Med Track: AWS Cloud-Enabled Healthcare Management System

Project Description:

MedTrack is a secure, cloud-based healthcare management platform designed to streamline patient care and administrative workflows. Built on Amazon Web Services (AWS), it allows healthcare providers to manage electronic health records, schedule appointments, conduct telemedicine consultations, and issue e-prescriptions from a single system.

The platform uses **AWS EC2** for hosting applications, **Amazon RDS** for reliable database storage, **S3** for storing medical documents, and **Cognito** for secure user authentication and access control. Automated notifications and reminders are sent via **AWS SNS** to keep patients informed.

By leveraging AWS cloud infrastructure, MedTrack delivers high availability, scalability, and robust data protection, helping clinics and hospitals improve efficiency while maintaining compliance with healthcare data regulations like HIPAA.

Scenario 1 – Appointment Booking and Notifications

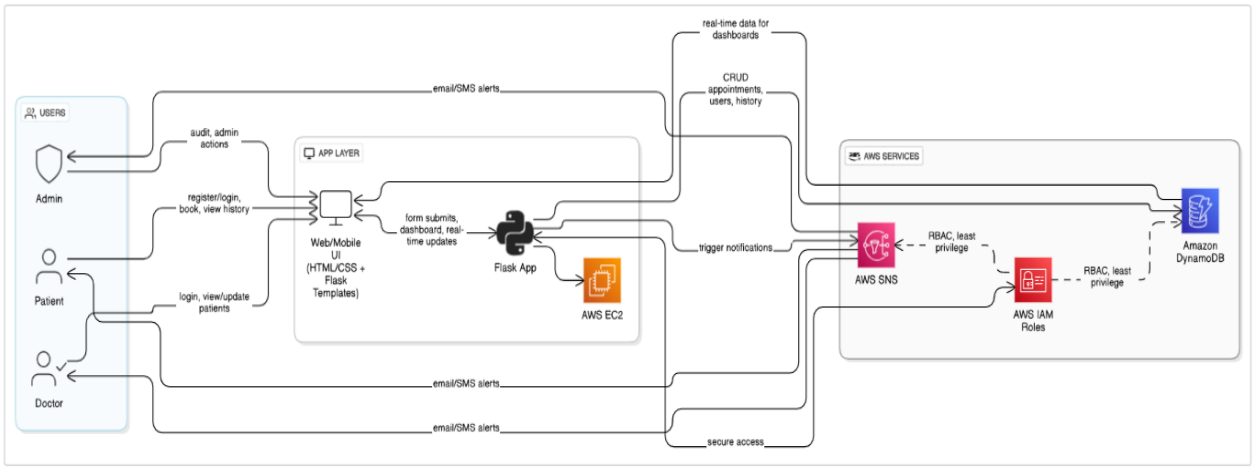
A patient logs into the MedTrack web app, which is hosted on **Amazon EC2** instances. They schedule an appointment, and the booking details are saved in **Amazon DynamoDB**, enabling fast retrieval and updates. Immediately, **AWS SNS** sends a confirmation SMS and email to the patient with appointment details.

Scenario 2 – Medical Record Update with Secure Access

A doctor logs in through the MedTrack portal running on **EC2**. Using permissions managed by **AWS IAM**, the doctor can securely access and update patient records stored in **DynamoDB**. Any changes are recorded in real time so all authorized staff see up-to-date information.

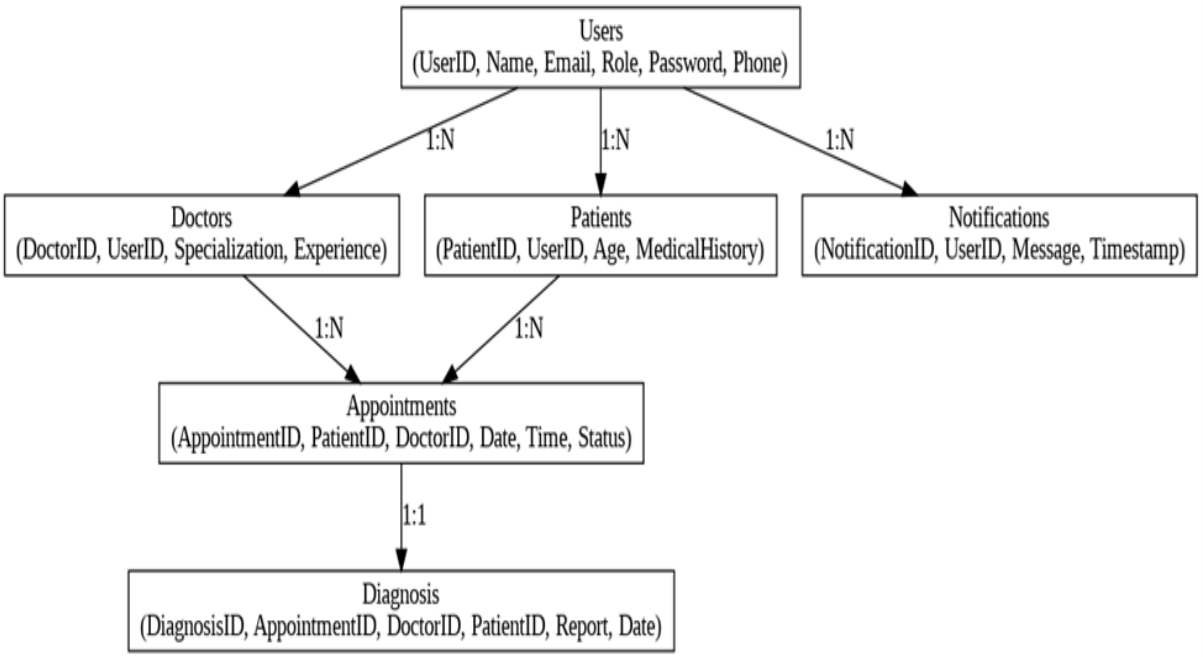
Scenario 3 – Emergency Alerts and Notifications

When critical lab results are entered into the system, MedTrack triggers an alert. A Lambda function scans the **DynamoDB** table for urgent flags and uses **AWS SNS** to send high-priority notifications to the assigned doctor's mobile device. **IAM** policies ensure only authorized medical staff can receive and act on these alerts.



AWS ARCHITECTURE

Entity Relationship (ER)Diagram:



Pre-requisites:

1. **AWS Account Setup:**
   https://docs.aws.amazon.com/accounts/latest/reference/getting-started.html
2. **AWS IAM (Identity and Access Management):**
   https://docs.aws.amazon.com/IAM/latest/UserGuide/introduction.html
3. **AWS EC2 (Elastic Compute Cloud):**
   https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/concepts.html

4. **AWS DynamoDB:**
   https://docs.aws.amazon.com/amazondynamodb/Introduction.html

5. **Amazon SNS:**
   https://docs.aws.amazon.com/sns/latest/dg/welcome.htm

6. **Git Documentation:**
   https://git-scm.com/doc

7.VS Code Installation: (download the VS Code using the below link or you can get that in Microsoft store)
https://code.visualstudio.com/download

Project WorkFlow:

1. AWS Account Setup and Login

Activity 1.1: Set up an AWS account if not already done.

Activity 1.2: Log in to the AWS Management Console

2. DynamoDB Database Creation and Setup

Activity 2.1: Create a DynamoDB Table.

Activity 2.2: Configure Attributes for User Data and Book Requests.

3. SNS Notification Setup

Activity 3.1: Create SNS topics for book request notifications.

Activity 3.2: Subscribe users and library staff to SNS email notifications.

4. Backend Development and Application Setup

Activity 4.1:Develop the Backend Using JavaScript.

Activity 4.2: Integrate AWS Services Using boto3.

5. IAM Role Setup

Activity 5.1: Create IAM Role

Activity 5.2: Attach Policies

6. EC2 Instance Setup

Activity 6.1: Launch an EC2 instance to host the JavaScript application.

Activity 6.2: Configure security groups for HTTP, and SSH access.

7. Deployment on EC2

Activity 7.1:Upload JavaScript

Files

8. **Activity 7.2**: Run the

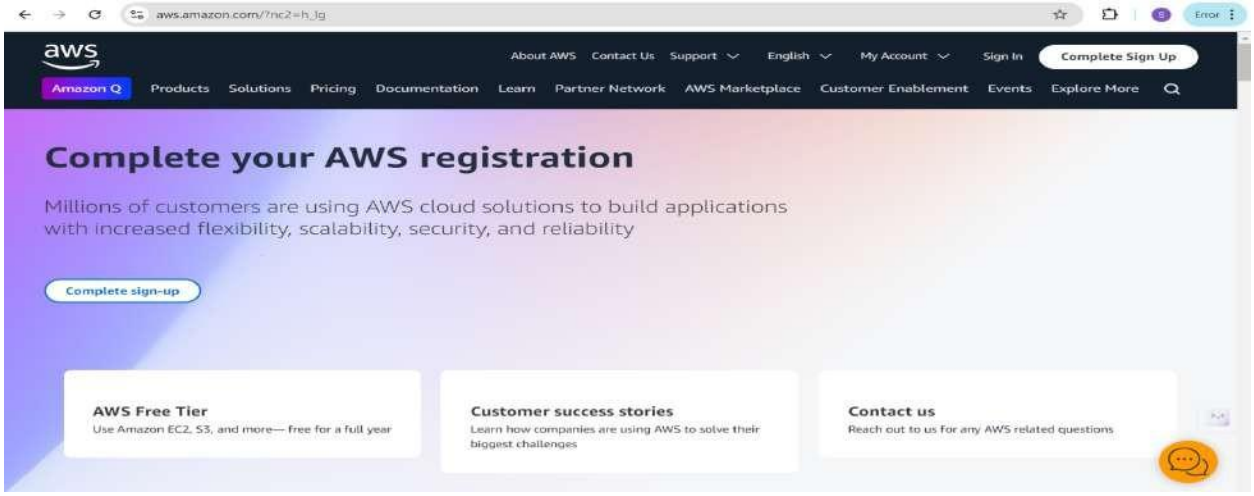
JavaScript App

9. Testing and Deployment

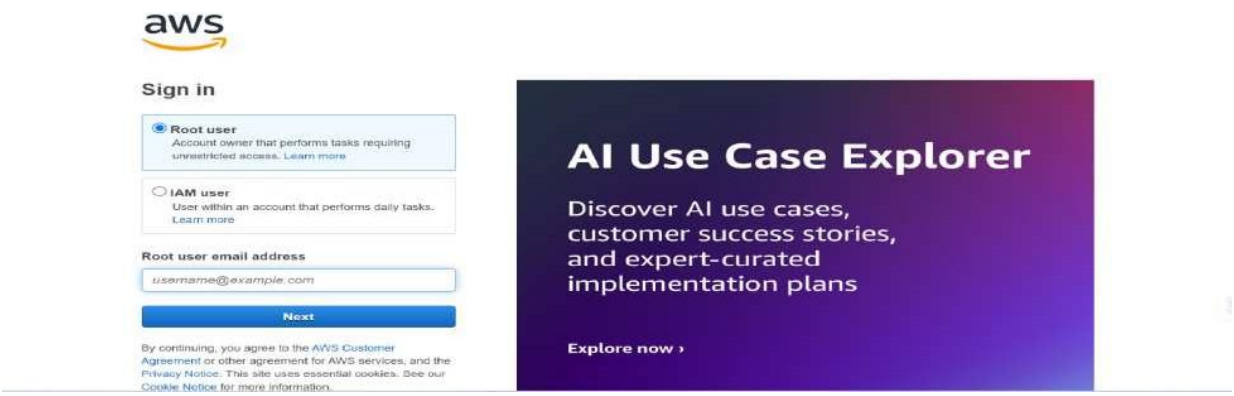
Activity 8.1: Conduct functional testing to verify user registration, login, book requests, and notifications.

Milestone 1: AWS Account Setup and Login

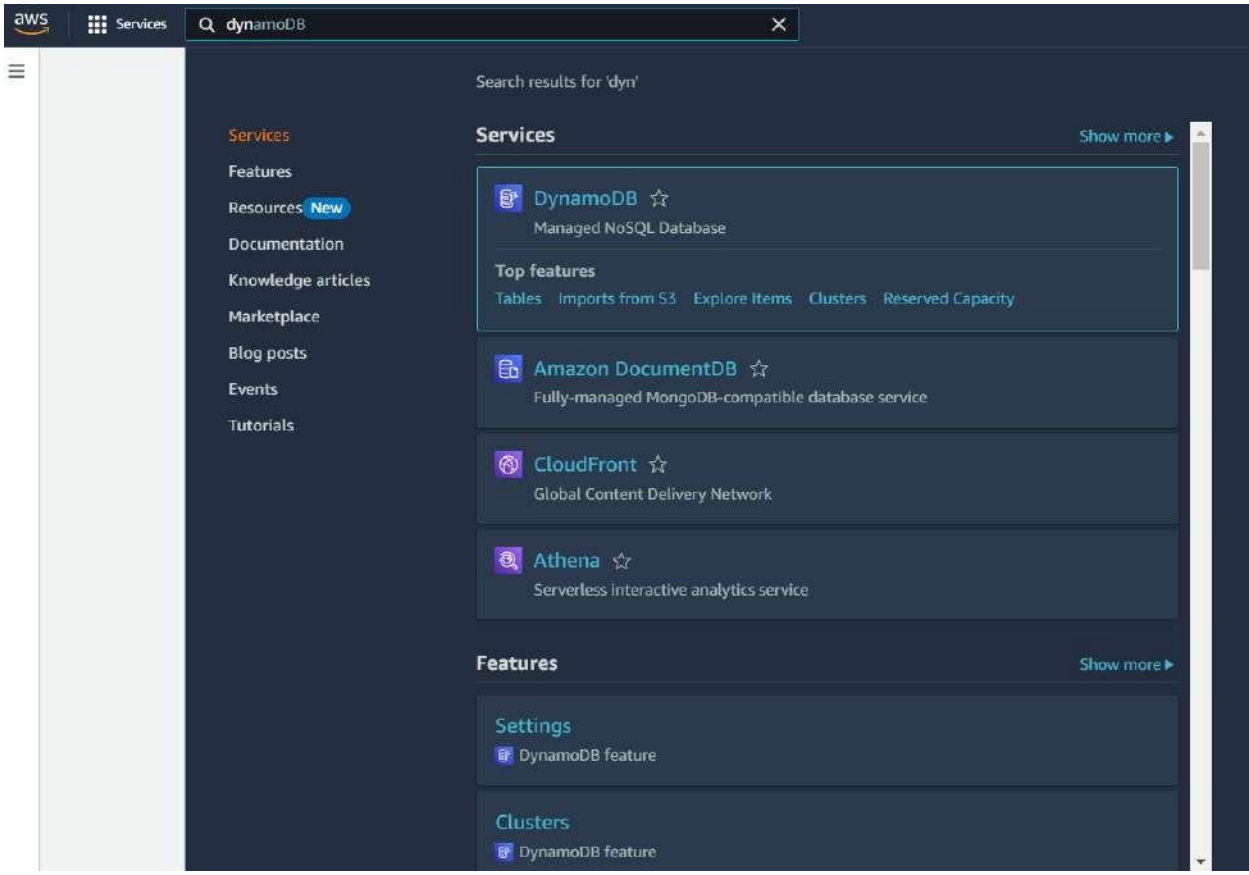
- **Activity 1.1: Set up an AWS account if not already done.**
  - Sign up for an AWS account and configure billing settings.

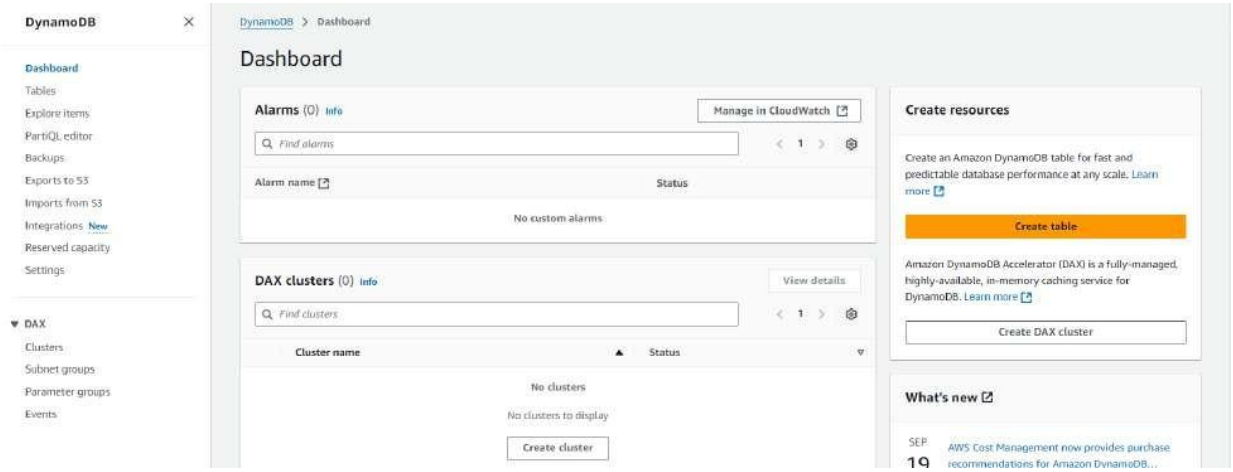


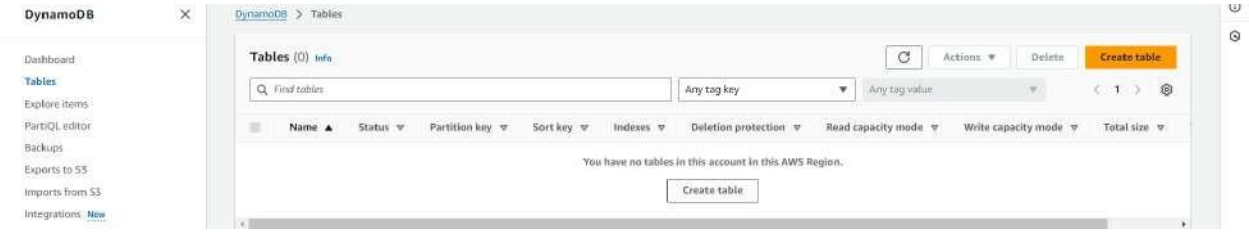
- **Activity 1.2: Log in to the AWS Management Console**
  - After setting up your account, log in to the [AWS Management Console].



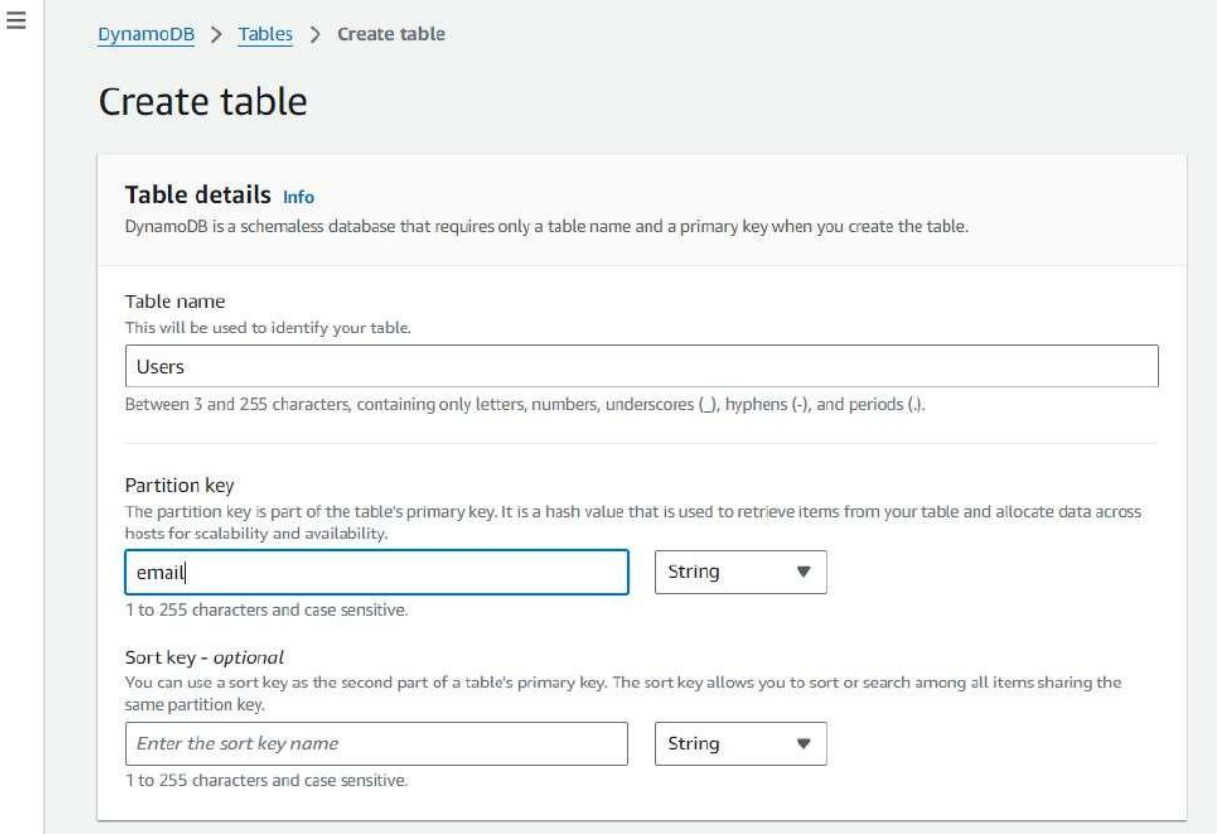
Milestone 2: DynamoDB Database Creation and Setup

- **Activity 2.1:Navigate to the DynamoDB**
    - In the AWS Console, navigate to DynamoDB and click on create tables.
    - 





- **Activity 2.2:Create a DynamoDB table for storing registration details and book requests.**
    - Create Users table with partition key “Email” with type String and click on create tables.



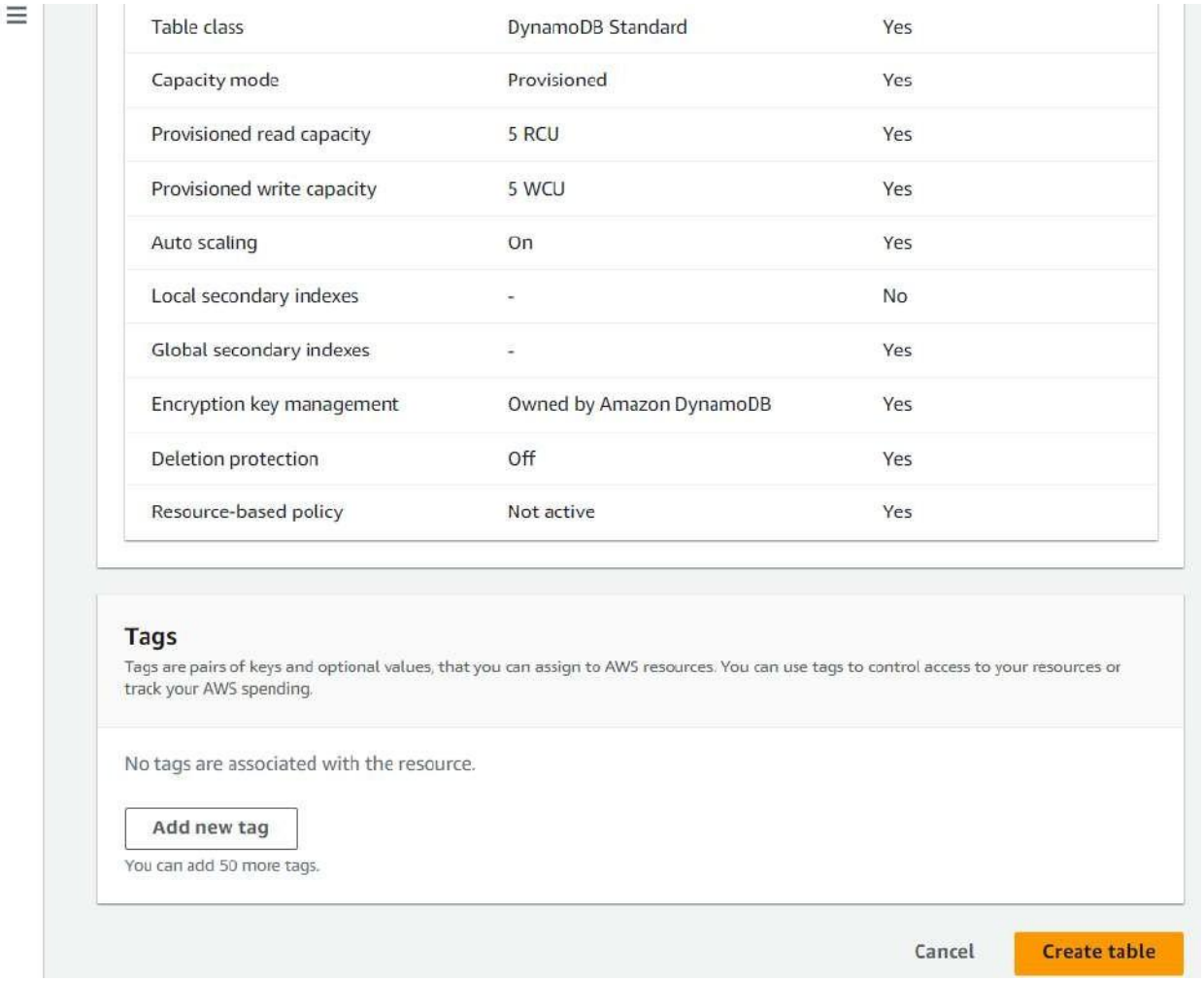
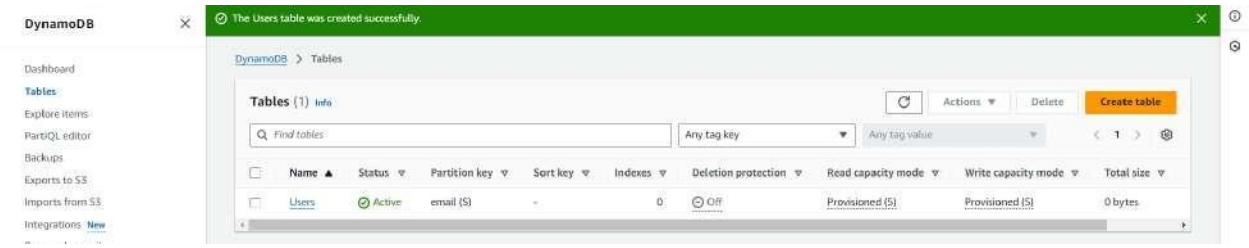


Table class	DynamoDB Standard	Yes
Capacity mode	Provisioned	Yes
Provisioned read capacity	5 RCU	Yes
Provisioned write capacity	5 WCU	Yes
Auto scaling	On	Yes
Local secondary indexes	-	No
Global secondary indexes	-	Yes
Encryption key management	Owned by Amazon DynamoDB	Yes
Deletion protection	Off	Yes
Resource-based policy	Not active	Yes



- Follow the same steps to create a requests table with Email as the primary key for book requests data.

" DynamoDB \ Tables } Create table

Create table

Table details inio

DynamoDB is a schemaless database that requires only a table name and a primary key when you create the table.

Table name

This will be used to identify your table.

Requests

Between 3 and 2S5 characters, curyLaJning unly letters, rJumLt s, uryderscores , hmheris (-[, and p@iods (.).

Partition key

The partition key ispart of the table's primar'/ key. It is a hash value that is used to retrieve items from your table and allocate data across

email String

1 ta 255 characters and case sensitive.

Sort key - *optional*

You can use a sort key as the second part of a tabte's primary key. The sort key allows you to sort or search among all rtems sharing the same partition key.

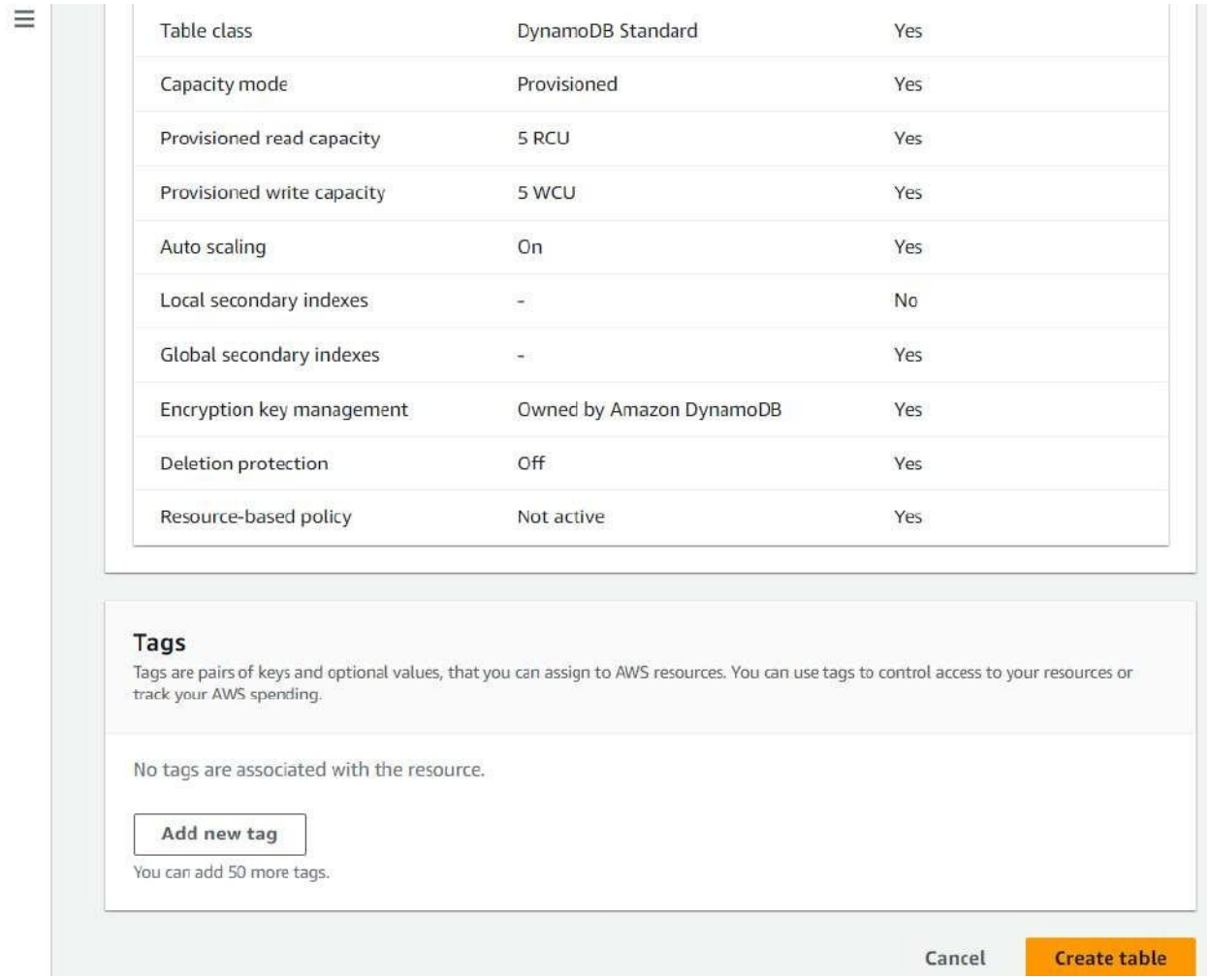
Enter the sort key nome String

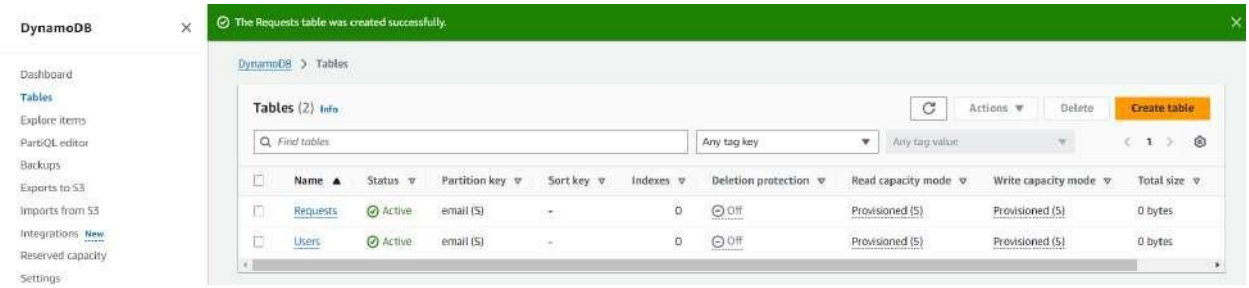
4 to 255 characters and case sensitive.

Table settings

@ Default settings

Customize settings

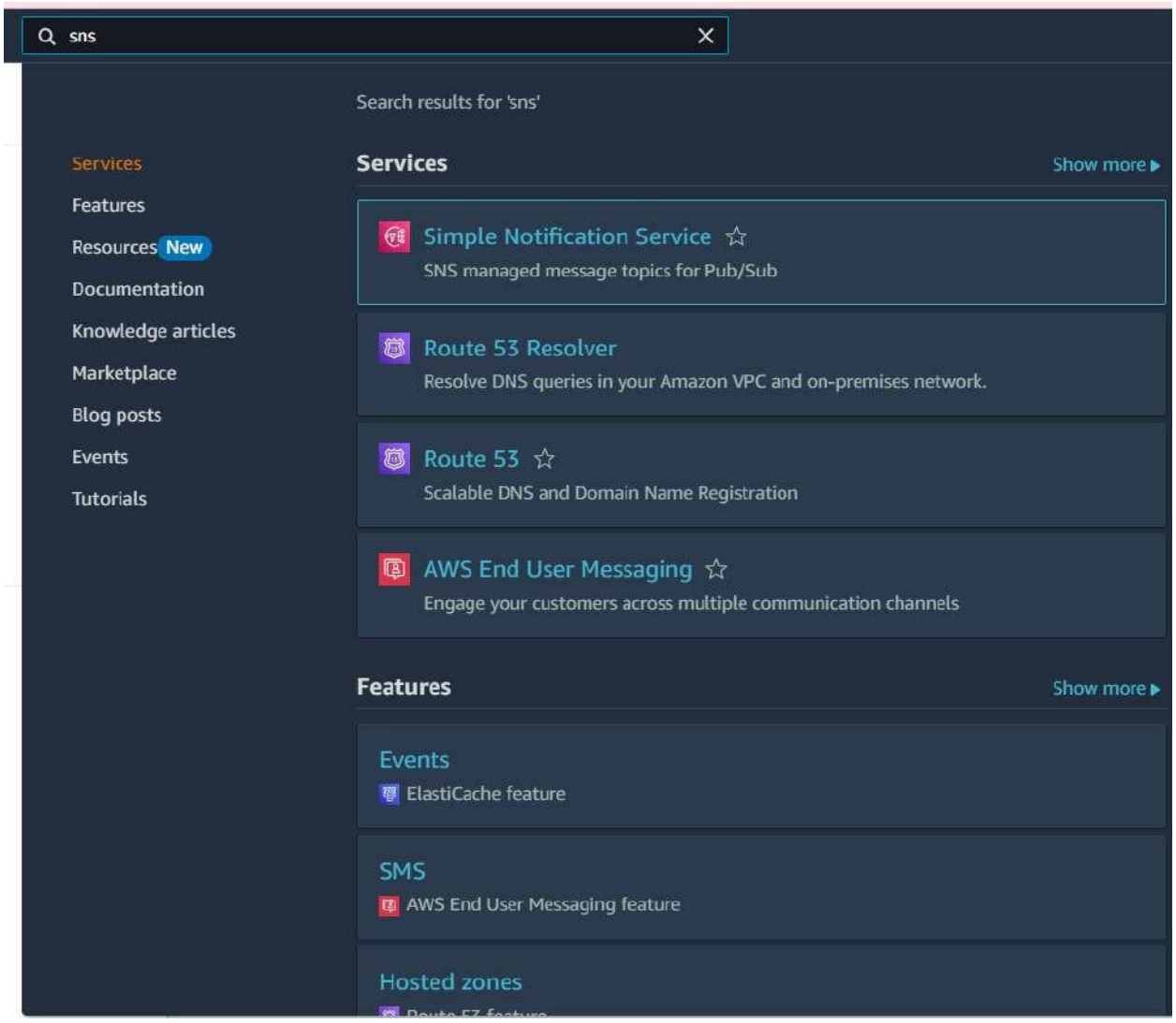


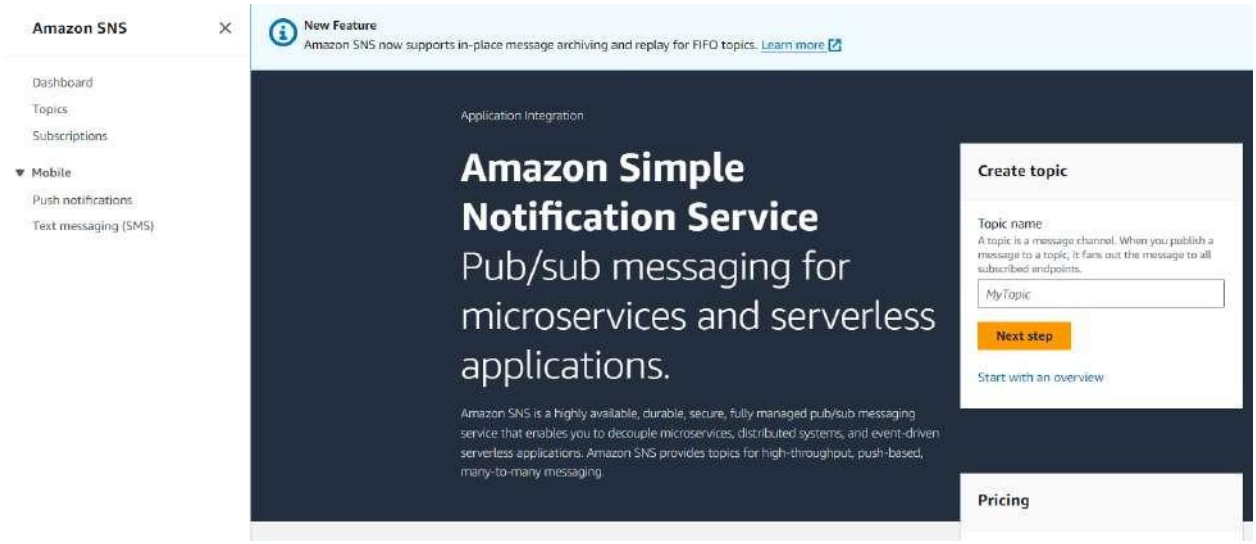


Milestone 3: SNS Notification Setup

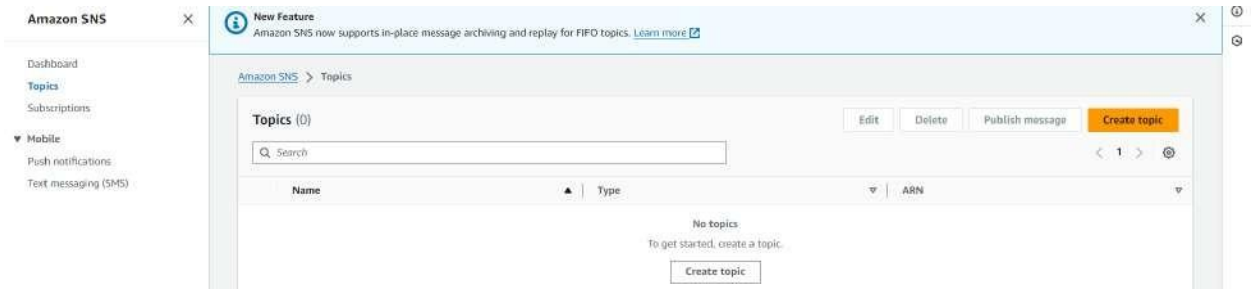
- **Activity 3.1: Create SNS topics for sending email notifications to users and library staff.**

- In the AWS Console, search for SNS and navigate to the SNS Dashboard.





- Click on **Create Topic** and choose a name for the topic.



- Choose Standard type for general notification use cases and Click on Create Topic.

Amazon 5N5 \ Topics Create topic

Create topic

Details

Type trrfo
Topic type cannot be modified atter topic is created

O FJFO (first-in, first-out)

- Strictly—preserved message ordering
- Mactly-onEe message delivery
- High throughput, up to ZOO publishes/second
- Subscription protocol: SQS

@ Standard

Best-effcrt message ordering
at-least once message delivery
Highest throughput in publishes/second
Subscription protocols: SQS, Lambda, HTTP, SI IS, email, mobile application endpoints

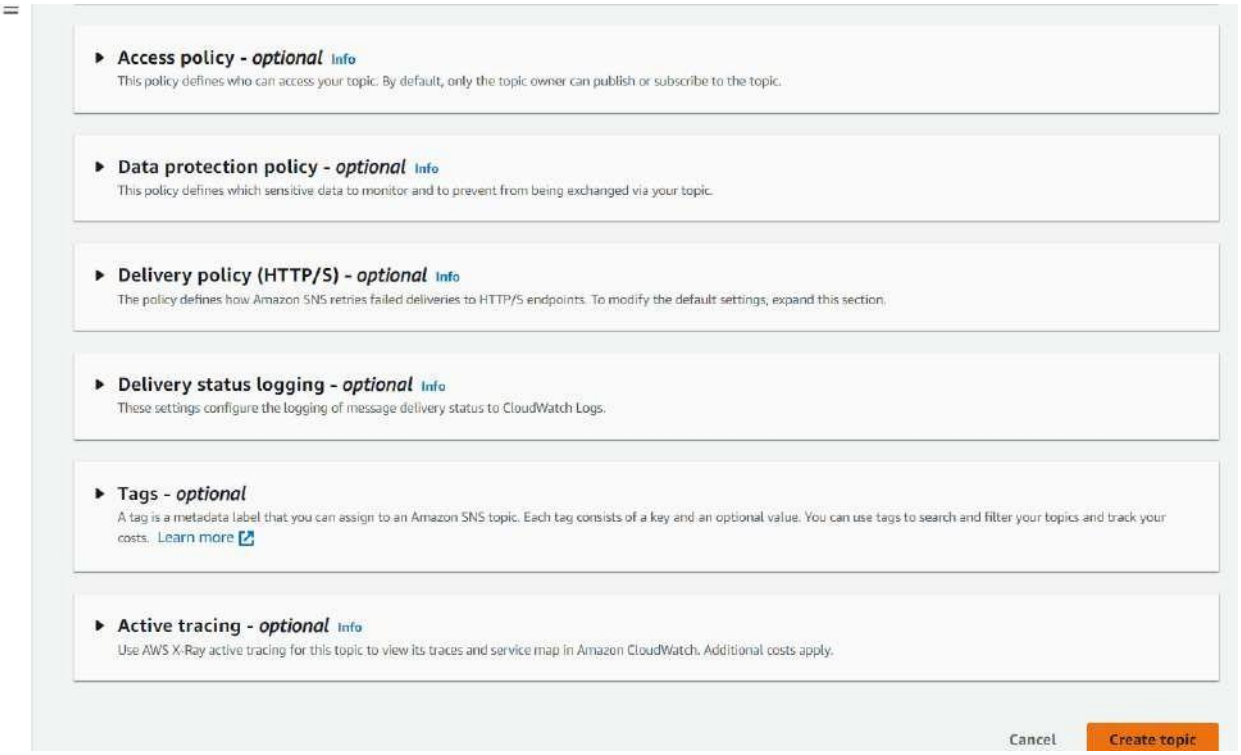
Name

BookRequeStNotificatiDr6

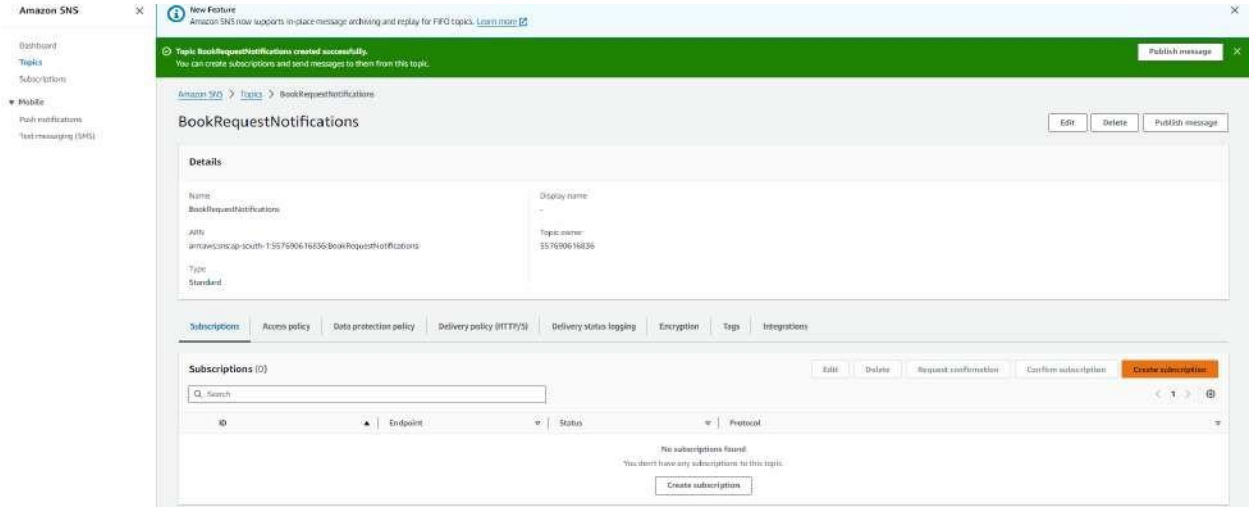
Maximum 256 characters. Can include alphanurr+eric characters, hyphens (-) and underscores M.

Display name - optional lrrfo
To use this topic with 5M5 subscriptions, enter a display name. Only the first 10 characters are displayed in an Si iS message.

Maximum 1 00 characters.

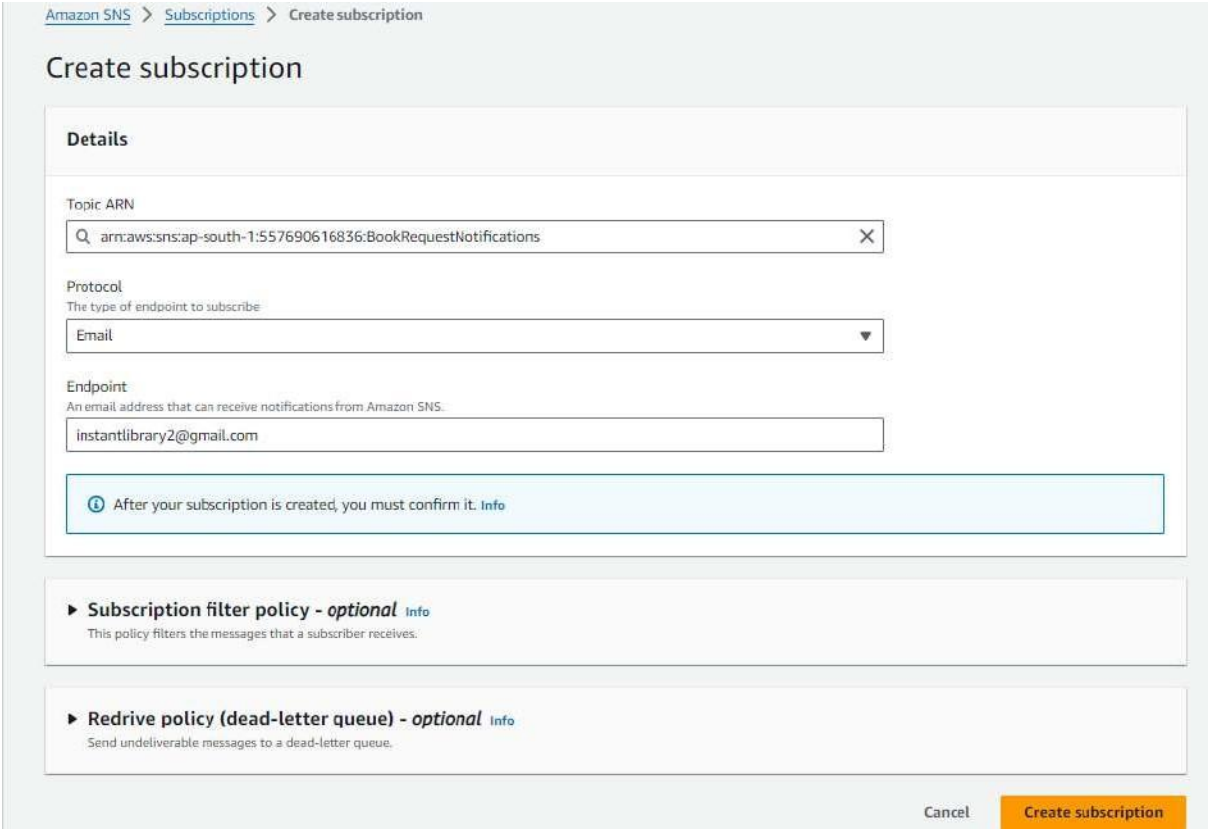


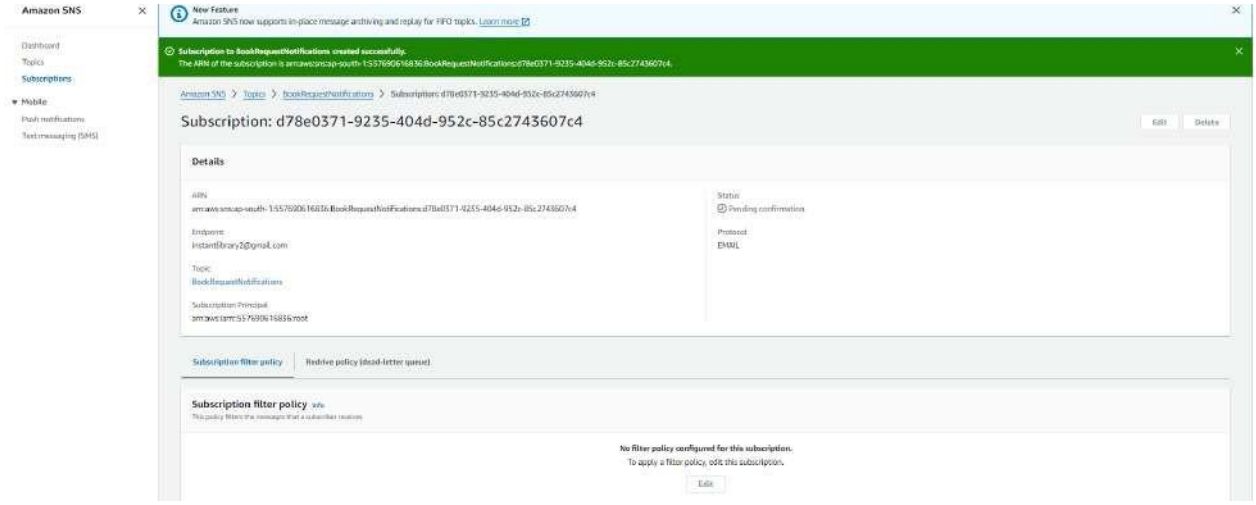
- Configure the SNS topic and note down the **Topic ARN**.



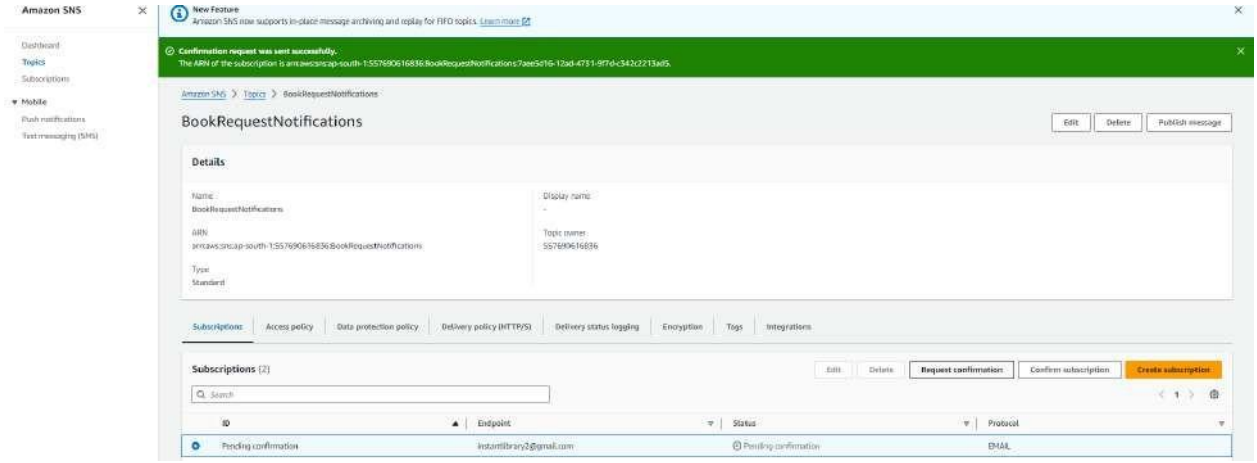
- **Activity 3.2: Subscribe users and staff to relevant SNS topics to receive real-time notifications when a book request is made.**

    - Subscribe users (or admin staff) to this topic via Email. When a book request is made, notifications will be sent to the subscribed emails**.**

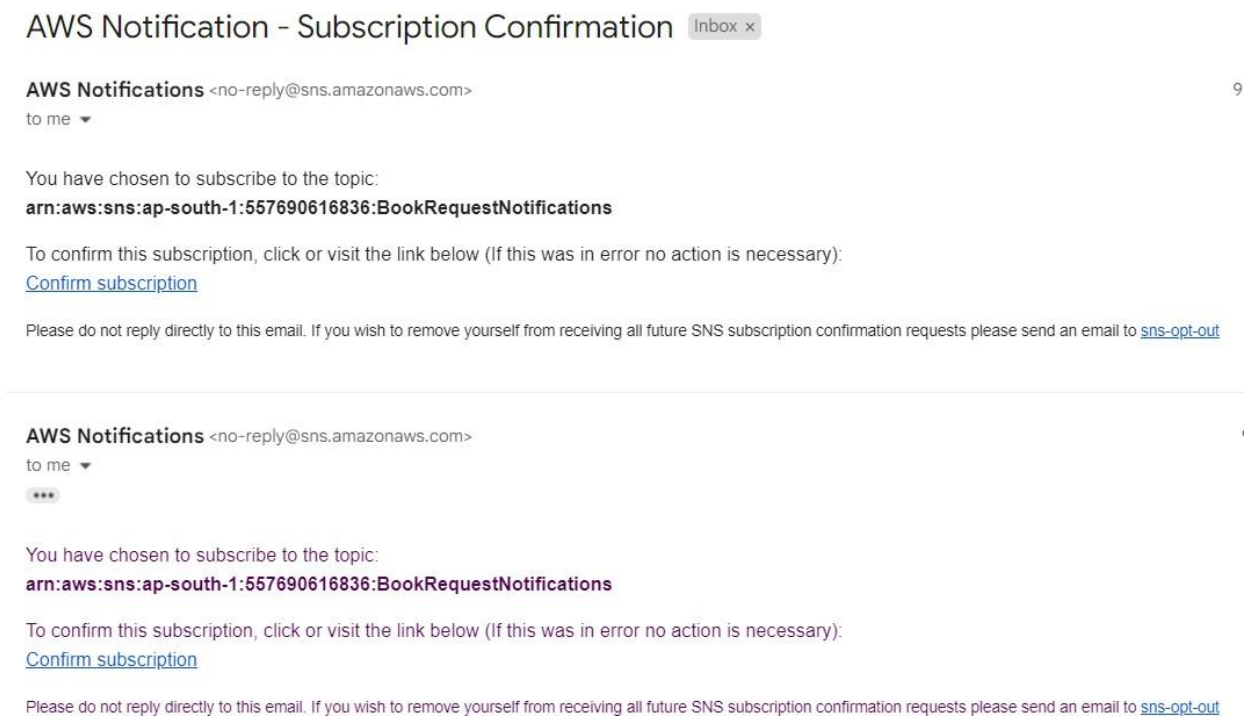




- After subscription request for the mail confirmation



- Navigate to the subscribed Email account and Click on the confirm subscription in the AWS Notification- Subscription Confirmation mail.



AWS Notification - Subscription Confirmation Inbox ×

AWS Notifications <no-reply@sns.amazonaws.com> 9
to me

You have chosen to subscribe to the topic:
arn:aws:sns:ap-south-1:557690616836:BookRequestNotifications

To confirm this subscription, click or visit the link below (If this was in error no action is necessary):
Confirm subscription

Please do not reply directly to this email. If you wish to remove yourself from receiving all future SNS subscription confirmation requests please send an email to sns-opt-out

AWS Notifications <no-reply@sns.amazonaws.com>
to me
•••

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arn:aws:sns:ap-south-1:557690616836:BookRequestNotifications

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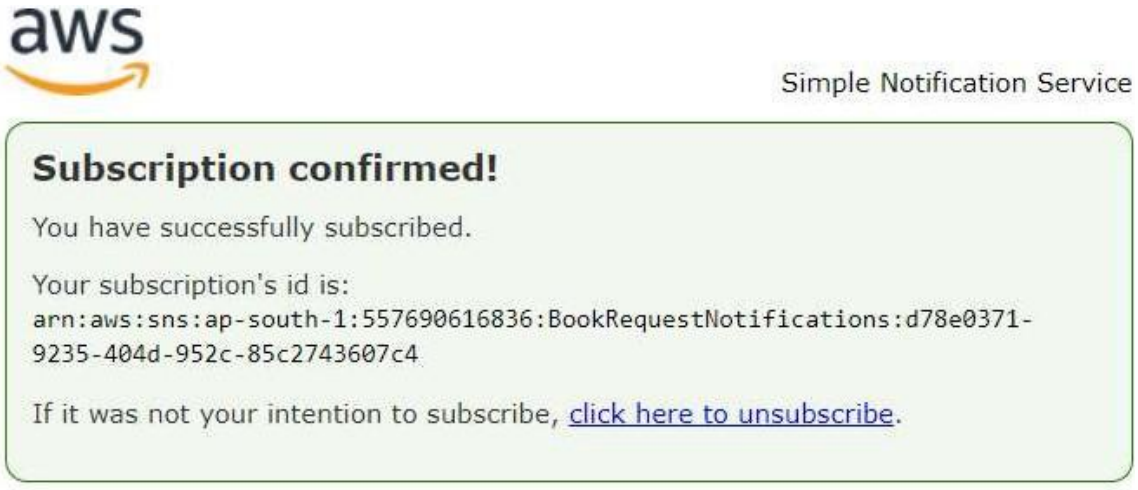


aws Simple Notification Service

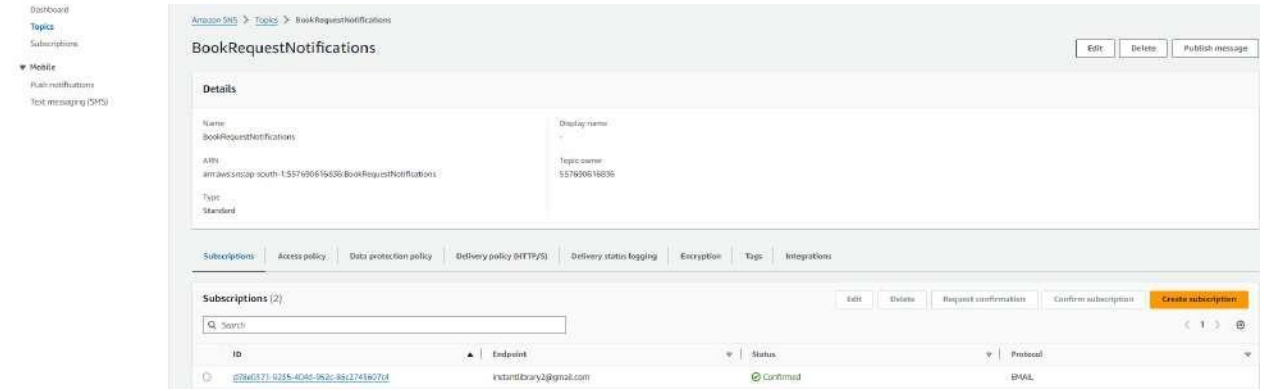
Subscription confirmed!

You have successfully subscribed.

Your subscription's id is:
arn:aws:sns:ap-south-1:557690616836:BookRequestNotifications:d78e0371-9235-404d-952c-85c2743607c4

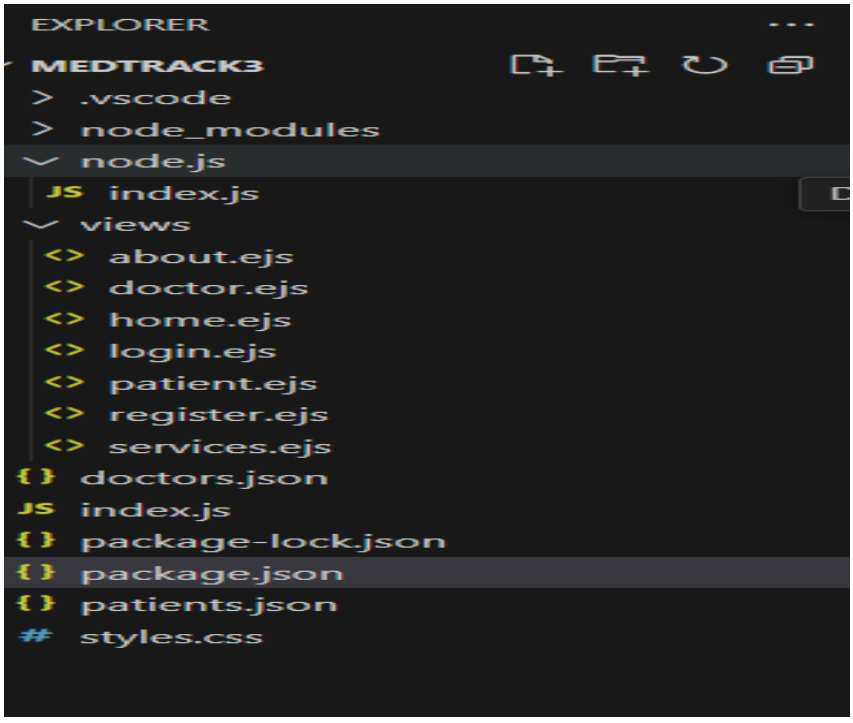
If it was not your intention to subscribe, click here to unsubscribe.

- Successfully done with the SNS mail subscription and setup, now store the ARN link.



Milestone 4:Backend Development and Application Setup

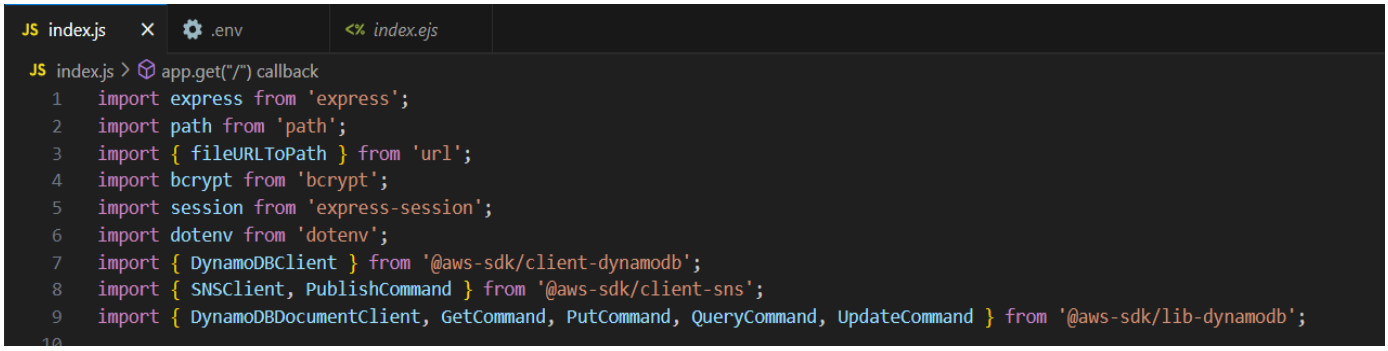
- **Activity 4.1: Develop the backend using JavaScript**
    - File Explorer Structure



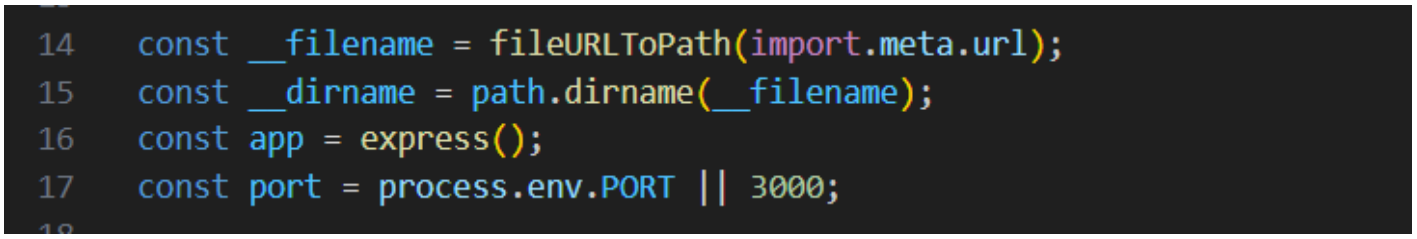
Description: set up the INSTANT LIBRARY project with an index.js file, a public/ folder for assets, and a views/ directory containing all required HTML pages like home, login, register, subject-specific pages (e.g., computer_science.html, data_science.html), and utility pages (e.g., request-form.html, statistics.html).

Description of the code :

- **Node js (Express) Initialization**



Description: import essential libraries including Express utilities for routing, Boto3 for DynamoDB operations, SMTP and email modules for sending mails, and Bcrypt for password hashing and verification



Description: initialize the Flask application instance using __filename to get the path of the directory and app is used to get express to start building the web app.

- **Dynamodb Setup:**

Description: initialize the DynamoDB resource for the ap-south-1 region and set up access to the Users and Requests tables for storing user details and book requests.

- **SNS Connection**

```
  // Send SNS notification
  if (SNS_TOPIC_ARN) {
    const snsCommand = new PublishCommand({
      TopicArn: SNS_TOPIC_ARN,
      Message: `New doctor registered: ${firstName} ${lastName} (${email}) - ${specialization}`,
      Subject: 'MedTrack Registration'
    });
    await snsClient.send(snsCommand).catch(err => console.error('SNS Error:', err));
  }

  res.redirect('/login');
});
```

Description: Configure **SNS** to send notifications when a book request is submitted. Paste your stored ARN link in the sns_topic_arn space, along with the region_name where the SNS topic is created. Also, specify the chosen email service in SMTP_SERVER (e.g., Gmail, Yahoo, etc.) and enter the subscribed email in the SENDER_EMAIL section. Create an 'App password' for the email ID and store it in the SENDER_PASSWORD section.

- **Routes for Web Pages**
  - **Home Route:**

```
app.get("/", (req, res) => res.render("index"));
app.get("/contactus", (req, res) => res.render("contactus"));
app.get("/about", (req, res) => res.render("about"));
app.get("/register", (req, res) => res.render("register"));
```

Description: define the home route / to automatically redirect users to the register page when they access the base URL.

- **Register Route:**

```
app.post('/register/patient', async (req, res) => {
  const { firstName, lastName, dob, gender, email, phone, address, password } = req.body;

  // Check if patient exists
  const existingPatient = await getUserByEmail(email, 'patient');
  if (existingPatient) return res.send('Patient exists');

  // Create new patient
  await createUser({
    id: Date.now().toString(),
    name: `${firstName} ${lastName}`,
    dob,
    gender,
    email,
    phone,
    address,
    password: await bcrypt.hash(password, 10)
  }, 'patient');

  // Send SNS notification
  if (SNS_TOPIC_ARN) {
    const snsCommand = new PublishCommand({
      TopicArn: SNS_TOPIC_ARN,
      Message: `New patient registered: ${firstName} ${lastName} (${email})`,
      Subject: 'MedTrack Registration'
    });
    await snsClient.send(snsCommand).catch(err => console.error('SNS Error:', err));
  }

  res.redirect('/login');
});
```

Description: define /register route to validate registration form fields, hash the user password using Bcrypt, store the new user in DynamoDB with a login count, and send an SNS notification on successful registration

- **login Route (GET/POST)**:

```
app.post('/check', async (req, res) => {
  const { email, password, role } = req.body;

  const user = await getUserByEmail(email, role);
  if (!user || !(await bcrypt.compare(password, user.password))) {
    return res.render('login', { message: 'Invalid credentials' });
  }

  req.session.user = {
    id: user.id,
    name: user.name,
    email: user.email,
    role: user.role
  };
  res.redirect(`/${role}`);
});
```

Description: define /login route to validate user credentials against DynamoDB, check the password using Bcrypt, update the login count on successful authentication, and redirect users to the home page

- **Home, E- book buttons and subject routes:**

```
// Appointment actions
app.post('/doctor/appointment/:id/precautions', requireDoctor, async (req, res) => {
  await updateAppointment(req.params.id, {
    precautions: req.body.precautions,
    status: 'Completed',
    updatedAt: new Date().toISOString()
  });
  res.redirect('/doctor');
});

app.post('/doctor/appointment/:id/reschedule', requireDoctor, async (req, res) => {
  await updateAppointment(req.params.id, {
    date: req.body.date,
    time: req.body.time,
    status: 'Rescheduled',
    updatedAt: new Date().toISOString()
  });
  res.redirect('/doctor');
});

app.post('/doctor/appointment/:id/cancel', requireDoctor, async (req, res) => {
  await updateAppointment(req.params.id, {
    status: 'Cancelled',
    updatedAt: new Date().toISOString()
  });
  res.redirect('/doctor');
});
```

Description: define /home-page to render the main homepage, /ebook-buttons to handle subject selection and redirection, and /<subject>.html dynamic route to render subject-specific pages.

- **Request Routes:**

```
  // Create appointment
  await createAppointment({
    doctorId,
    doctorName: doctor.name,
    specialty: doctor.specialization,
    patientId: req.session.user.id,
    patientName: req.session.user.name,
    date,
    time,
    reason
  });

  res.redirect('/patient');
});
```

Description: define /request-form route to capture book request details from users, store the request in DynamoDB, send a thank-you email to the user, notify the admin, and confirm submission with a success message.

Exit Route:

```
app.get('/logout', (req, res) => {
  req.session.destroy(() => res.redirect('/'));
});
```

Description: define /exit route to render the exit.html page when the user chooses to leave or close the application.

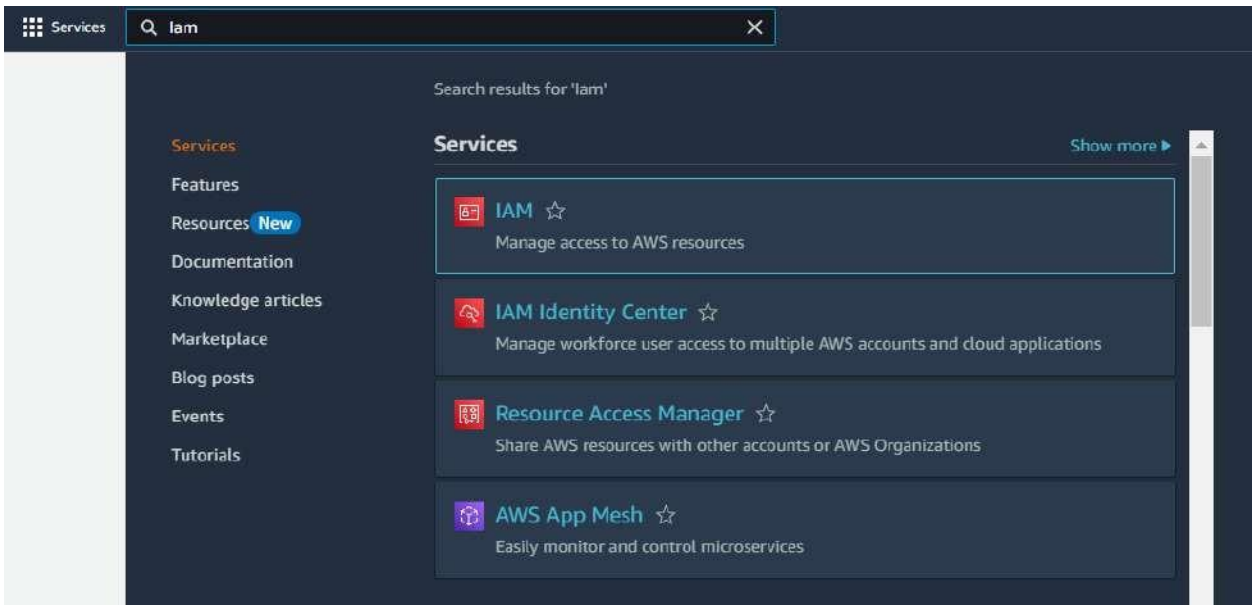
Deployment Code:

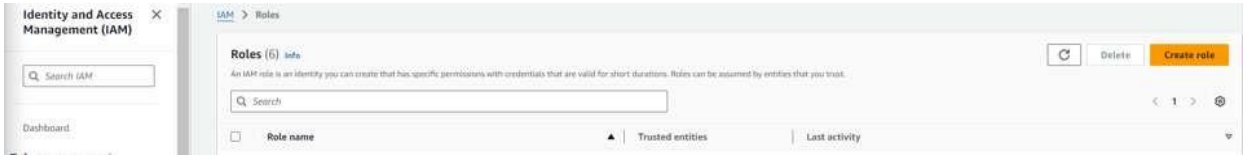
```
app.listen(3000, '0.0.0.0', () => {
  console.log(`Server running at http://localhost:3000`);
  console.log(`Using AWS Region: ${REGION}`);
  console.log(`Patients Table: ${PATIENTS_TABLE}`);
  console.log(`Doctors Table: ${DOCTORS_TABLE}`);
  console.log(`Appointments Table: ${APPOINTMENTS_TABLE}`);
});
```

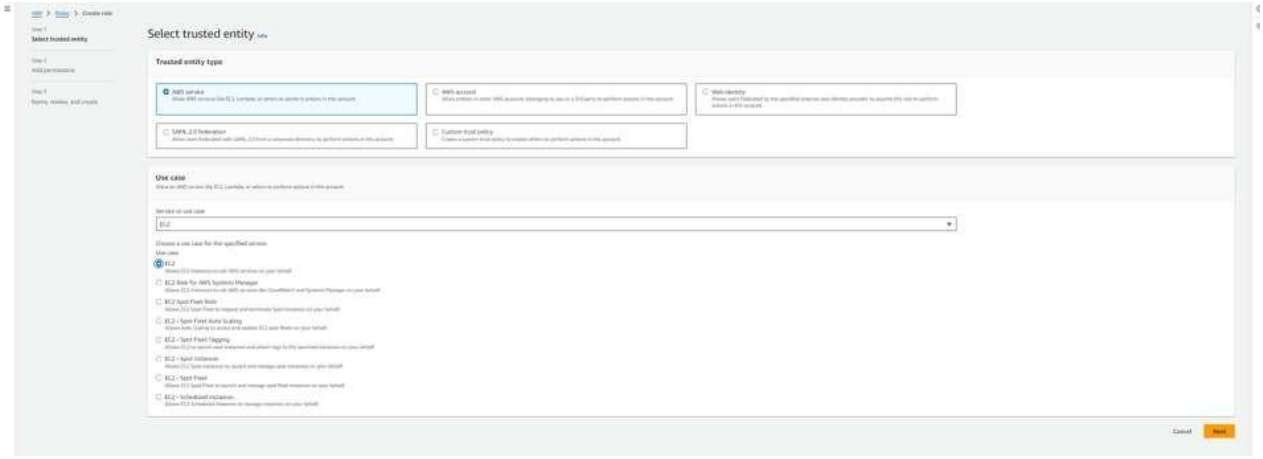
Description: start the Flask server to listen on all network interfaces (`0.0.0.0`) at port `80` with debug mode enabled for development and testing.

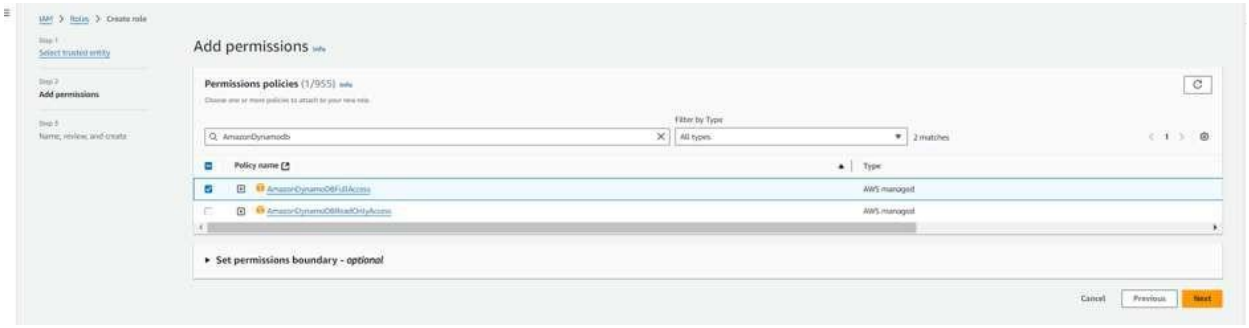
Milestone 5: IAM Role Setup

- **Activity 5.1:Create IAM Role.**
    - In the AWS Console, go to IAM and create a new IAM Role for EC2 to interact with DynamoDB and SNS.







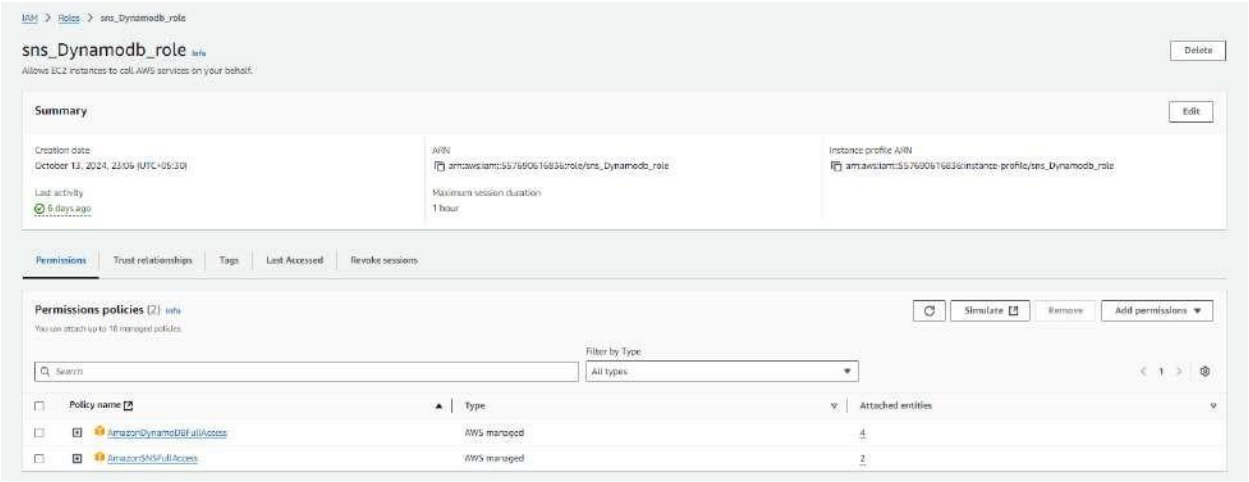


- **Activity 5.2: Attach Policies.**

  Attach the following policies to the role:

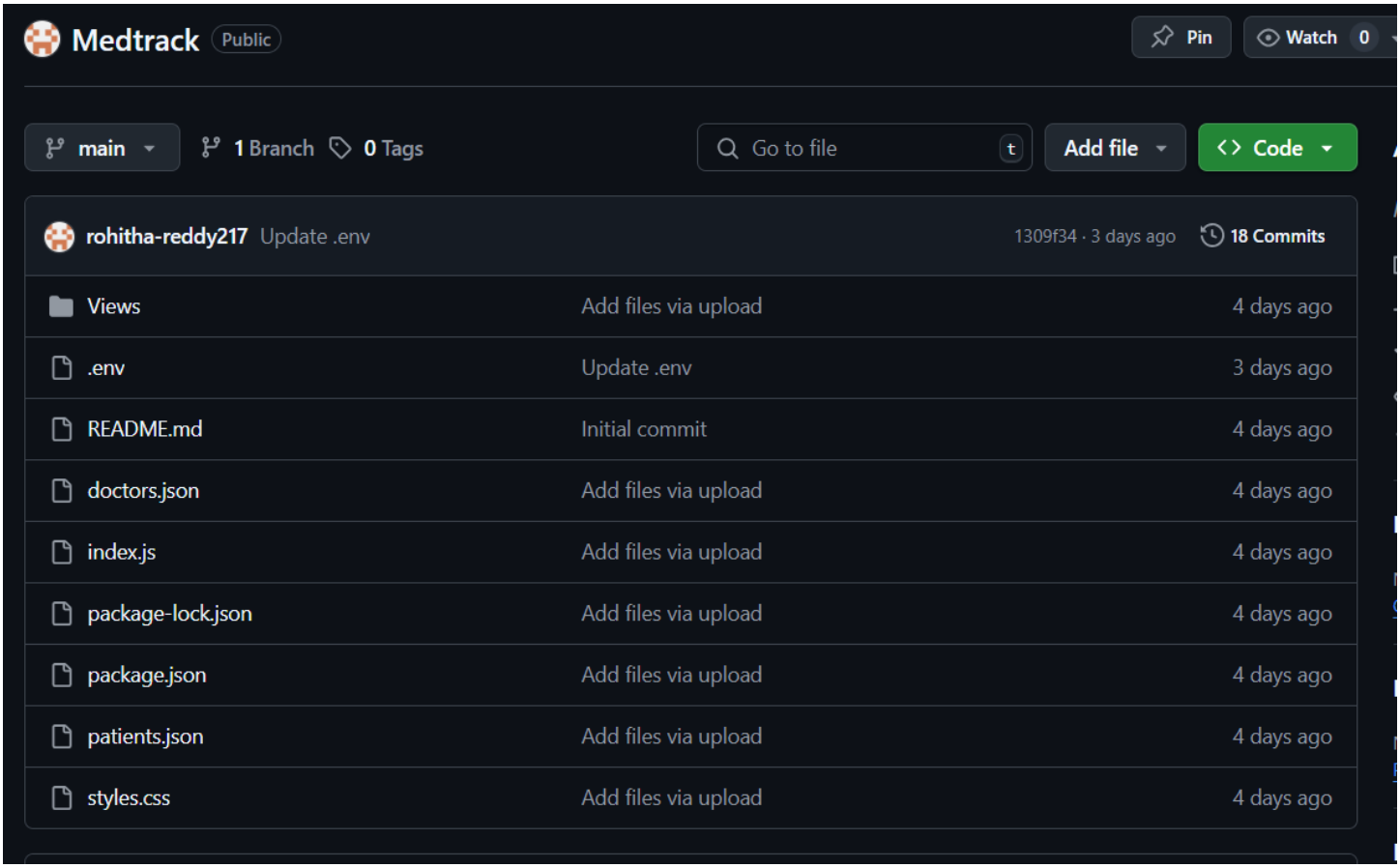
  - AmazonDynamoDBFullAccess: Allows EC2 to perform read/write operations on DynamoDB.
  - AmazonSNSFullAccess: Grants EC2 the ability to send notifications via SNS.

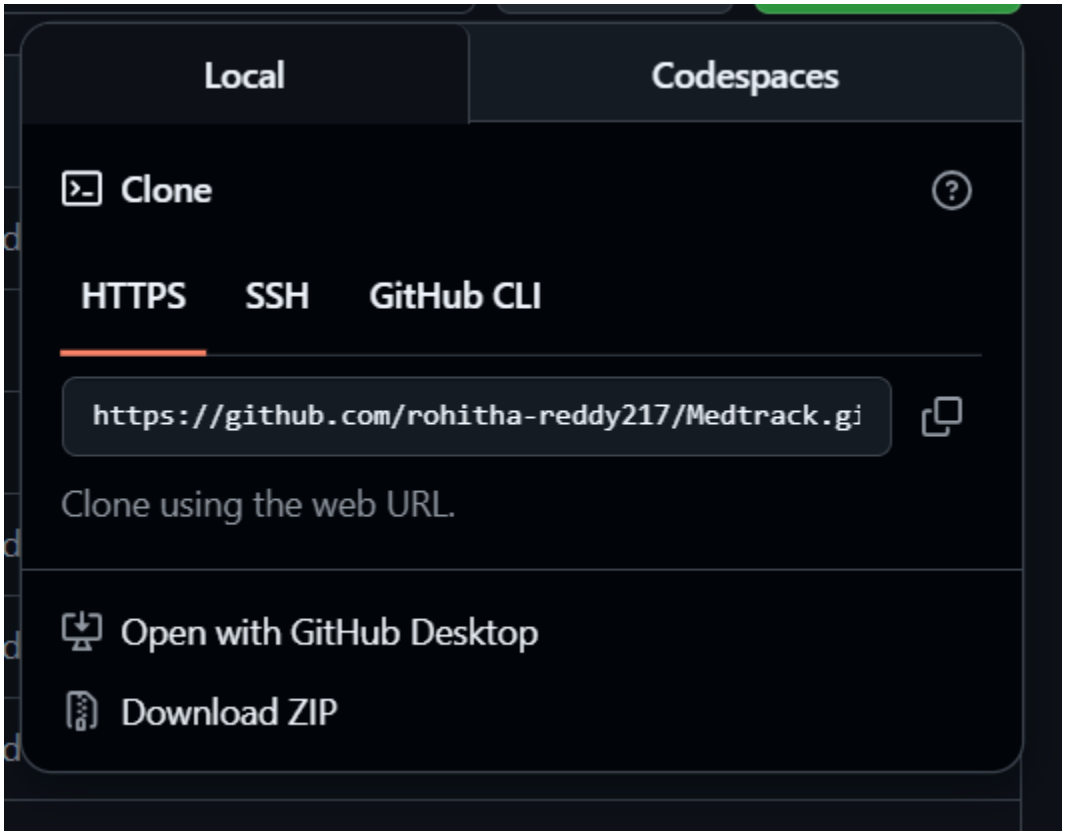
Add permissions



Milestone 6: EC2 Instance Setup

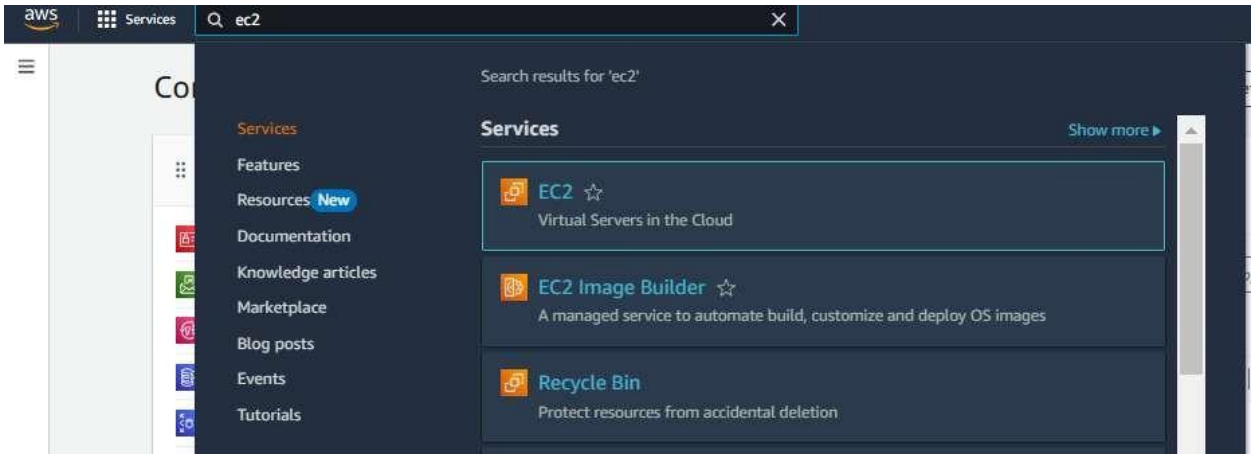
- **Note: Load your index.js and Html files into GitHub repository.**



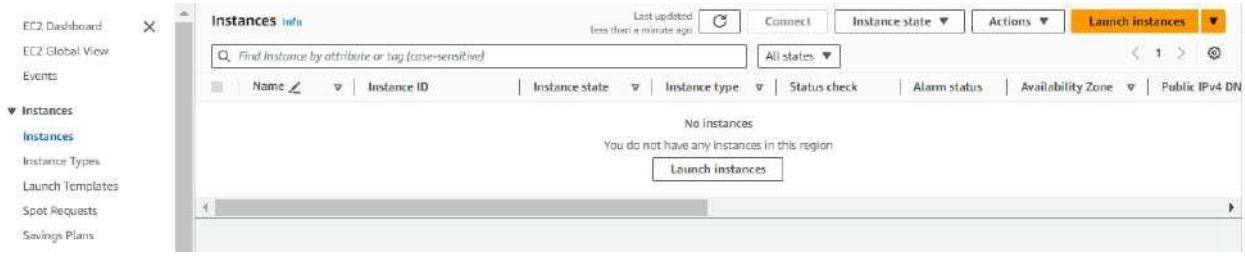


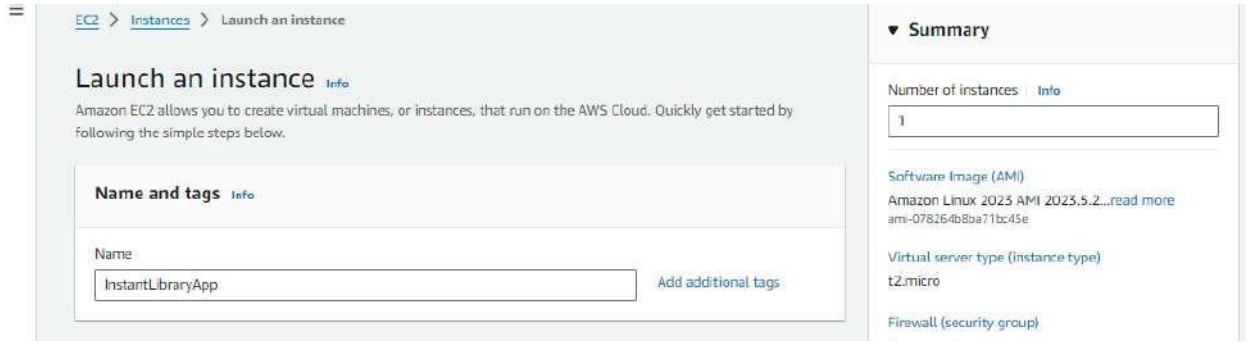
- **Activity 6.1: Launch an EC2 instance to host the Flask application.**

    - **Launch EC2 Instance**
        - In the AWS Console, navigate to EC2 and launch a new instance.

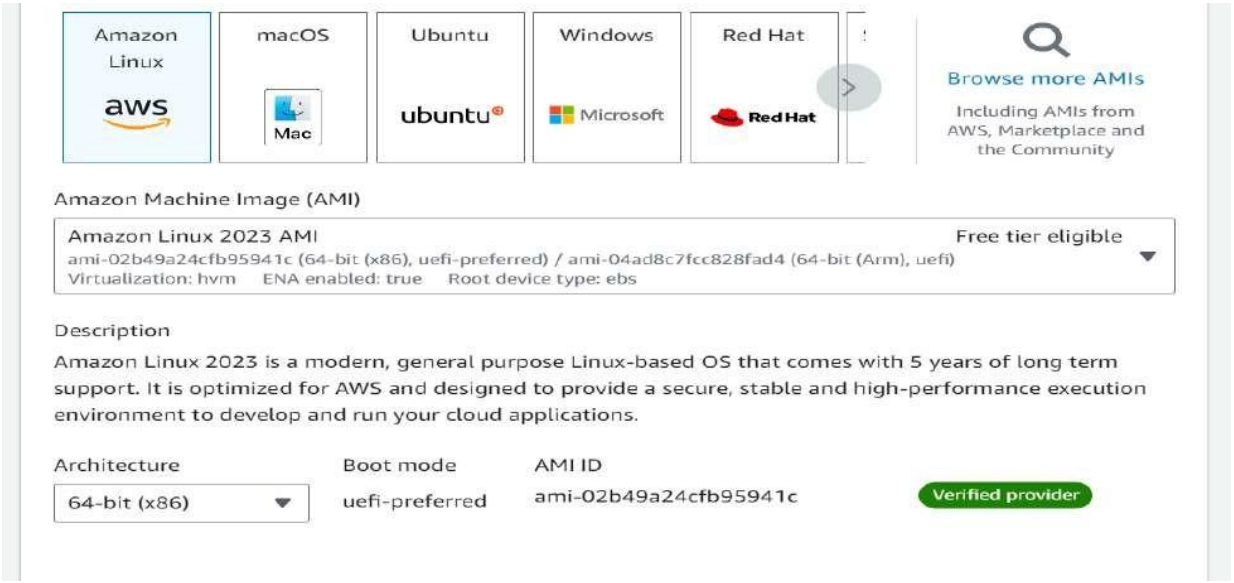


- Click on Launch instance to launch EC2 instance

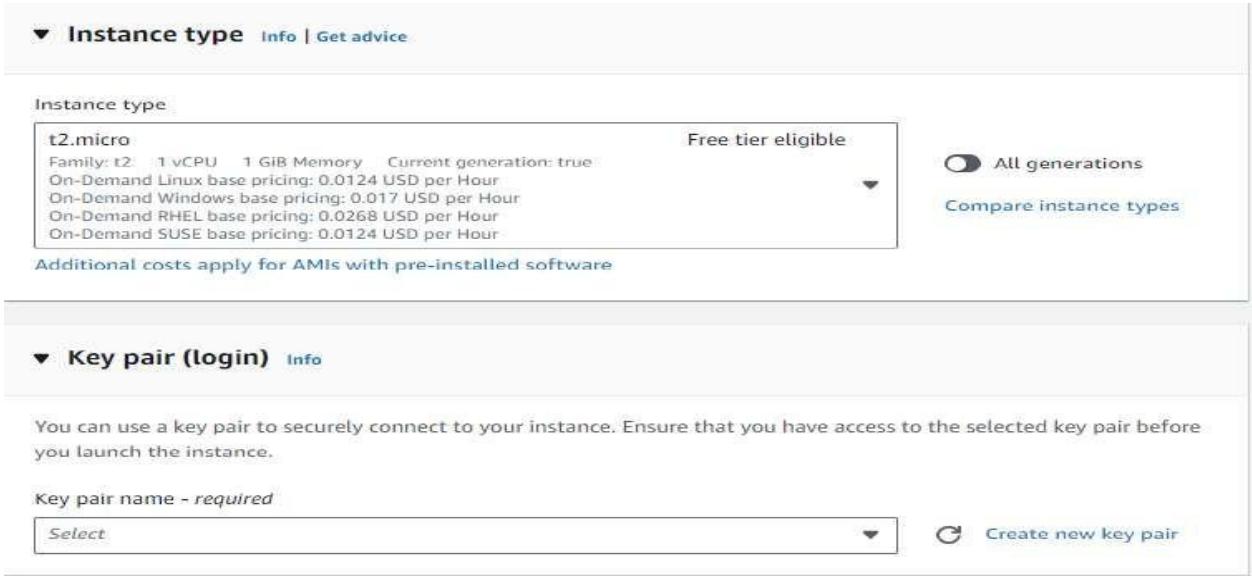


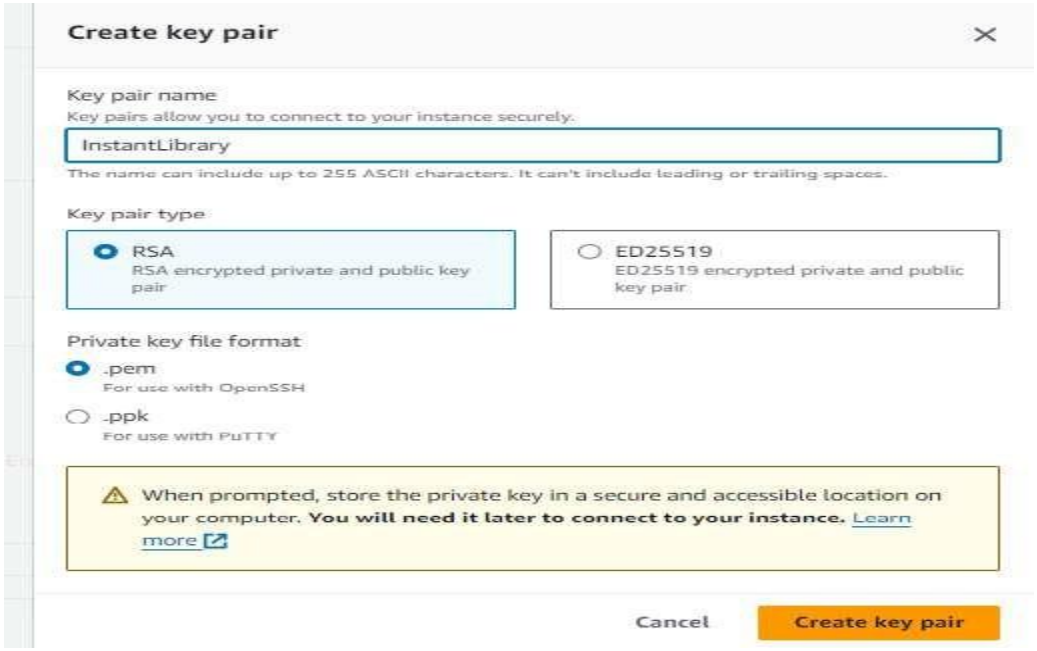


- Choose Amazon Linux 2 or Ubuntu as the AMI and t2.micro as the instance type (free-tier eligible).



- Create and download the key pair for Server access.





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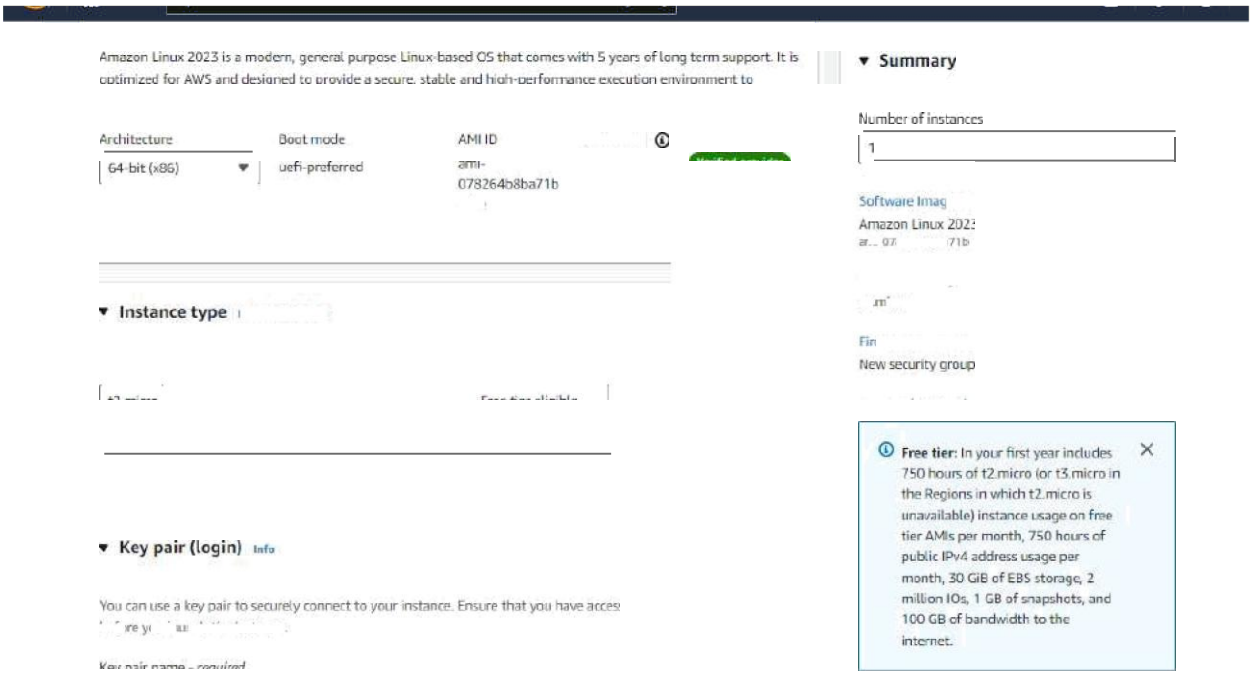
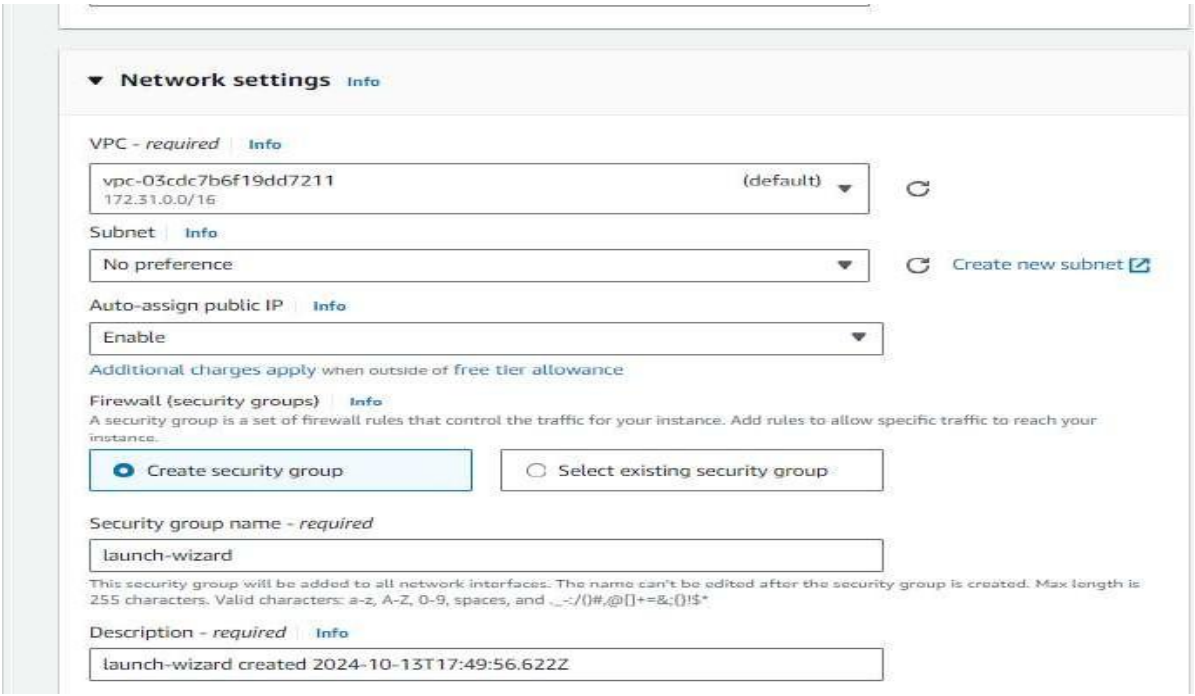
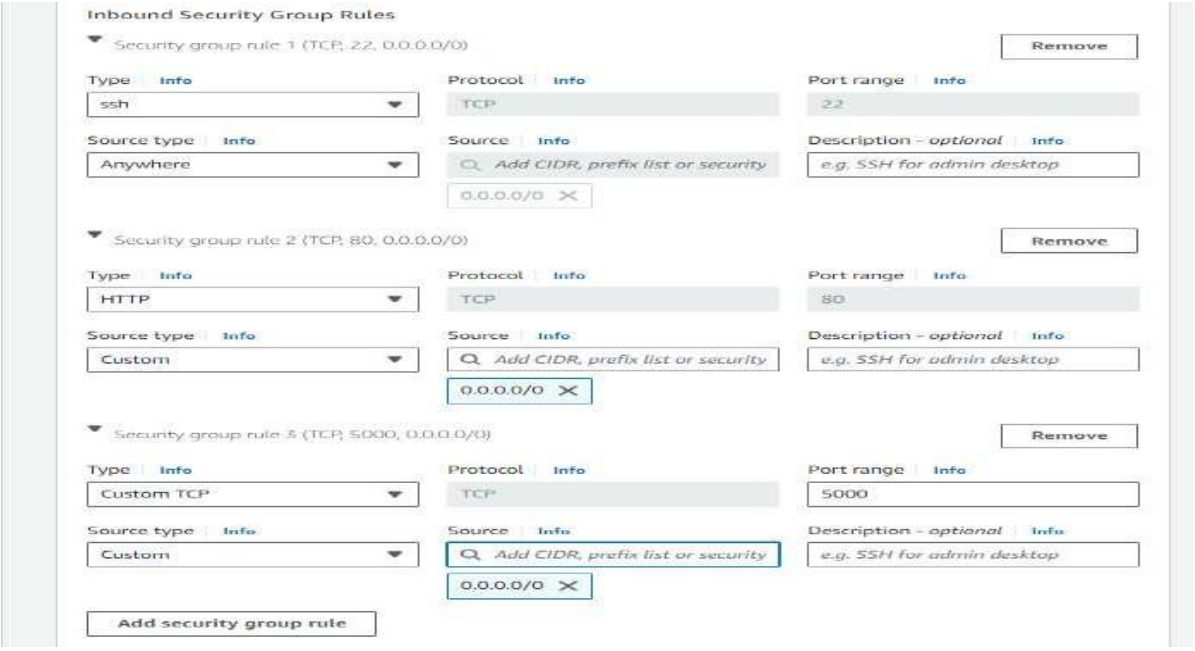
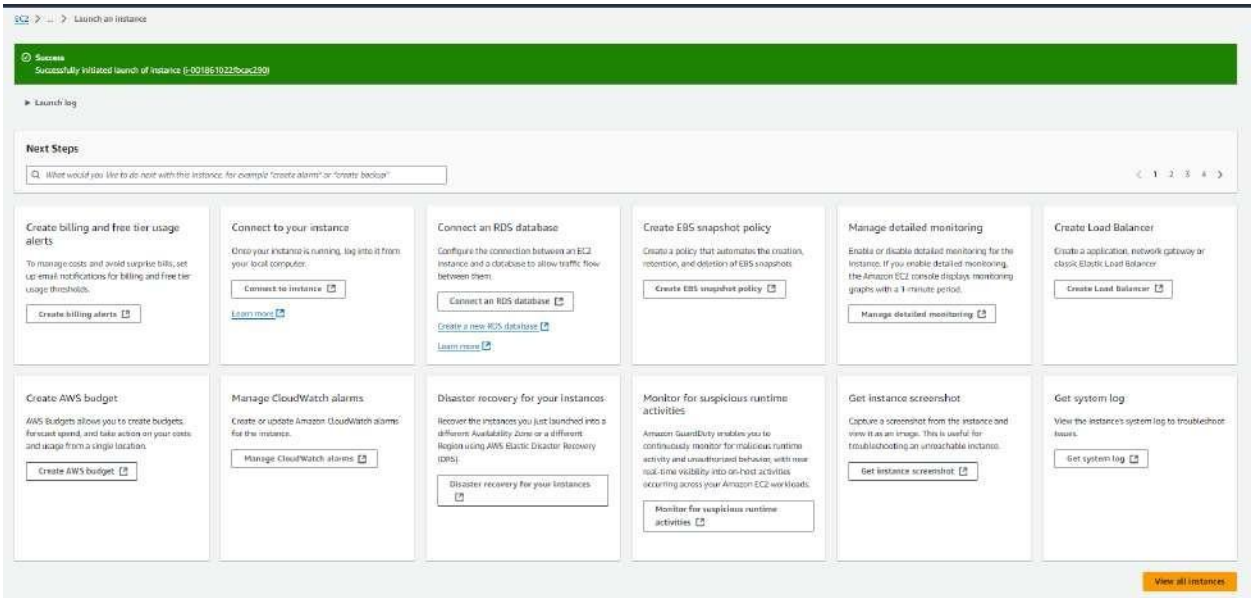


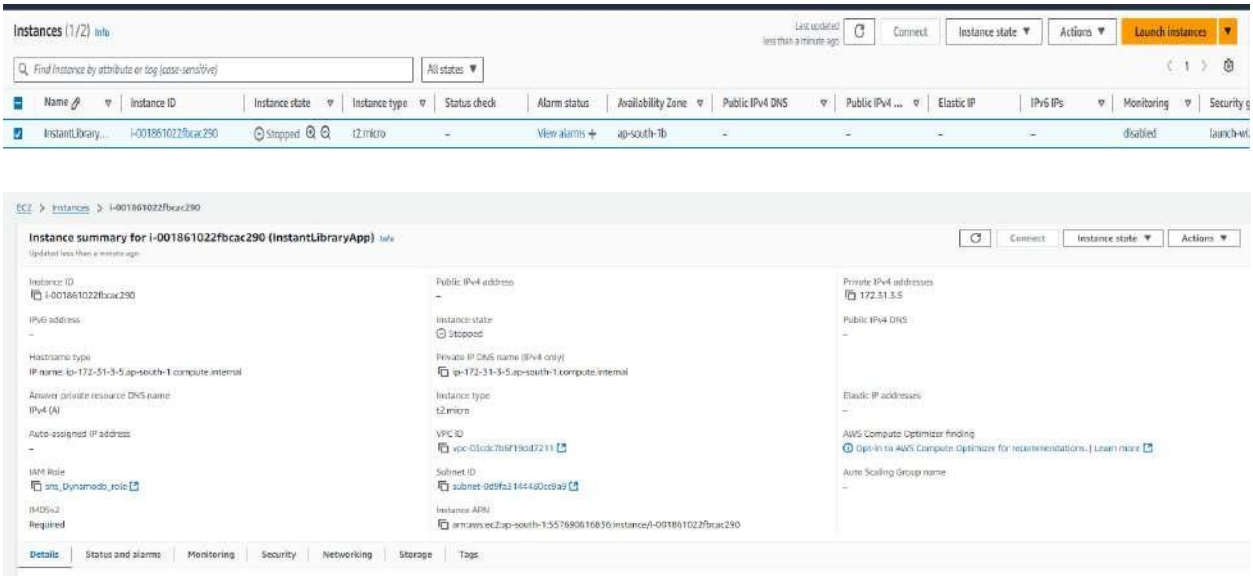
- **Activity 6.2:Configure security groups for HTTP, and SSH access.**

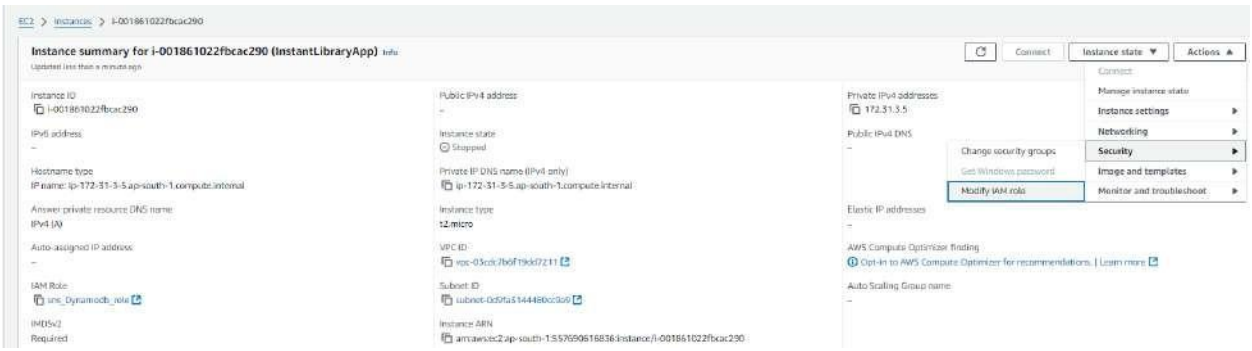


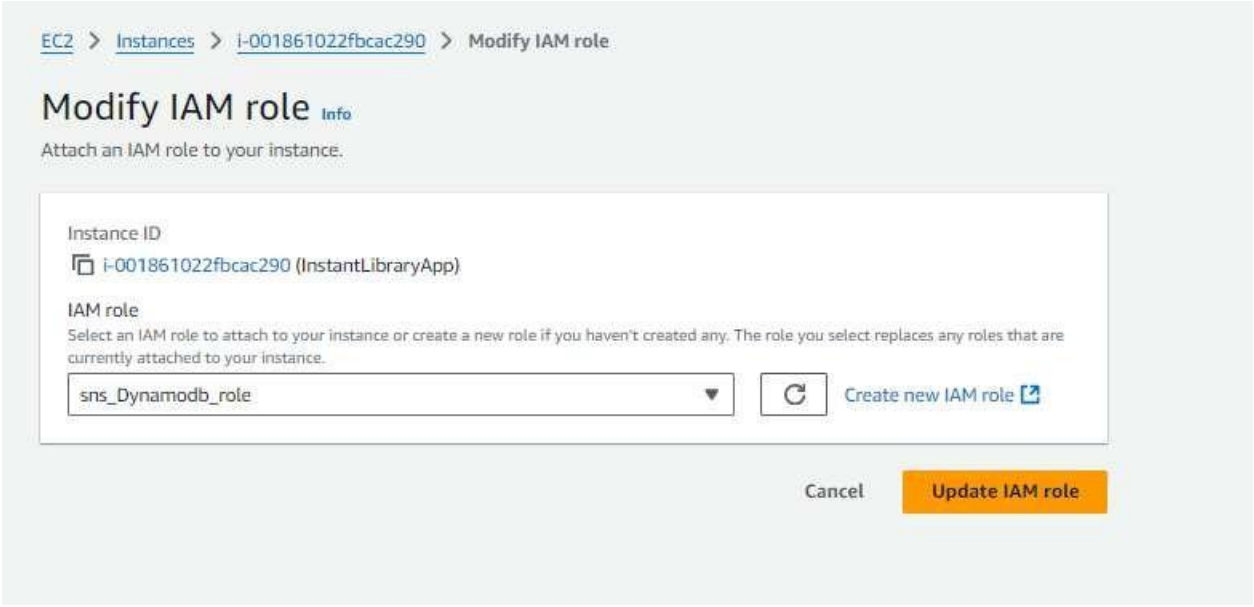




- To connect to EC2 using **EC2 Instance Connect**, start by ensuring that an **IAM role** is attached to your EC2 instance. You can do this by selecting your instance, clicking on **Actions**, then navigating to **Security** and selecting **Modify IAM Role** to attach the appropriate role. After the IAM role is connected, navigate to the **EC2** section in the **AWS Management Console**. Select the **EC2 instance** you wish to connect to. At the top of the **EC2 Dashboard**, click the **Connect** button. From the connection methods presented, choose **EC2 Instance Connect**. Finally, click **Connect** again, and a new browser-based terminal will open, allowing you to access your EC2 instance directly from your browser.







- Now connect the EC2 with the files

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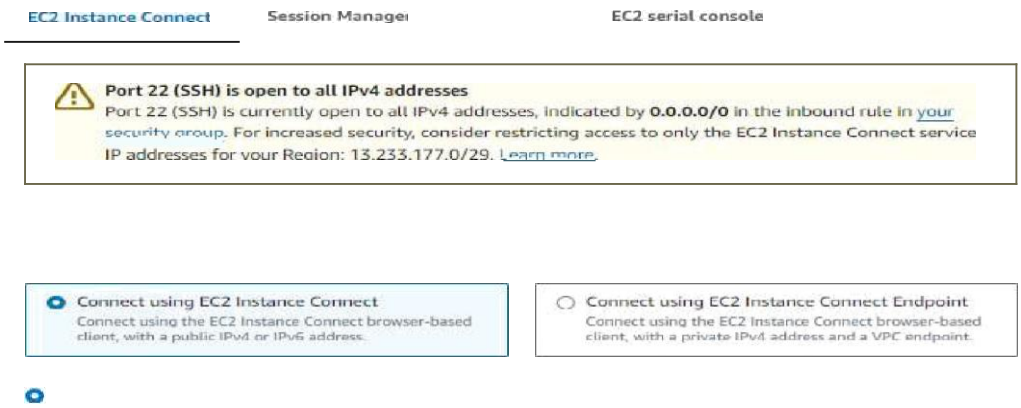
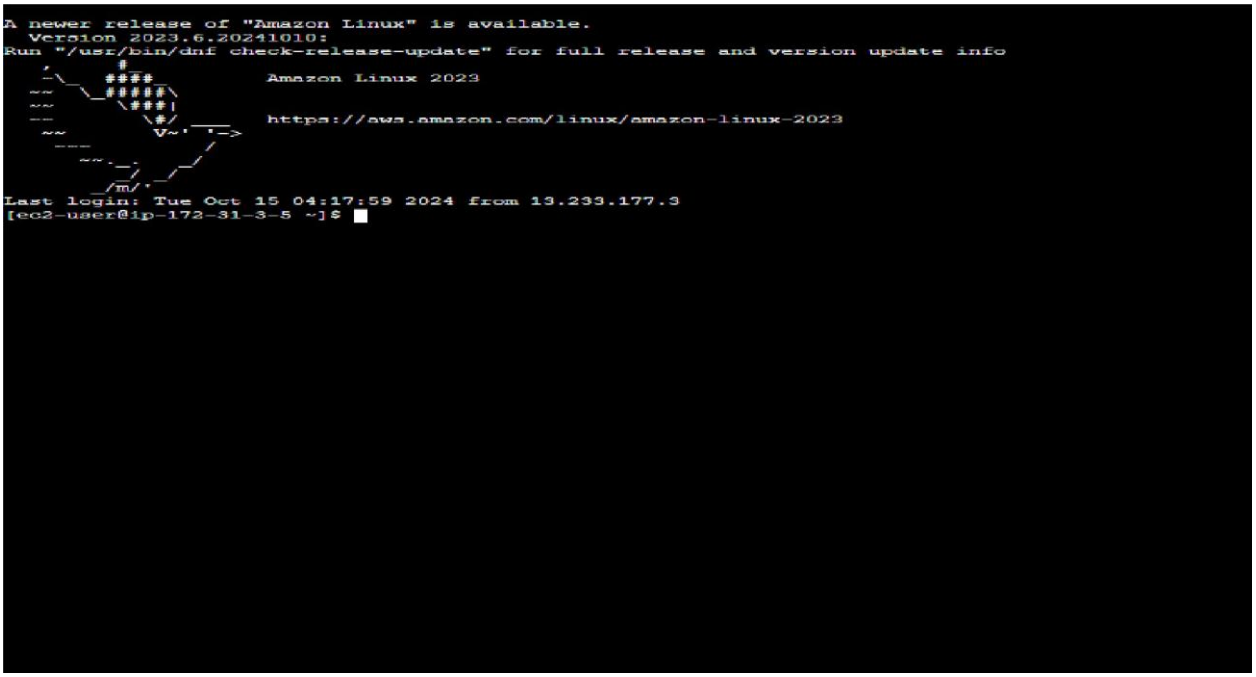




Milestone 7: Deployment on EC2

Activity 7.1: Install Software on the EC2 Instance

```
# Update system and install Node.js, npm, git
sudo yum update -y
curl -fsSL https://rpm.nodesource.com/setup_18.x | sudo bash -
sudo yum install -y nodejs git
```

Activity 7.2:Clone Your Flask Project from GitHub

Clone your project repository from GitHub into the EC2 instance using Git.

```
# Clone your Node.js project from GitHub

git clone https://github.com/prasannakumar133/MedTrack-repo.git

# Install project dependencies

npm installNote: change  your-github-username and your-repository-name with your
```

- This will download your project to the EC2 instance.

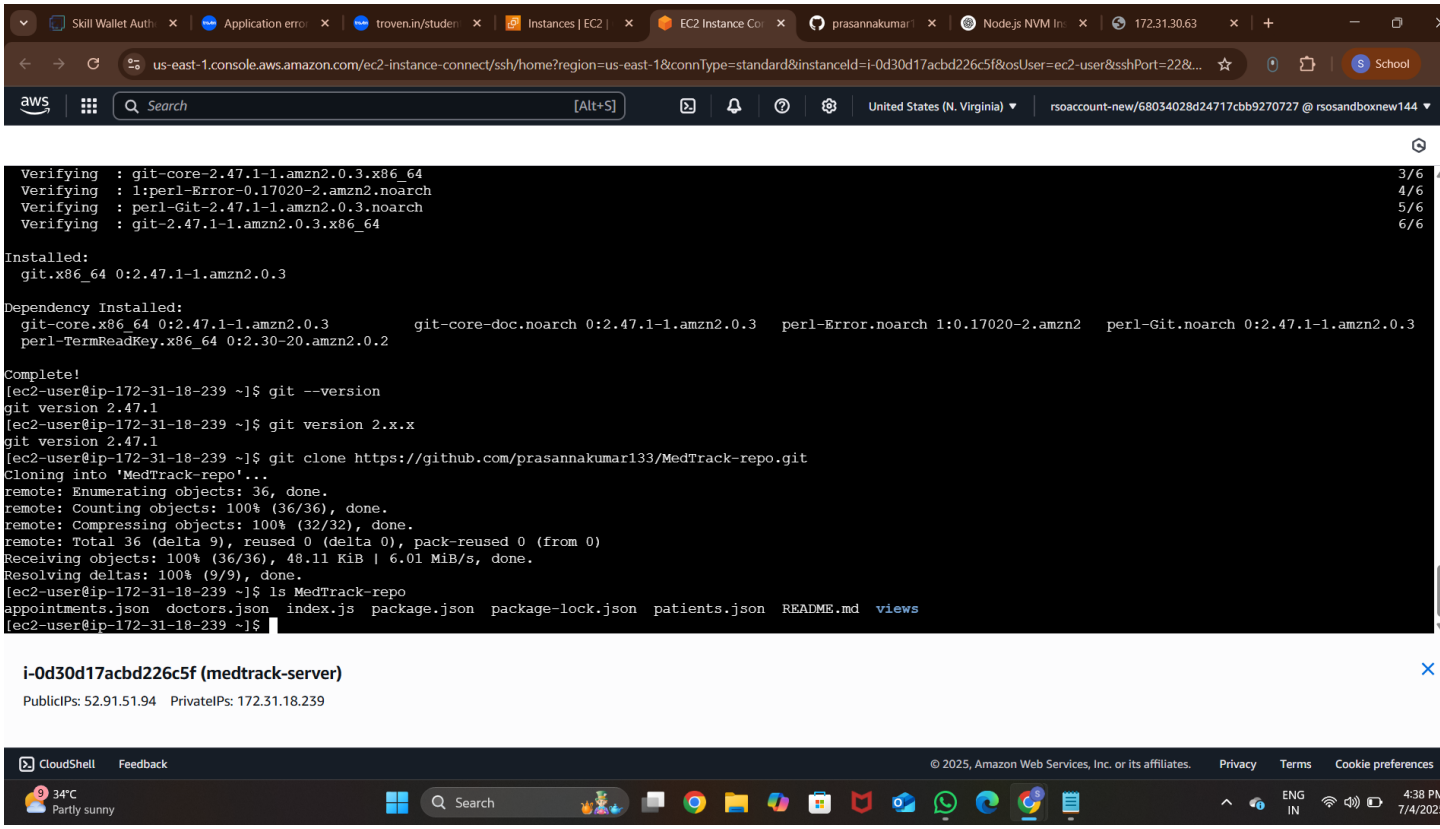
To navigate to the project directory, run the following command:

cd MedTrack-repo

Once inside the project directory, configure and run the Nodejs application by executing the following command with elevated privileges:

Run the Flask Application

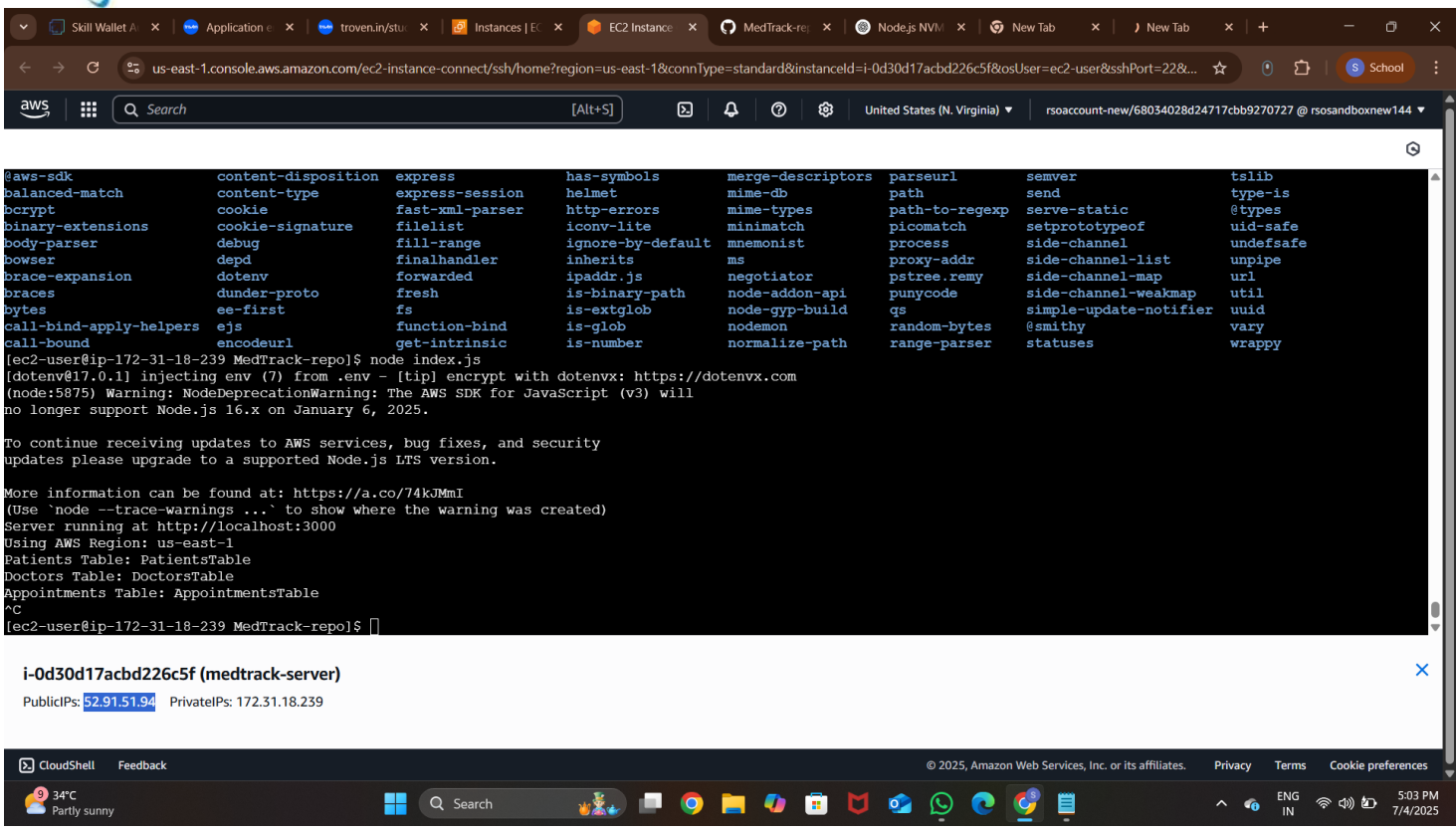
```
# Install project dependencies
npm install

# Install PM2 globally to keep the app running
sudo npm install -g pm2

# Start the app using PM2 (replace 'app.js' with your entry point if different)
pm2 start app.js
pm2 save
pm2 startup
# Copy and run the command shown by the previous line (for startup on reboot)

# (Optional) Allow the app port (3000) through firewall
sudo firewall-cmd --zone=public --permanent --add-port=3000/tcp
sudo firewall-cmd --reload
```



Verify the Nodejs app is

running: Done! Your app is running at http://<your-ec2-public ip>:3000

Run the Nodejs app on the EC2 instance


@aws-sdk content-disposition express has-symbols merge-descriptors parseurl semver tslib
balanced-match content-type express-session helmet mime-db path send type-is
bcrypt cookie fast-xml-parser http-errors mime-types path-to-regexp serve-static @types
binary-extensions cookie-signature filelist iconv-lite minimatch picomatch setprototypeof uid-safe
body-parser debug fill-range ignore-by-default mnemonist process side-channel undefsafe
bowser depd finalhandler inherits ms proxy-addr side-channel-list unpipe
brace-expansion dotenv forwarded ipaddr.js negotiator pstree.remy side-channel-map url
braces dunder-proto fresh is-binary-path node-addon-api punycode side-channel-weakmap util
bytes ee-first fs is-extglob node-gyp-build qs simple-update-notifier uuid
call-bind-apply-helpers ejs function-bind is-glob nodemon random-bytes @smithy vary
call-bound encodeurl get-intrinsic is-number normalize-path range-parser statuses wrappy
[ec2-user@ip-172-31-18-239 MedTrack-repo]$ node index.js
[dotenv@17.0.1] injecting env (7) from .env - [tip] encrypt with dotenvx: https://dotenvx.com
(node:5875) Warning: NodeDeprecationWarning: The AWS SDK for JavaScript (v3) will
no longer support Node.js 16.x on January 6, 2025.
To continue receiving updates to AWS services, bug fixes, and security
updates please upgrade to a supported Node.js LTS version.
More information can be found at: https://a.co/74kJMmI
(Use `node --trace-warnings ...` to show where the warning was created)
Server running at http://localhost:3000
Using AWS Region: us-east-1
Patients Table: PatientsTable
Doctors Table: DoctorsTable
Appointments Table: AppointmentsTable
^C
[ec2-user@ip-172-31-18-239 MedTrack-repo]$
i-0d30d17acbd226c5f (medtrack-server)
PublicIPs: 52.91.51.94 PrivateIPs: 172.31.18.239

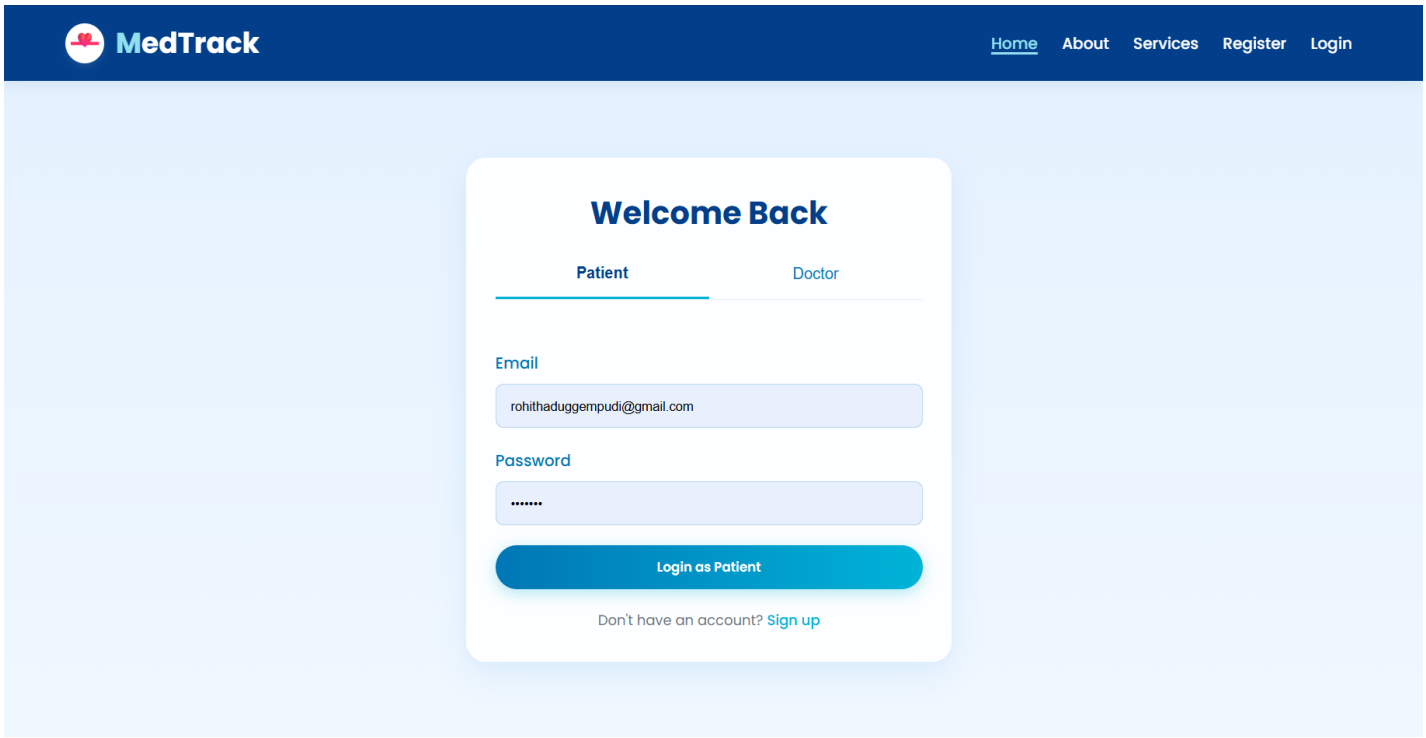
Access the website through:

PublicIPs:http://52.91.51.94:3000/

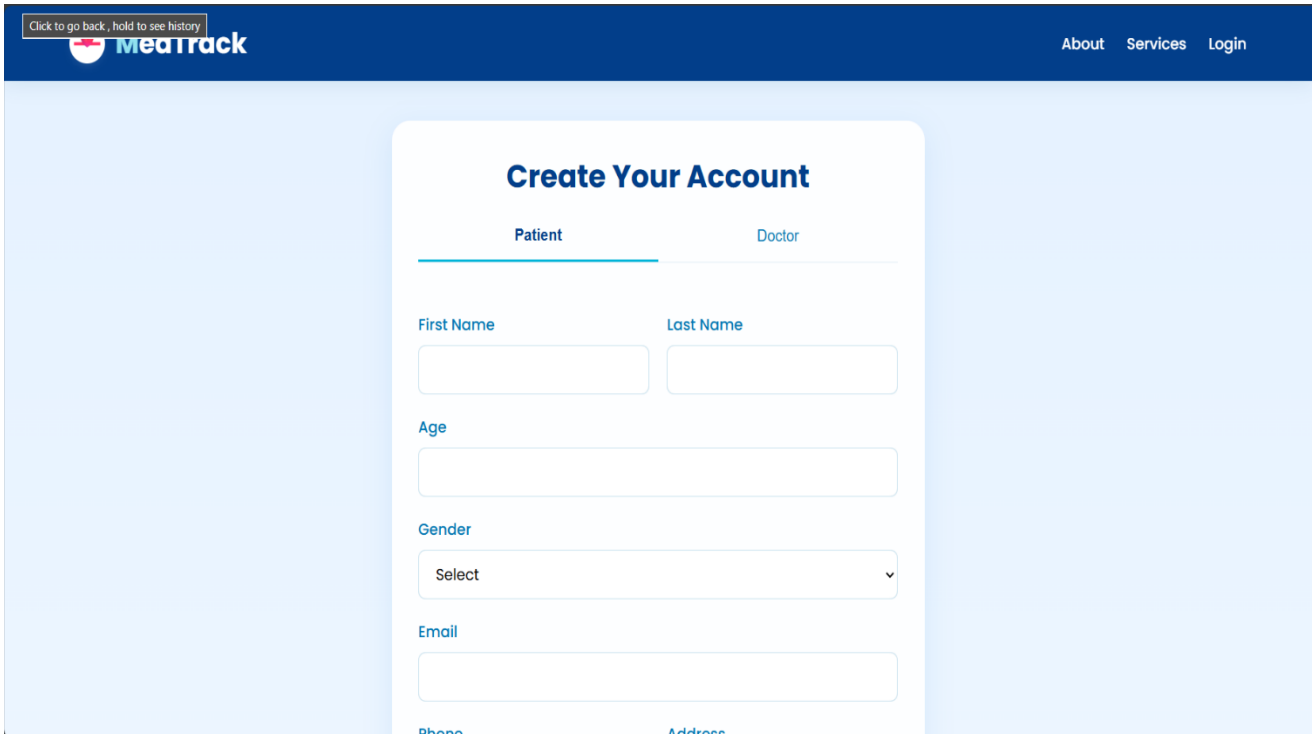
Milestone 8: Testing and Deployment

- **Activity 8.1: Conduct functional testing to verify user registration, login, requests, and notifications.**

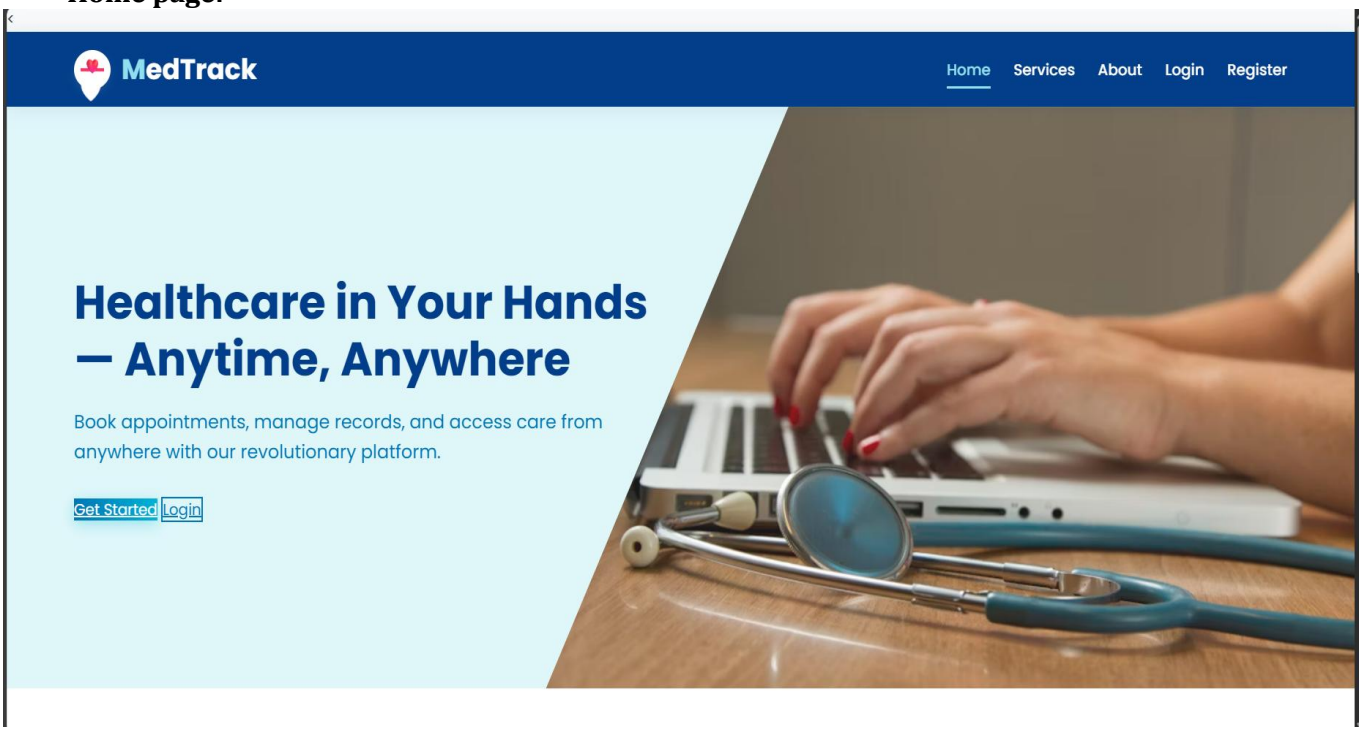
Login Page:



Register Page:



Home page:



About Us page:

Founded in 2020, MedTrack emerged from a simple idea: healthcare should be accessible, efficient, and patient-centered. Our team of doctors, engineers, and healthcare professionals came together to bridge the gap between medical providers and patients through innovative technology

Services Page

Top Services

Telemedicine

Smart Appointment

Health Records Cloud

Conclusion:

MedTrack illustrates the power of leveraging AWS cloud services to build a modern, reliable healthcare management system. By combining **Amazon EC2** for scalable application hosting, **DynamoDB** for fast and flexible data storage, **SNS** for instant notifications, and **IAM** for fine-grained access control, MedTrack ensures secure, efficient, and responsive healthcare operations.

The system streamlines the entire patient care process—from appointment scheduling and telemedicine consultations to emergency access to records and automated alerts—reducing administrative overhead and improving the patient experience. With high availability, data encryption, and compliance-ready infrastructure, MedTrack empowers healthcare providers to focus on delivering quality care while maintaining trust and data security.

Overall, this project demonstrates how cloud-native solutions can transform traditional healthcare environments into agile, scalable, and patient-centric ecosystems.

SMARTBRIDGE
Let's Bridge the Gap

Smart Internz

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