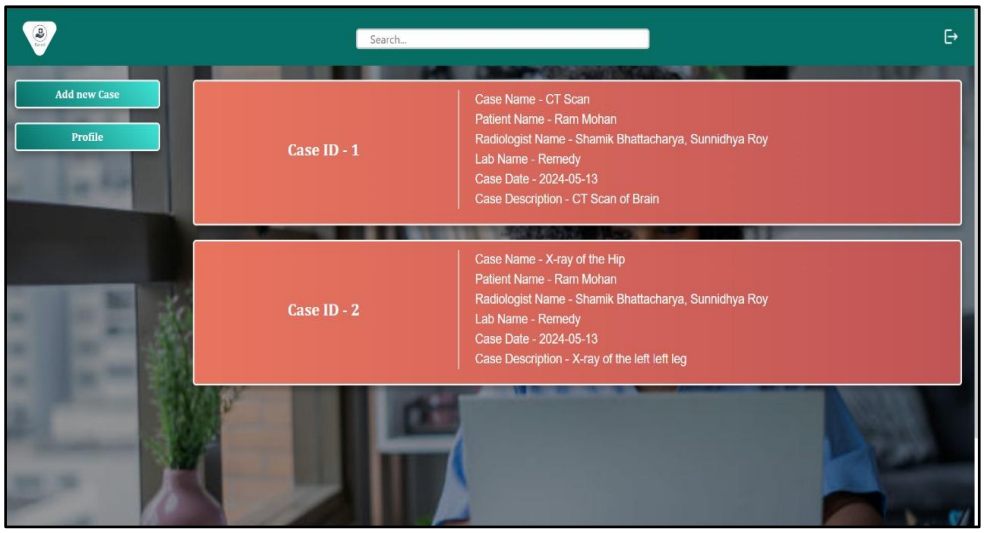
- **Radiologist:** The admin landing page for radiologist shows the details of each lab registered in the database. Admin can add a radiologist by clicking on 'Add Radiologist'. It will show a form which the admin has to fill. Upon submitting the form, it will add the new radiologist to the database and will also show the new added Lab into the Admin Landing Page. Admin can also remove a radiologist by clicking on the 'Remove' button on the particular cell of that Radiologist.



Doctor:

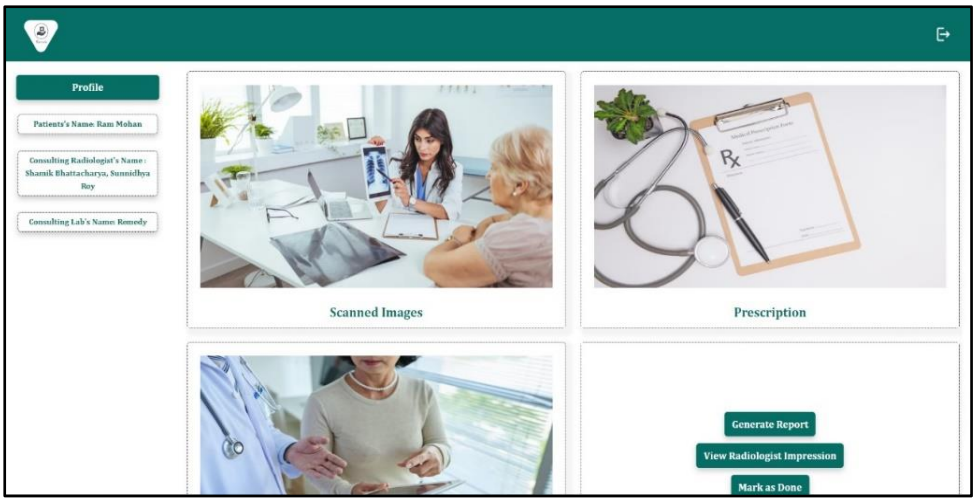
- **Login**: In the first page for Doctor, we have login page for doctor. It will ask for a valid username and password. Upon providing correct credentials, it will send an OTP to the registered email id of the doctor. Then it will directly go to the OTP validate page. If provided wrong credentials, it won't allow the doctor to go to next page and will ask for correct credentials again.

- **OTP Validation**: This page will ask for an OTP, and the doctor will have to provide the OTP sent to his/her email. On providing correct OTP, it will direct to Doctor's landing page. If provided with wrong OTP it won't allow the doctor to go to next page and will ask for correct OTP again. This adheres our **two-factor authentication**.
- **Doctor Landing**: Here, Doctor can see all the cases under him. Each cell here represents a case, and it details are also listed in the cell: CaseID, Case Name, Patient Name, Radiologist Name, Lab Name, Case date and Case description.

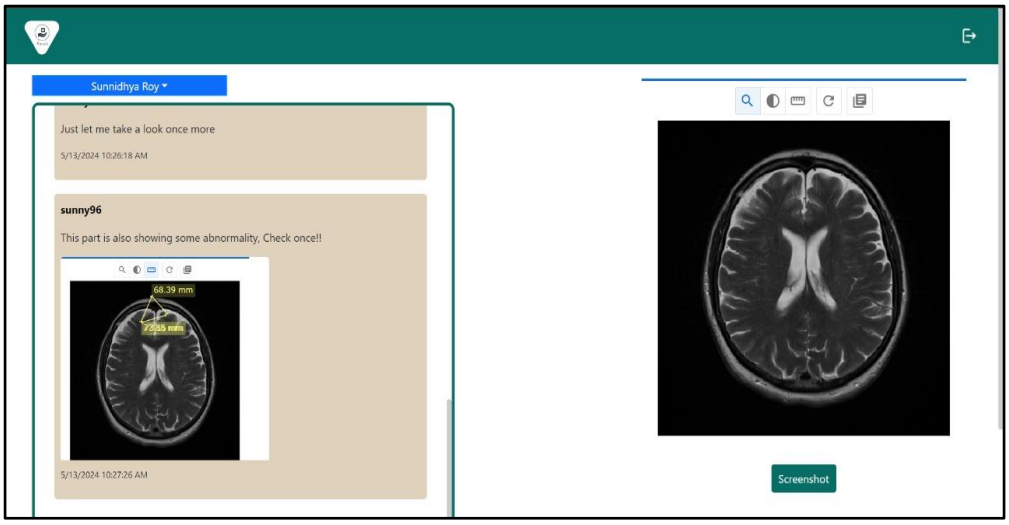


- **Adding a New Case**: To add a new case, the doctor has to click on the 'Add New Case' button. It will open a form named 'Case Creation' asking for these fields: Case Name, Doctor Name, Patient Name. On filling up the fields and clicking on the Submit button, it will generate a new case in the database and it will also show in a new cell with its details in the doctor landing page.
- **Profile**: On Clicking on 'Profile' button, it will go to the doctor's profile page. The doctor's profile page consists of his/her username, Name, Degree and other details.
  - To **Change Password**, the doctor has to click on the 'Change Password' button. It will open a form with fields: Current Password and New Password. The doctor on filling out the form and clicking on submit button, it will change the password to the new given password of the doctor profile.
  - **Case Details:** On clicking on any cell of the landing page, it will go to the details page of that particular case.

- **Doctor's Details Page** : The details page consists of four entities: Scanned Images, Radiologist's Report, Prescription and Final Diagnosis. Also, it will show the name of the patient and doctor for that particular case. On clicking on the Scanned Image cell, it will directly go to the Chat page of that case. Details page also contain 'Generate Final Report' button. Once clicking, he/she can generate report inspecting radiologist's impression. Once done, the doctor can click 'Mark as Done' button to mark the case as completed.

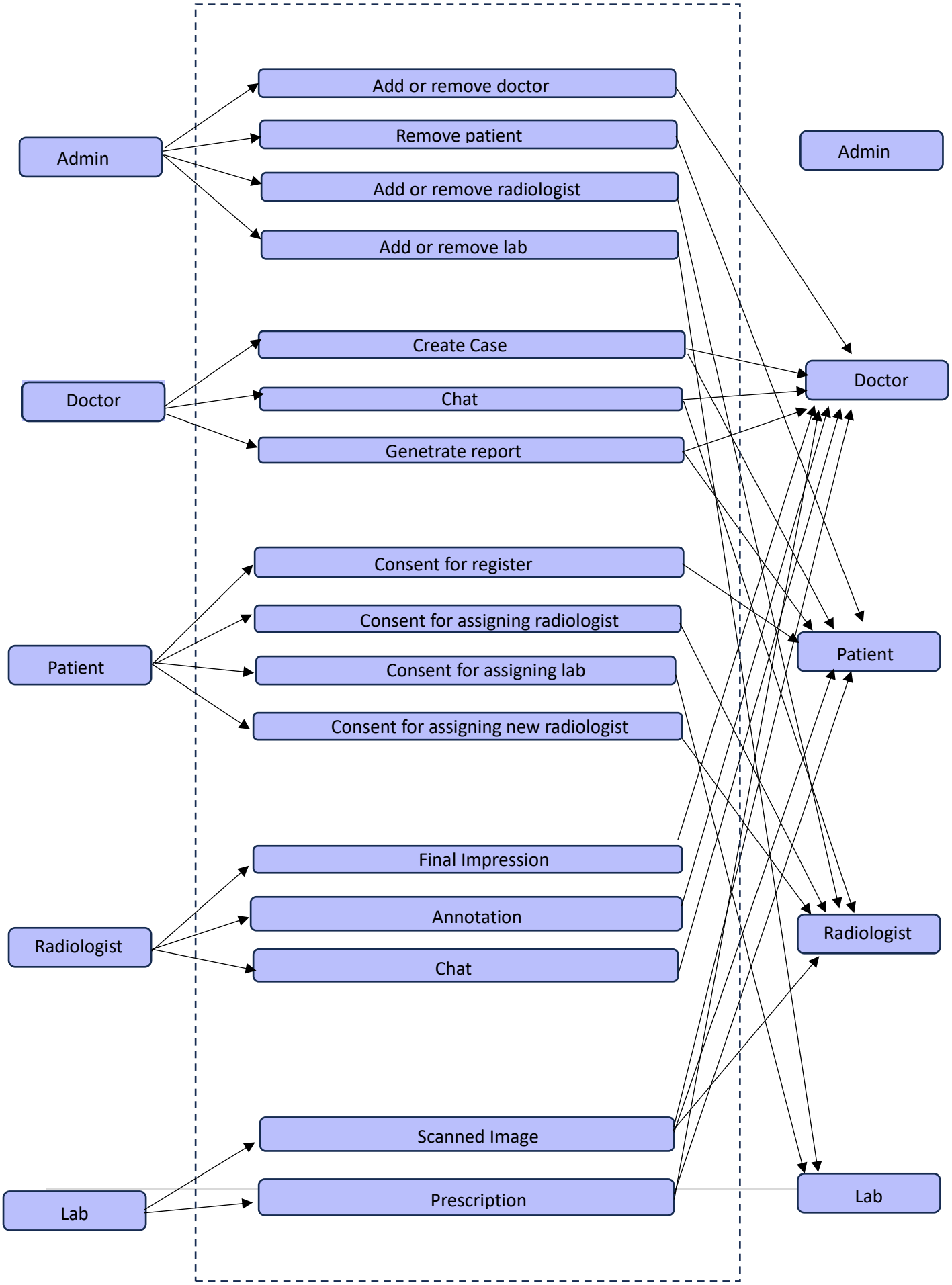


- **<u>Chat between Doctor and Radiologist</u>**: The chat page consists of a real-time chat between the radiologist assigned by the patient and the doctor. It will also have the scanned image uploaded by the lab of that particular case. The doctor can annotate the scanned image to inspect, and on clicking on the 'Screenshot' button, it will be directly uploaded in the chat. The doctor also can upload any image manually by 'Choose File' button.



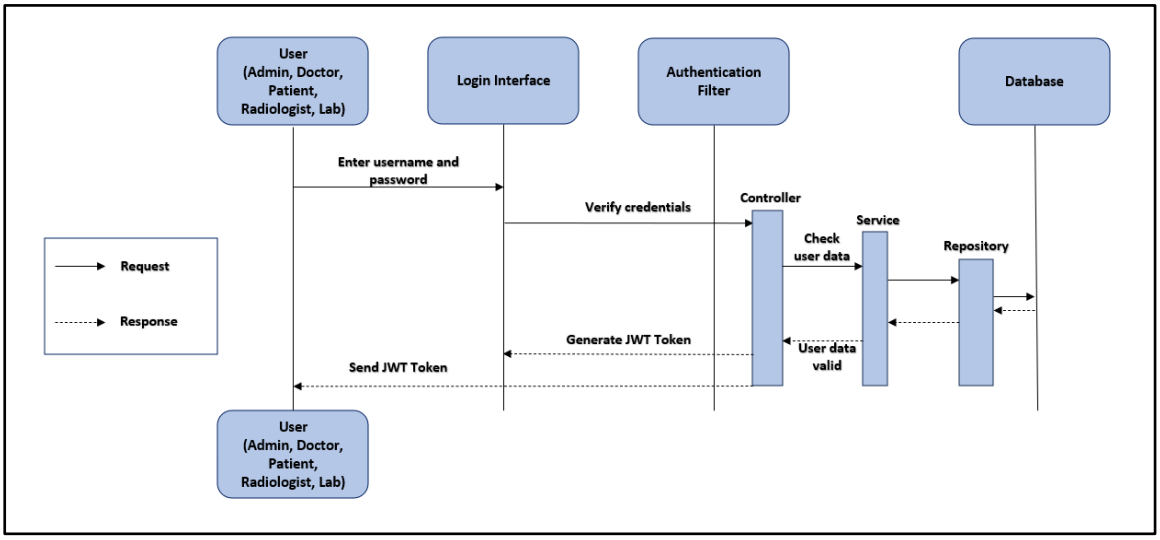
- **<u>Assigning a new radiologist</u>**: If the doctor wants to consult with a new radiologist for the particular case, he/she can choose any radiologist from the drop-down menu. On clicking his/her desired radiologist, it will send a consent form to the patient, requesting for the new assignment. If the patient approves, the new radiologist will be assigned to the particular case, and then a new chat thread will be created between the doctor and the new radiologist. The doctor has the option to toggle between the chats of these two radiologists.

Use Case Diagram



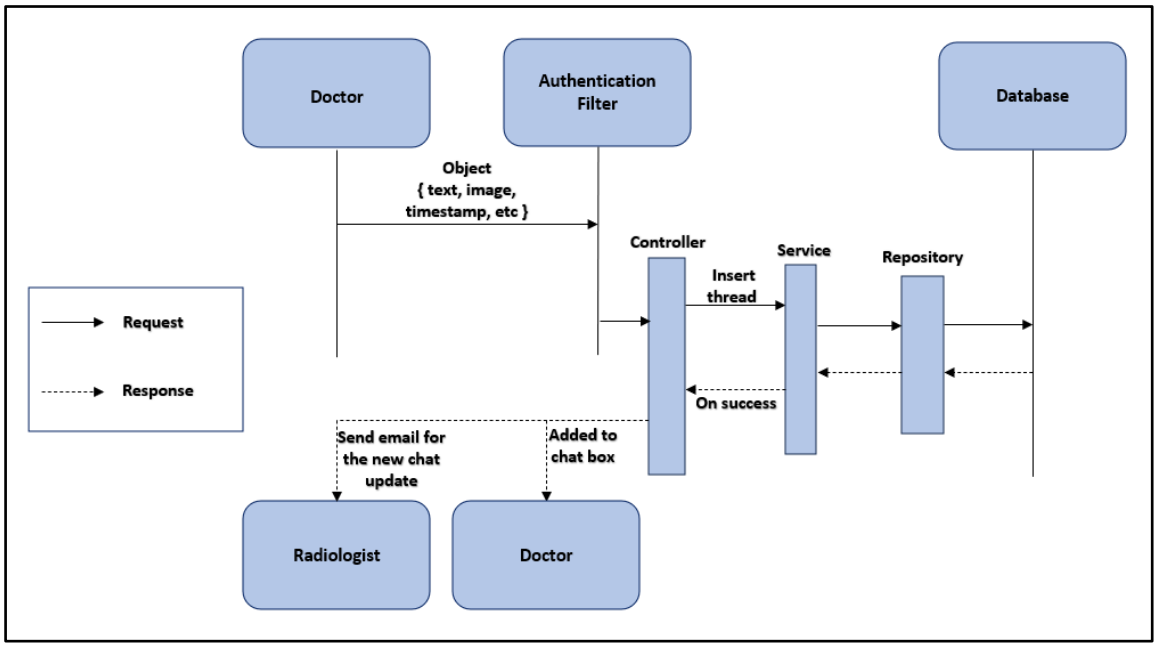
Sequence Diagram

Login Module with JWT authentication

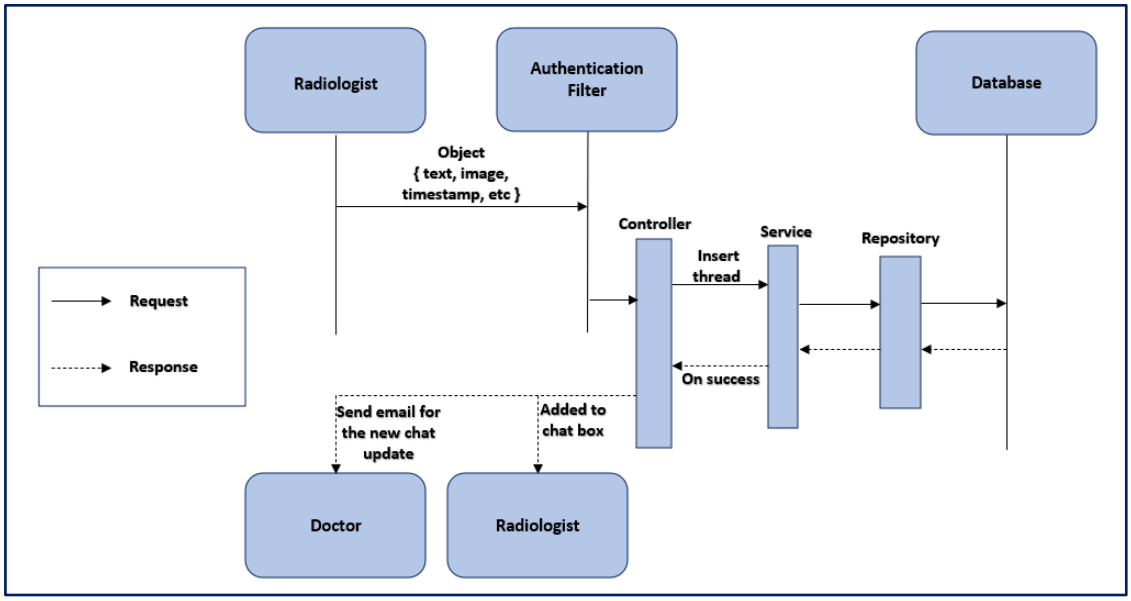


Chat Module between Doctor and Radiologist

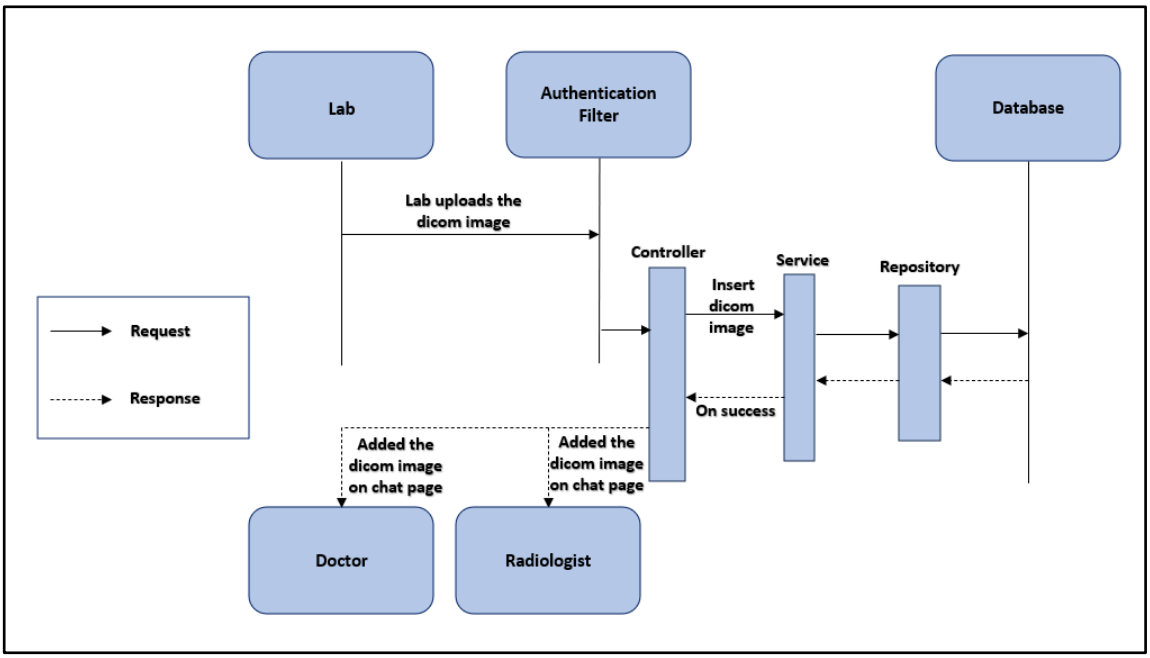
- **When Doctor do chat with Radiologist:**



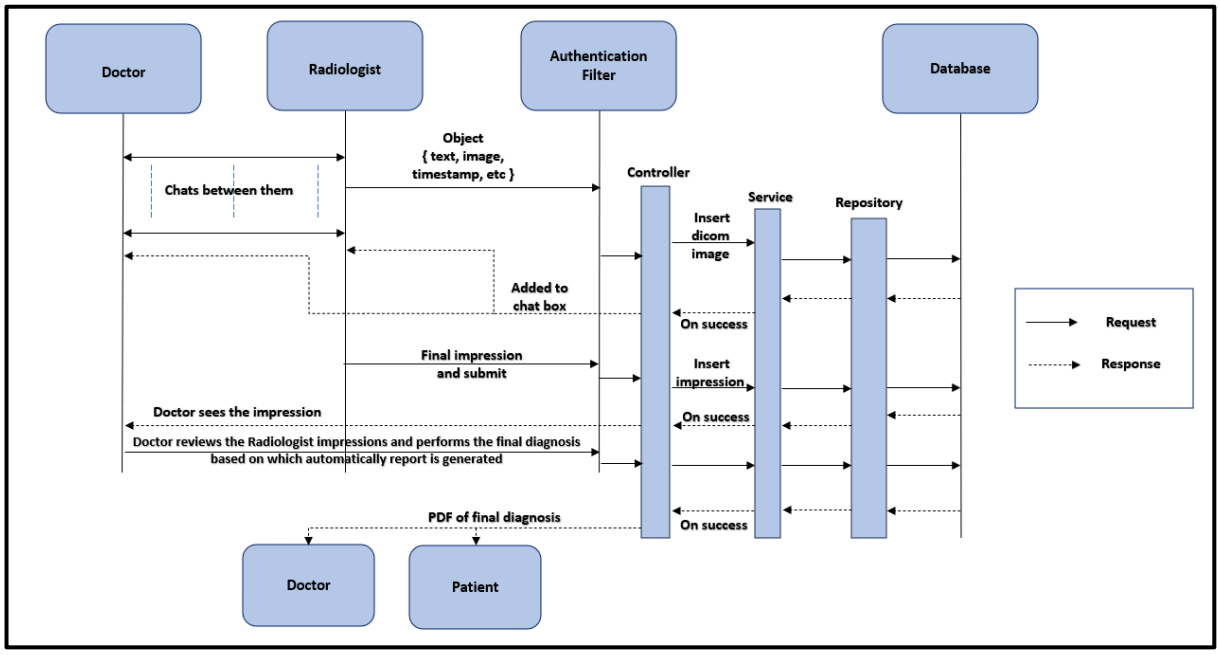
- **When Radiologist do chat with Doctor:**



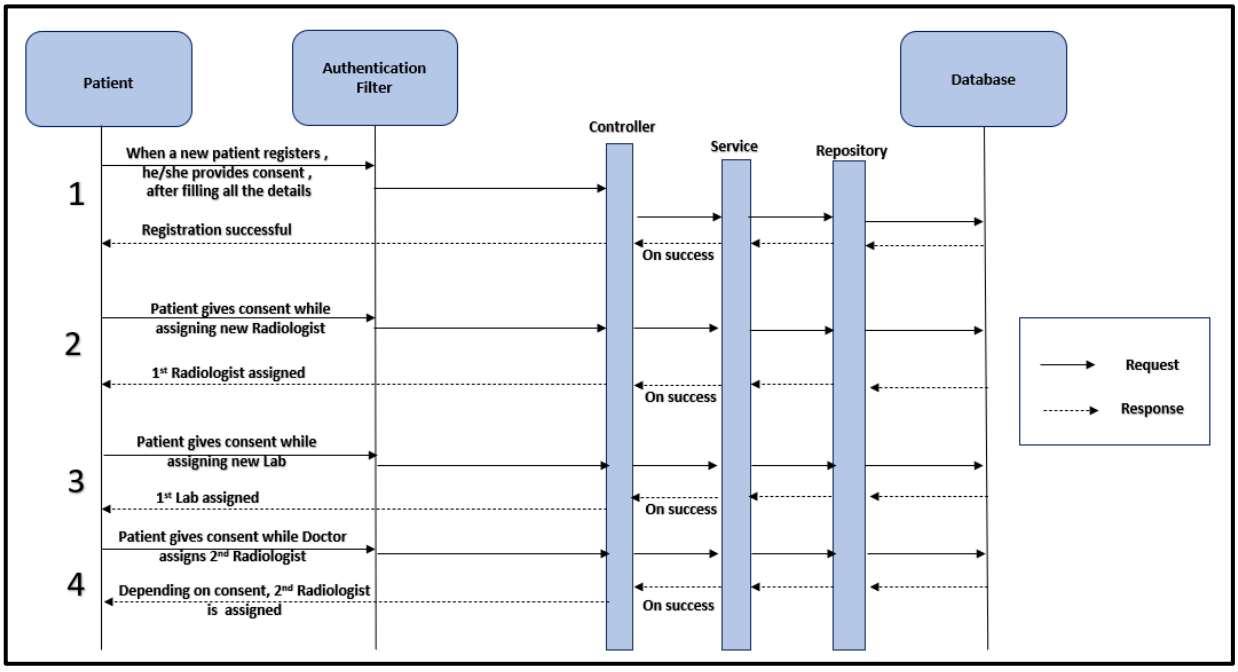
Dicom Module



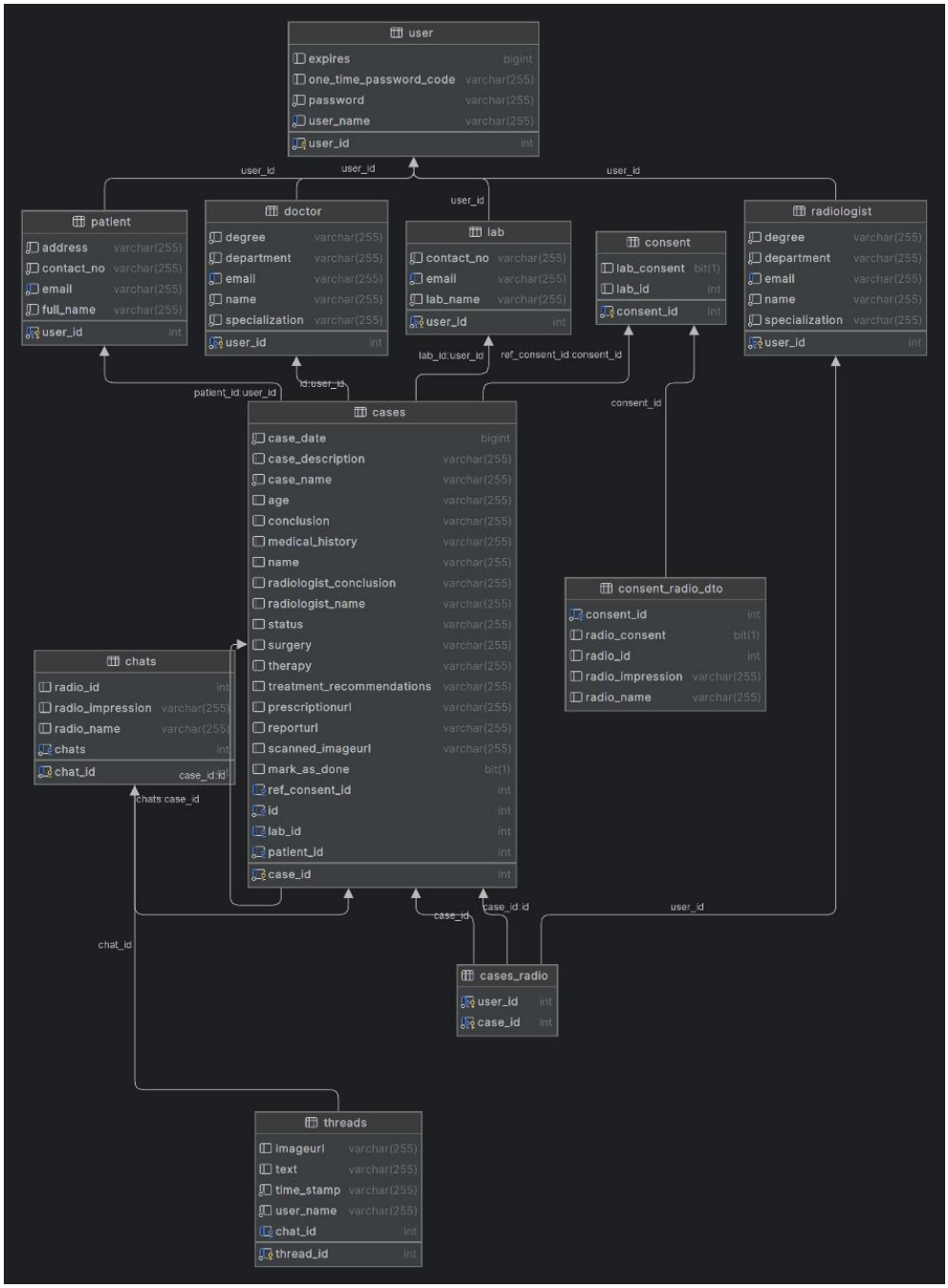
Report Generation Module



Consent Management Module



DB Schema


user
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password varchar(255)
user_name varchar(255)
user_id int
patient
address varchar(255)
contact_no varchar(255)
email varchar(255)
full_name varchar(255)
user_id int
doctor
degree varchar(255)
department varchar(255)
email varchar(255)
name varchar(255)
specialization varchar(255)
user_id int
lab
contact_no varchar(255)
email varchar(255)
lab_name varchar(255)
user_id int
consent
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lab_id int
consent_id int
radiologist
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department varchar(255)
email varchar(255)
name varchar(255)
specialization varchar(255)
user_id int
cases
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case_name varchar(255)
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conclusion varchar(255)
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name varchar(255)
radiologist_conclusion varchar(255)
radiologist_name varchar(255)
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therapy varchar(255)
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reporturl varchar(255)
scanned_imageurl varchar(255)
mark_as_done bit(1)
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lab_id int
patient_id int
case_id int
consent_radio_dto
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radio_impression varchar(255)
radio_name varchar(255)
chats
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radio_impression varchar(255)
radio_name varchar(255)
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user_id
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consent_id
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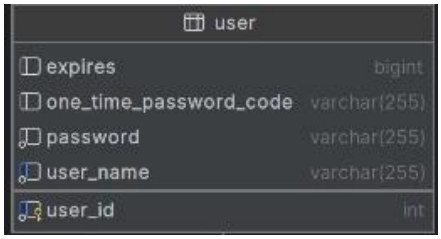
user_id

Description of every Table

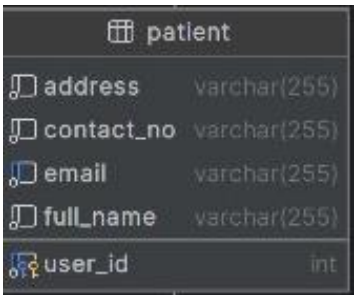
1.



User table which contains all the type of users.

Our users are Patient, Doctor, Radiologist, Lab

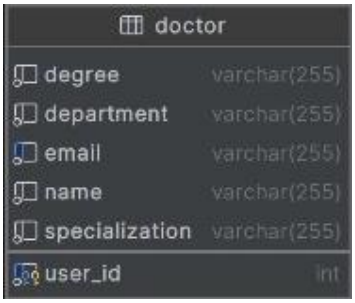
2.



Contain information about patient along

with the user id of the patient in the users's table

3.



Contain information about doctor along

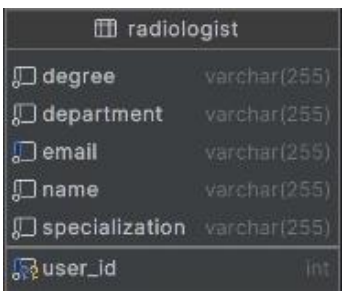
with the user id of the doctor in the users's table

4.

Contain information about lab along

with the user id of the lab in the users's table

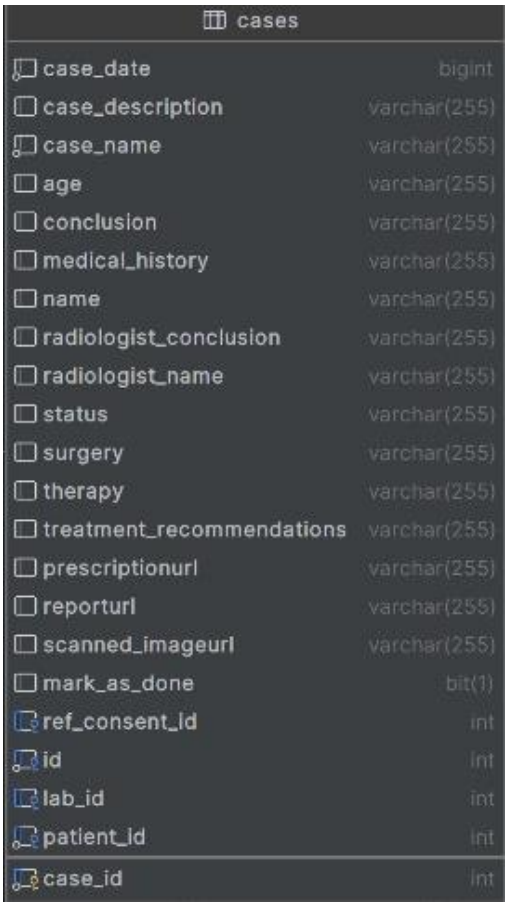
5.



Contain information about radiologist along

with the user id of the radiologist in the users's table

6.



Contain information about cases

7.

Gives information about consent

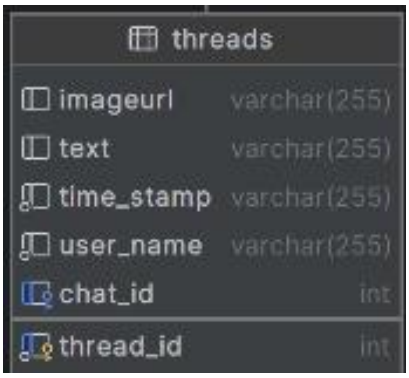
8.

Gives information about consent of the radiologist

9.

Contains the information of the chat between radiologist and doctor

10.



Contains the information about the individual chats

API Documentation:

Doctor

- Doctor login: logins a doctor
  http://localhost:8080/doctor/login
- Validate OTP for doctor: validates an OTP when a doctor logins
  http://localhost:8080/doctor/login/validateOTP
- Get details of profile of doctor: gets details of the particular doctor
  http://localhost:8080/doctor/getProfileDetails
- Change password of doctor: changes password of the doctor profile with the new password provided by the doctor.
  http://localhost:8080/doctor/changePassword
- Gets list of Cases: gets the list of cases
  http://localhost:8080/doctor/getListOfCases
- Get list of Doctors: gets the list of all doctors currently registered in our database
  http://localhost:8080/doctor/getListOfDoctors
- Create Case: Creates case by the doctor for a particular patient
  http://localhost:8080/doctor/createCase
- Mark as Done: marks the current case as done by the doctor
  http://localhost:8080/doctor/markAsDone
- Get Case by CaseID: get the particular case by its CaseID
  http://localhost:8080/doctor/getCaseByCaseId
- Get Case by Case ID: Get any particular case under the doctor by its case id
  https://localhost:8080/doctor/getCaseByCaseId
- Insert Thread Chat: Inserts Chat Threads
  http://localhost:8080/doctor/insertThreadChat
- Update Report: Generate Report for the particular Case
  http://localhost:8080/doctor/updateReport
- Assign new radiologist: Helps assigning a new radiologist by the doctor to that particular case
  http://localhost:8080 /doctor/assignNewRadiologist

Lab

- Lab login: logins a lab
  http://localhost:8080/lab/login
- Validate OTP for lab: validates an OTP when a lab logins
  http://localhost:8080/lab/login/validateOTP
- Get details of profile of lab: gets details of the particular lab
  http://localhost:8080/lab/getProfileDetails
- Change password of lab: changes password of the lab profile with the new password provided by the lab.

http://localhost:8080/lab/changePassword

- Gets list of Cases: gets the list of cases
  http://localhost:8080/lab/getListOfCases
- Get list of Labs: gets the list of all labs currently registered in our database
  http://localhost:8080/lab/getListOfLabs
- Upload Images: Uploads images by the lab for a particular case IDhttp://localhost:8080/lab/uploadImages

Radiologist

- Radiologist login: logins a radiologist
  http://localhost:8080/radiologist/login
- Validate OTP for radiologist: validates an OTP when a radiologist logins
  http://localhost:8080/radiologist/login/validateOTP

- Get details of profile of radiologist: gets details of the particular radiologist
  http://localhost:8080/radiologist/getProfileDetails
- Change password of radiologist: changes password of the radiologist profile with the new password provided by the lab.
  http://localhost:8080/radiologist/changePassword

- Gets list of Cases: gets the list of cases
  http://localhost:8080/radiologist/getListOfCases
- Get list of Radiologists: gets the list of all radiologists currently registered in our database
  https://localhost:8080/radilogist/getListOfRadiologists
- Get Case by Case ID: Get any particular case under the radiologist by it's case id
  https://localhost:8080/radiologist/getCaseByCaseId
- Update Radiologist's Impressions: updates radiologist's impressions for a particular case
  https:localhost:8080/radiologist/updateRadioImpression

Patient

- Patient login: logins a patient
  http://localhost:8080/patient/login
- Validate OTP for patient: validates an OTP when a patient logins
  http://localhost:8080/patient/login/validateOTP
- Patient register: registers a patient
  http://localhost:8080/patient/register
- Get details of profile of patient: gets the details of the particular patient
  http://localhost:8080/patient/getProfileDetails

- Change password of patient: changes password of the patient profile with the new password provided by the patient.
  http://localhost:8080/patient/changePassword

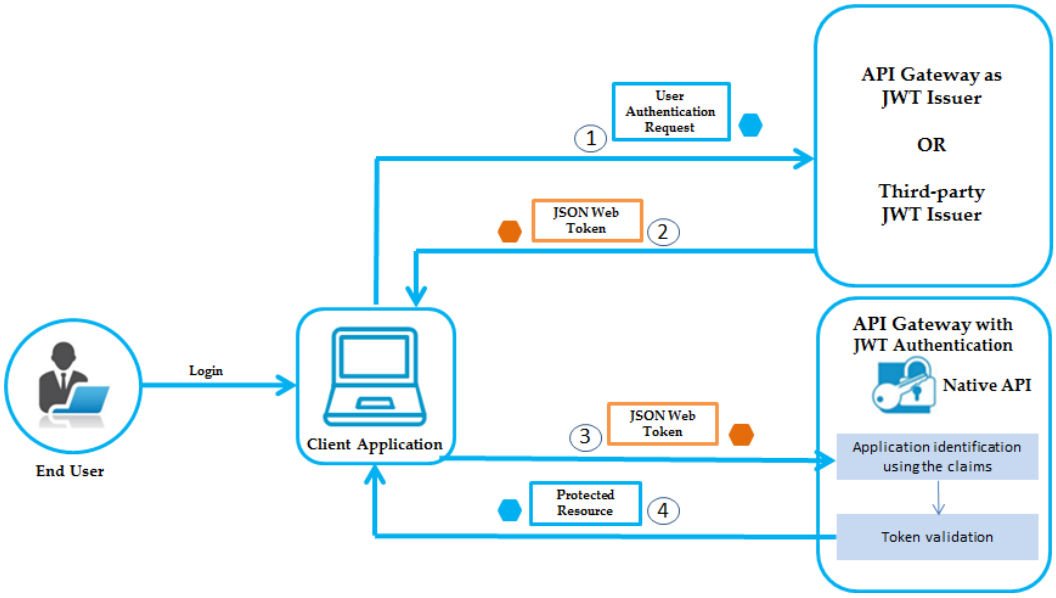
- Gets list of Cases: gets the list of cases
  http://localhost:8080/patient/getListOfCases
- Gets list of patients: gets list of all the patients currently registered in the database
  http://localhost:8080/patient/getListOfPatients
- Assign Radiologist: assigns a radiologist by the patient for the particular caseID
  http://localhost:8080/patient/assignRadiologist
- Assign Lab: assigns a lab for the particular CaseID by the patient
  http://localhost:8080/patient/assignLab
- Get Case by Case ID: Get any particular case of the patient by its case id
  https://localhost:8080/patient/getCaseByCaseId
- Consent for assigning new radiologist: It helps asking Patient for consent for assigning new radiologist for the case.
  https://localhost:8080/patient/assignRemoveNewRadiologist

Admin:

- Doctor register: registers a doctor
  http://localhost:8080/doctor/register
- Removes doctor: removes a doctor from the database
  http://localhost:8080/doctor/remove
- Lab register: registers a lab into the database
  http://localhost:8080/lab/register
- Removes lab: removes a lab from the database
  http://localhost:8080/lab/remove
- Radiologist register: registers a radiologist into the database
  http://localhost:8080/radiologist/register
- Removes radiologist: removes a radiologist from the database
  http://localhost:8080/radiologist/remove
- Removes patient: removes a patient from the databasehttp://localhost:8080/patient/remove

Security and Technical Safeguards:

1) JWT based Authentication:



JSON Web Token (JWT) — is an open standard (RFC 7519) that defines a compact and self-contained way for securely transmitting information between parties as a JSON object. This information can be verified and trusted because it is digitally signed.
Once the user is logged in, each subsequent request will include the JWT, allowing the user to access routes and resources that are permitted with that token.
JSON Web Tokens contains three blocks separated by dots:

1. Header
2. Payload
3. Signature

The first two blocks are in JSON format and additionally encoded in Base64 format.
JWT typically looks like the following:
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFtZSI6IkpvaG4gRG9lIiwiaWF0IjoxNTE2MjM5MDIyfQ.SflKxwRJSMeKKF2QT4fwpMeJf36POk6yJV_adQssw5c

How JWT is being used?

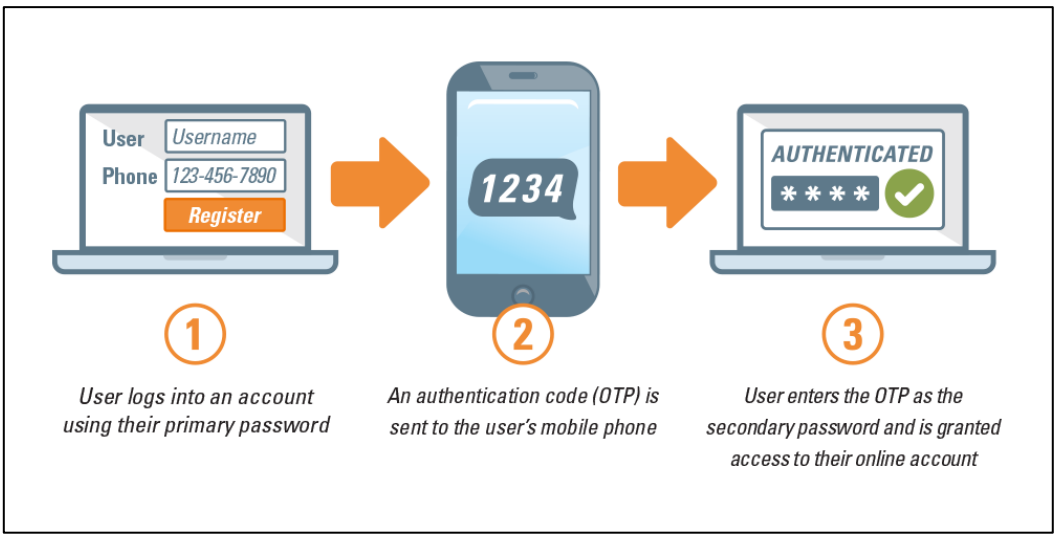
1. User (Patient, Doctor, Radiologist, Lab or Admin) logs in using username and password.
2. Server validates the username and the password against the entry in the database.
3. Upon validation, the server sends a JWT token, which serves as authentication token hereon for the rest of the session for that particular user.
4. In our case we have kept the validity for the token as 1hr and on signing out the token is then invalid to use.

2) Role Based Authentication using JWT

Role-Based Access Control (RBAC) is implemented using JSON Web Tokens (JWT) to enhance authorization within our project. We have delineated 5 distinct roles: Doctor, Patient, Admin, Radiologist, Lab each endowed with specific permissions governing their actions and operations within the system. These permissions are meticulously enforced through JWT tokens, which are generated post successful authentication of the user's credentials.

During an attempt to access an API endpoint, the JWT token accompanying the request undergoes validation. This validation process entails verifying the token's signature to ensure its integrity and authenticity. Furthermore, the token is parsed to extract crucial role information pertaining to the user.

3) Two factor Authentication using OTP:



Two-factor authentication (2FA) employing a One-Time Password (OTP) mechanism is a robust security measure implemented to fortify user accounts and enhance access control. In this approach, users are required to provide two forms of identification before gaining access to their accounts: their regular login credentials (such as username and password) and a unique, time-sensitive OTP.

The OTP is generated using a randomized algorithm and is valid for a single use within a specific timeframe, in our case 5mins. We are delivering the OTP using email of thee registered user.

Here's how the process generally works:

1. **Initiating the Login**: The user initiates the login process by entering their username and password into the system.
2. **Requesting OTP**: After successfully entering the initial credentials, the system prompts the user to provide a second form of authentication in the form of an OTP.
3. **Generating OTP**: The system generates a unique OTP using an algorithm and sends it to the user via email.
4. **Entering OTP**: The user receives the OTP and enters it into the system within the designated timeframe.
5. **Verification**: The system verifies the entered OTP against the expected value generated during step 3. If the OTP matches, access is granted. Otherwise, access is denied.

Benefits of 2FA using OTP include:

- **Enhanced Security**: By requiring two forms of identification, 2FA significantly reduces the risk of unauthorized access, even if one factor (like a password) is compromised.
- **Mitigation of Credential Theft**: OTPs are valid for a single use and are time-sensitive, making them ineffective for attackers attempting to reuse stolen credentials.
- **Flexible Implementation**: OTPs can be delivered via various channels, allowing users to choose the method most convenient and secure for them.

4) OTP based Image Uploading by Lab

Once the Patient has gone to the Lab and performed the required scans the Lab will have to upload the scans to the Platform, in order to do that we are enabling OTP based authentication where the Lab will send an OTP to the user and using that OTP the Lab will upload the scanned images and the doctor's prescription, if OTP is correct the images will be uploaded else if the OTP is invalid or has expired appropriate message will be displayed and the Lab will resend the OTP to the user.

This way we provide additional security when dealing with Patients confidential information and the images are uploaded only when the user validates it with an OTP thus ensuring privacy and security of their information.

5) Consent Management System

We have a robust consent management system in place which helps to distribute and share information among actors only when the Entity whose information it is gives consent to share it.

Thus this ensures that anybody cannot share information like that, they need to get the consent of the concerned actor before sharing the information.

How we have implemented Consent Management?

1. The patient while registering needs to approve the given conditions of data sharing as mentioned in the consent document which shows the various clauses. Approving that will only allow the patient to register.
2. Once the Doctor creates a case and assigns a Patient, for the first time they will have full liberty to choose a Lab and a Radiologist of their choice, each time while assigning a new radiologist/lab they will be required to read and agree to a Consent Form mentioning all the clauses post which the required Radiologist/ Lab will be assigned.
3. Now suppose the Doctor is not content with the first Radiologist's analysis they can request for a new Radiologist of their choice which goes to the Patient for their consent. The patient may give or deny consent to the doctor's request.

Some of the benefits this can ensure are as follows:

Legal Compliance: Ensures compliance with regulations such as HIPAA (Health Insurance Portability and Accountability Act) and GDPR (General Data Protection Regulation) by managing patient consent for data processing and sharing.

Patient Empowerment: Empowers patients by giving them control over how their medical data is used and shared, fostering trust between patients and healthcare providers.

Risk Mitigation: Reduces the risk of data breaches and legal liabilities associated with unauthorized data access or sharing by obtaining explicit consent from patients before accessing their medical records. The patient will have full control.

Customized Consent: Allows customization of consent forms based on specific procedures, treatments, or data sharing scenarios, ensuring that patients understand and agree to the intended use of their data.

Enhanced Data Security: Strengthens data security measures by implementing access controls and encryption mechanisms to protect sensitive patient information like password, personal info, ensuring compliance with privacy regulations.

Patient-Centric Approach: Demonstrates a commitment to patient privacy and confidentiality, fostering a patient-centric approach to healthcare delivery and promoting trust in the Tele Radiology Platform.

6) **B-Crypt:**

The Bcrypt algorithm serves as a formidable tool for password encryption, ensuring the security of user authentication processes. Employing a one-way hashing procedure, Bcrypt transforms plaintext passwords into irreversible hash values. By integrating salt and key stretching techniques, it fortifies defenses against prevalent attacks like rainbow table exploitation and brute-force assaults. These hashed passwords are securely stored, providing robust protection for user credentials. This approach adheres to best practices for secure password management in applications and systems.

We have encrypted the "**passwords column**" of all the users thus ensuring no third party even if they gain access to the database entries will not be able to decrypt the password value thus preventing them from gaining access into the system.

4	NULL	NULL	$2a$10$Gq37o//NSCGEaI4aJ.OSY.HMYQWKAw...	sham99
5	NULL	NULL	$2a$10$q/kiYjOUgp8ltE2sxCs4J.qRHfmIJqes0h...	lab05
6	NULL	NULL	$2a$10$cnrpMGy/hojA6GzYj3k4cOcOre.Sk/m/G...	Ram

As our DB is segregated and most of the tables are being accessed by JWT authenticated API's it is quite difficult for intruders to gain access of the system. The open APIs access tables which are lean and have very less information.

Additional Features:

- **Automatic Report Generation and Miscellaneous:**
    1. The case will conclude with the automatic generation of report based on the Doctor's Diagnosis as a pdf file.
    2. The Radiologists impression will also be viewable as a pdf to both the doctor and the patient.
    3. The Prescription and the Dicom Image of the Scan will also be viewable as part of the report.

    This feature makes report generation easy and is accessible by anybody anywhere thus providing immense flexibility without compromising on security as all these information are accessible only to the patient and the doctor.

- **Image Downloading Feature:**

1. The patient and the doctor can download the Prescriptions, Report and Radiologist Impression as well. This can help the patient to access the information anywhere and get consultation from different people they want.

- **Two factor Authentication:**
  Two-factor authentication (2FA) employing a One-Time Password (OTP) mechanism is a robust security measure implemented to fortify user accounts and enhance access control. In this approach, users are required to provide two forms of identification before gaining access to their accounts: their regular login credentials (such as username and password) and a unique, time-sensitive OTP. This ensures added security to the system.

- **OTP based Image uploading:**
  This ensures that the scans and reports are being uploaded to the correct user thus causing any data breach of personal information.

- **Email based Notification for all the events in the system:**
  Various events that sends out notification in our platform are as follows:
  1. Account Creation for all the Users
  2. OTP generation during login.
  3. New Case Creation where notification is sent out to the concerned patient.
  4. Radiologist/ Lab Assignment by the patient sends out notification to the concerned entity.
  5. New Radiologist Request and Assignment.
  6. Chat update between Doctor and Radiologist.
  7. Change Password.
  8. Case Completion. etc.

Privacy Policy Summary

Project title: Kavach – India's leading Teleradiology Platform.

Team no: 3

Team Members: Samarpita Bhaumik, Sunnidhya Roy, Shamik Bhattacharjee, Subhankhi Maiti

Please answer the following in as much detail as you can provide. In the table below, "user" refers to the "data subject" – the person(s) whose personal data is being collected and processed in your application.

Data Fiduciaries *Identify the organizations/entities that "determine the purpose and means of processing of personal data"*	Kavach Application
Nature of the application/platform *Summarize the overall purpose of your solution – what it broadly does, and not how it does it*	Kavach, our innovative Teleradiology Platform facilitating seamless communication between doctors, radiologists, labs, and patients. Doctors create cases, patients assign specialists, and our intuitive chat interface enables efficient collaboration. Automatic report generation and downloadable prescriptions streamline the diagnostic process, ensuring swift and accurate healthcare delivery.
Personal data collected	*For each item of personal and/or sensitive data, mention the item and the purpose for which it is collected* *List one data item per line*
Data Item	**Purpose**
Patient Name	Used to personally address the patient
Patient Email	Verifies the authenticity of the patient
Patient Age	Used for identifying the age of the patient
Patient's Prescription	This is provided in the prescription of the doctor which is uploaded, used to identify potential age related issues

Patients Scanned Image	Dicom image of the patient is required to do any kind of analysis of what the patient might be suffering from by the doctor and the radiologists
Patient's Address	Used to identify the location of the patient
Doctor's Name	Used to personally address the doctor
Doctor's Degree	Used to identify the doctor's qualification
Doctor's Specialization	Used to identify what kind of cases can be managed by the doctor
Doctor's Email	Verifies the authenticity of the doctor
Radiologist's Name	Used to personally address the radiologist
Radiologist's Degree	Used to identify the radiologists's qualification
Radiologist's Specialization	Used to identify what part of the body can be diagnosed by the radiologist
Radiologist's Email	Verifies the authenticity of the radiologist
Lab's Name	Used to personally address the lab
Lab's Phone No.	Used to keep track of the phone details
Lab's Email	Verifies the authenticity of the lab
Lab's Address	Used to identify the location of the lab
Informed consent *List the steps at which user consent is obtained, and the mechanism of consent collection.*	During registration, patients must review and agree to a detailed consent form outlining the use, handling, and protection of personal data, including specifics on data collection, processing, retention, and sharing with third parties. To proceed, users must actively select an "I Acknowledge" option, indicating their informed consent. Also while assigning Radiologist/ Lab the Patient should agree to the Consent Form highlighting data sharing with the entities.
Data Minimization *Are all data items collected required for the proposed processing? Identify those that are not*	NA

needed for the stated purposes	
Confidentiality *How is this ensured. List any 3rd parties with whom the data is shared, and the purpose*	We utilize JWT (JSON Web Tokens) as a compact and self-contained approach for securely transmitting data between parties. Sensitive Information like password exchanged between our servers and clients is encrypted for enhanced security. In addition to robust encryption standards safeguarding data at rest in our databases, we implement two-factor authentication (2FA) for an added layer of security. This authentication method requires users to provide two different authentication factors to gain access, significantly bolstering the protection of sensitive information. We even use OTP based Image Uploading to ensure minimal data breach happens.
Purpose Limitation *Identify mechanisms in place to prevent data use for other than stated purposes*	Our APIs are properly designed to operate properly upon the provision of requisite data as parameters. This approach guarantees precise and controlled access to functionalities. However, should the supplied data be inadequate or improper, appropriate error messages will be provided to guide users towards rectification.
Security *List the security related mechanisms and technical safeguards to protect privacy*	JWT (JSON Web Tokens): Secure information transmission and user session management. 2 factor authentication provides enhanced level of security to the user accounts thus providing better Security and Personal Information Management. The open APIs communicate with lean tables which have very minimal information where we have even encrypted the password column thus preventing any kind of breach.
Data Retention *For what period of time is the collected data stored. What happens to the data at the end of that period*	Our database employs encryption to safeguard stored data, mitigating potential malicious attacks effectively. As a result, we have opted not to enforce a specific data retention period, prioritizing continuous data security measures. Sensitive information like passwords are encrypted to prevent hackers to access user account, the open API's access very lean tables which have minimal information. Rest tables are guarded by JWT authentication.

Data Deletion Requests *Describe the mechanism by which users can request deletion of some or all of their data. If no such mechanism exists, state so*	The User can request the Admin to delete the data.
Account Deletion *How are requests for deletion of accounts by users handled. What happens to the data of accounts that are deleted*	The Users can send an email to the Admin to delete their account and which in turn will delete all the information about the user.
Revoking Consent *Can users revoke some or all of the consent they have provided. What is the mechanism for revoking consent?*	As consent is obtained during registration for all users, a specific mechanism for revoking consent has not been incorporated, suitable measures have been taken to properly make the user read the consent form and then give consent.
Other Privacy related remarks	We have implemented 2 factor Authentication to ensure proper authorization and authentication of the user who is trying to login. We have implemented OTP based Image Uploading for Lab to ensure minimal data breach takes place as user will be authenticated before uploading the scanned images and prescription.