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Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

M. Tech. (Integrated) Software Engineering

School of Computer Science and Engineering (SCOPE)

Online Learning Management System using Amazon Web Services

SWE4002 – Cloud Computing

Final Report Submission

submitted by

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Objective

The objective of this project is to develop a cloud-based **Learning Management System (LMS) using Amazon Web Services (AWS)** that offers a secure, scalable, and serverless platform for online education and management. The system enables educators to create and manage courses, conduct live classes, track attendance, and assess students through quizzes, while students can access course materials, join live sessions, and participate in evaluations seamlessly. By integrating services such as Cognito, Lambda, DynamoDB, S3, API Gateway, SNS, IAM, CloudWatch, and Amplify, the LMS ensures efficient automation, real-time communication, high performance, and cost optimization. The overall aim is to deliver a reliable and interactive e-learning platform powered entirely by cloud infrastructure.

List of Modules

(i) User Authentication and Management
(ii) Course Management
(iii) Live Class Management
(iv) Quiz Management
(v) Attendance Management
(vi) Notification Service
(vii) Profile Management
(viii) Monitoring and Logging

Detailed description of the module

1. **User Authentication and Management**
   - User authentication and management were achieved using Amazon Cognito for authentication with two separate user pools for Students and Educators.
   - Students will have the ability to sign themselves up, but educator accounts must be created by an Administrator in Cognito.
   - After an account is confirmed, we use a post-confirmation Lambda trigger to save user details to a DynamoDB with the user-supplied information.
   - Additionally, a post-confirmation Lambda trigger sends an activation email (via SNS) to guide the users through the unlocking of their accounts.
   - This allows for safe and seamless login to your safe, secure system with data that is available across the platform

2. **Course Management**
   - Course management will utilize the frontend which the Educator can create and upload with the frontend and connected to a Lambda function via API Gateway.

- Students will only be able to see the list of course links and videos that were uploaded via pre-signed URLs provided by Lambda before being uploaded to Amazon S3.
- All course metadata (course titles, course description, URLs, course IDs) are saved in the DynamoDB instance so students and educators can access these items in the courses created in Fowler.

3. **Live Class Management**
   - Educators can schedule and start scheduled live classes from the frontend to the Zoom API (Server-to-Server OAuth App) via a Lambda function.
   - The class metadata (class name, class links, class scheduled time) are saved using the identifiers in the dynamoDB.
   - Educators and Students can fetch the information and link into the classes.
   - Lastly, there are Lambda functions (dedicated) created for tracking attendance for classes scheduled and manage attendance to be saved on the IAM Role in the DynamoDB.

4. **Quiz Management**
   - The quiz system leverages AWS Lambda, API Gateway, and DynamoDB to function.
   - Educators will be able to create quizzes by entering a title, start time, end time, and multiple-choice questions (MCQs) with their corresponding answers.
   - Each quiz will be assigned a unique Quiz ID; all quiz data is saved in DynamoDB in array format.
   - Once the quiz is created, a Simple Notification Service (SNS) email will be automatically sent to students with the quiz information (Quiz ID, title, timings).Students will be able to take the quiz by entering the unique Quiz ID; once the quiz is submitted, the results (name, email, Quiz ID, score) will be saved to a Quiz Results table in DynamoDB.
   - Educators will have access to see all quizzes they have created and the students' results through the Lambda functions.

5. **Management of Attendance**
   - Each live class has attendance taken by the operation of Lambda and DynamoDB.
   - Each live class has a Class ID saved in the LMS_Attendance table.
   - When a student joins a live class, the Lambda function marks the student's attendance with the class information.
   - Educators will be able to track attendance for each class by pulling that data from DynamoDB with the Class ID.

6. **Notification Service**
    - Once again, we took advantage of Amazon Simple Notification Service (SNS).SNS is used to send notification emails to users when events occur that are important to the user, such as, quiz notifications, and account activations of any new user.
    - We use Lambda functions to trigger an SNS topic depending on backend events, it allows us to notify users when we feel it is necessary.

7. **Profile Management**
    - We are using Amazon Cognito and Lambda to manage profiles of educators and students.
    - Once the user has signed in successfully, the studentprofile Lambda function retrieves the user's information (name, email etc.) from Cognito.
    - This greatly contributes to the notion of data consistency and the safe retrieval of the users profile through the sign-in process.
    - In a similar fashion, the educator is able to see a full listing of all registered students through the use of another lambda to pull student details from DynamoDB.

8. **Monitoring and Logging**
    - We utilized the uses of Amazon Cloudwatch.
    - We will use Cloudwatch to monitor performance of the lambda functions and log execution for bug tracking.
    - Cloudwatch monitors and logs the invocation from the API Gateway, log any error codes returned from API calls, and monitor latency capabilities to reliably pass workloads.
    - This module provides developers a means to debug runtime issues as it happens whether on an issues page,url or id.

Architecture

Amplify

Frontend (HTML, CSS, JS)
Hosted via AWS Amplify (WebsiteHosting)

Amazon Cognito

Amazon Cognito (Authentication)

2 User Pools: Student & Educator

Student Actions (Login, Courses, etc.)

Educator Actions (Course, Quiz, etc.)

Amazon API Gateway

Amazon API Gateway (Routing requests)

Connects Frontend ↔ Lambda Functions

AWS Lambda

- CognitoUserSync (Post signup trigger)
- CreateLiveClass (Zoom API integration)
- getCoursesList / getCourseContent
- presignedurl / uploadCourseData
- saveCourseMetadata
- studentprofile / studentlist
- recordattendance / getAttendance
- quiz creation and result handling

Amazon DynamoDB

Stores users, courses, quizzes,attendance, live class info

Amazon S3

Stores course videos & materials (pre-signed URL)

Amazon SNS

Sends activation link & quiz alert emails

Amazon CloudWatch

(Logs, Monitoring, Errors)

- Monitors Lambda executions
- Tracks system health

Zoom API

Zoom API (Live Classes)

(via Server-to-Server OAuth)

Used by Lambda to create & manage live class links

Individual Contribution

Pamala Thanmai

- Designed and coded the Frontend in HTML, CSS and JavaScript.
- Combined the frontend and backend services via API gateway endpoints.
- Deployed the LMS site on AWS Amplify and controlled its deployment pipeline (based on GitHub).
- Established SNS on Amazon to receive notification of quiz and user activation via email.
- Designed the Quiz Management Module:
    - Creation of quizzes, management of questions and storage of their results using Lambda and DynamoDB.
    - SNS to post quiz notifications among students automatically.

SubireddyGari Harshitha Reddy

- AWS Cognito User Authentication and Authorization, which is implemented.
- Developed two distinct user groups, one being Students and another one being Educators.
- Install Lambda triggers (Post Confirmation) to perform automatic synchronization of data to DynamoDB.
- Assured secure user access and both role-based authentication.

Dogiparthi Harini

- Developed and deployed the back-end logic in AWS Lambda and API Gateway in all the core functionalities.
- Stored DynamoDB to save and get course, quizzes data, attendance data, and user data.
- Developed the Course Management Module (upload, fetch, and store content on the basis of pre-signed URLs of S3 + Lambda).
- Zoom Server to Server OAuth Application to create and manage Live Classes.
- Applied CloudWatch to Introduce Attendance Tracking, Profile Management and Monitoring.
- Set IAM Roles in order to grant access to Lambda, S3, and DynamoDB safely.
- CloudWatch Logs End to end system testing and debugging.

Tools/Software requirement

Frontend:

- *HTML, CSS, JavaScript:* Applied to create interactive and responsive web pages on the interface of students and educators.
- *AWS Amplify:* An app that is utilized to host and roll out the LMS web application directly out of GitHub.

Backend:

- *AWS Lambda:* Serverless computing service that is applied to implement the logic of the backend and interlink among various services in AWS.
- *Amazon API Gateway:* API Gateway is utilized to develop, publish and administer REST and HTTP APIs, which interlink the frontend to the Lambda functions.
- *Amazon DynamoDB:* NoSQL database that is used to store user information, courses, quizzes, attendance, classes.
- *Amazon Cognito:* This is employed to authenticate and manage user-securely (two different user pools: Student and Educator).
- *Amazon Simple Notification Service (SNS): Sends* notification emails (e.g. quiz notifications, account activation) in an automated fashion.
- *Amazon S3:* It will be used to store videos and materials of courses and retrieve them based on pre-sign URLs.
- *Amazon CloudWatch:* Utilized to monitor Lambda functions and monitor logs along with debugging errors.
- *AWS Identity and Access Management (IAM):* Applied to roles and permissions between AWS services.

Other Tools:

- *Zoom Developer Account (Server-to-Server OAuth App):* It is used to make and manage live classes.
- *Visual Studio Code:* The code development tool used when writing frontend and Lambda functions.
- *GitHub:* Utilised in version control and in integration with AWS Amplify to allow continuous deployment.

AWS services used

1) **Amazon Cognito (User Authentication/ Authorization)**
    - Transactions with users of two pools of secured access and registration of students and teachers.
    - Cognito has a post-confirmation trigger, which invokes a Lambda function to store the information of new users into DynamoDB.
    - Sends the users email messages with SNSs when he is registered.
    - Ensures access control and secure session management of both roles.

2) **AWS lambda (Serverless Backend Logic)**
    - Conducts all the back-end operations such as user synchronization, course management, quiz management, attendance management and real time classes management.
    - Cognito events, API gateway calls or internal processes.
    - Gathers and reads data in DynamoDB, sends pre-signed URLs to S3 and calls Zoom API to retrieve live classes.
    - Eliminates the usage of dedicated servers meaning that it is scalable and cost-effective.

3) **Amazon API Gateway (Frontend Backend Bridge)**
    - Connects the web frontend with Lambda backend functions using REST and HTTP API.
    - Course uploading, content acquisition, quiz creation, and accessing attendance are some of the processes involved.
    - Granted access to APIs appropriately and authorization.
    - Manages as the communication support of all frontend activities.

4) **Amazon DynamoDB (Database Storage)**
    - Stores all the system data including the users, courses, quizzes, live classes and attendance.
    - It has 4 major tables, namely: Cognitousers, Courses, LMS_LiveClasses, LMS_Attendance.
    - Offers well-scaling, high-speed, and serverless data storage by the use of the NoSQL technology in order to obtain rapid access to data.
    - The Lambda functions use it to store all the information about the application in an effective way.

5) **Amazon S3 (Storage repository of course material)**
    - Stores course videos and study materials uploaded by educators.
    - Upload and download via pre-signed URLs (generated by Lambda).
    - A separate bucket to store files (edu-platform-course), and a separate bucket to store links (DynamoDB).
    - Provide safe, unlimited and trustworthy content storage.

6) **Amazon Simple Notification service (SNS) (Email Notifications)**
    - Sends email messages to learners and faculty.
    - Appears in the notification of a quiz, as well as in the activation of an account.
    - Together with Lambda to automatically e-mail when specific events were monitored.
    - Offers real time communication across the platform.

7) **AWS Identity and Access management (IAM) (Permissions Control)**
    - The permissions to the access of Lambda, S3, DynamoDB, and SNS.
    - Every Lambda function has an IAM role which permits a list of actions.
    - Ensures good service to service communication and the removal of unauthorized access.
    - Secures and compliance of the system overall.

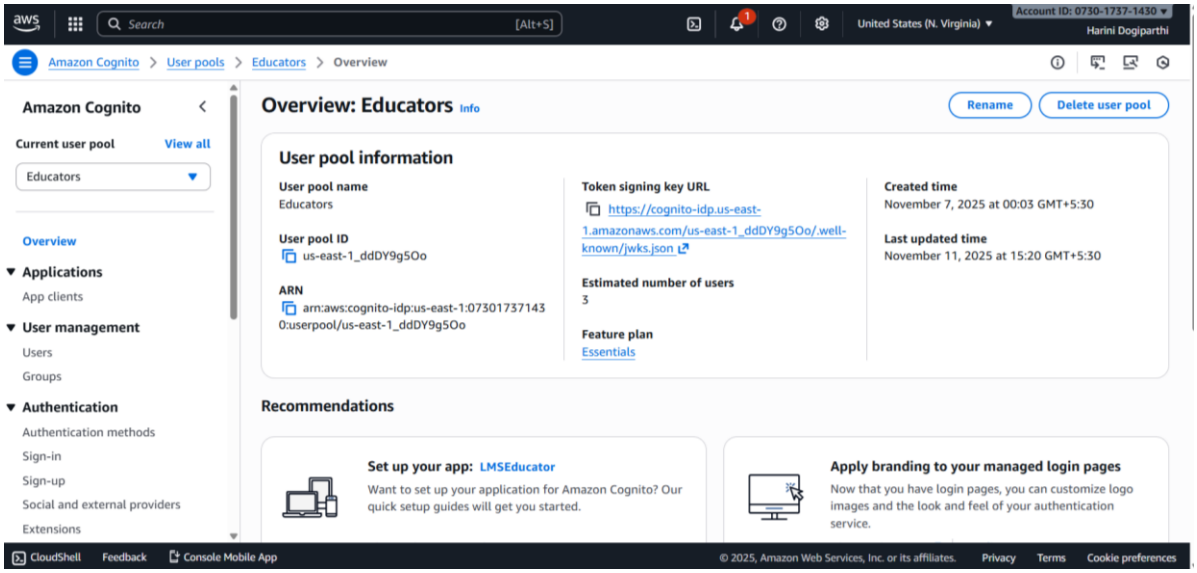
8) **Amazon CloudWatch(Monitoring and debugging)**
    - Monitoring performance and log of execution of every Lambda function.
    - Identify and remove errors in API calls and back-end processes.
    - Optimize using tracking and track performance information.
    - The product is very reliable and it is easily troubleshootable.

9) **AWS Amplify(Monitoring and debugging)**
    - Just a service, the open source LMS written in HTML, CSS and JavaScript.
    - Automatic deploying and construction on GitHub.
    - Provides an online address to a web site: (https://main.dijffme8w1boe.amplifyapp.com)
    - Offers scalable, fast and secure hosting offering.

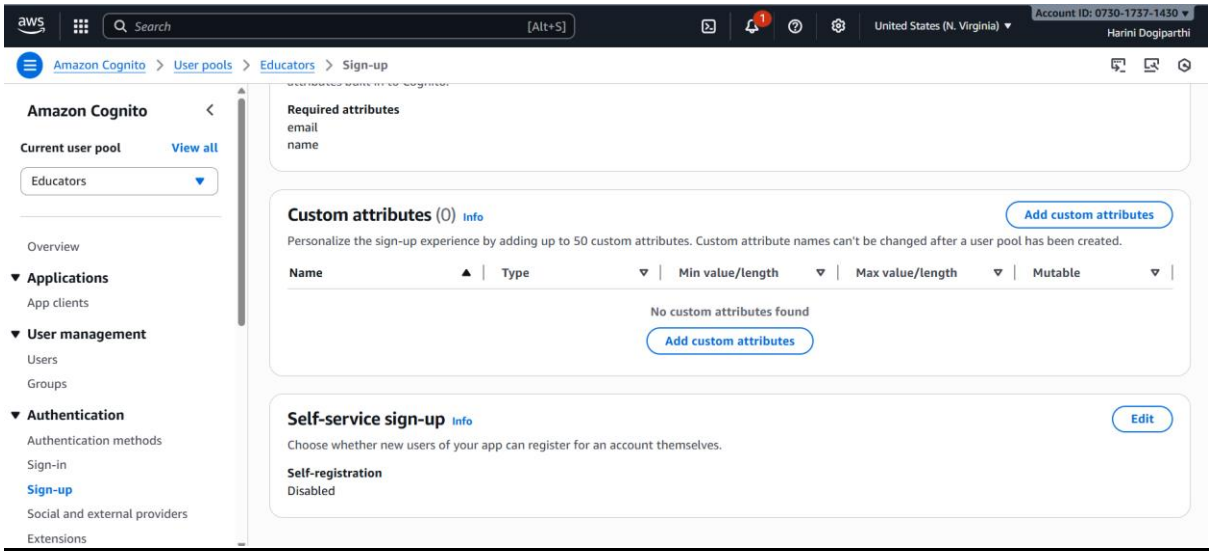
Screen shots of all services and features of project

(i) COGNITO :

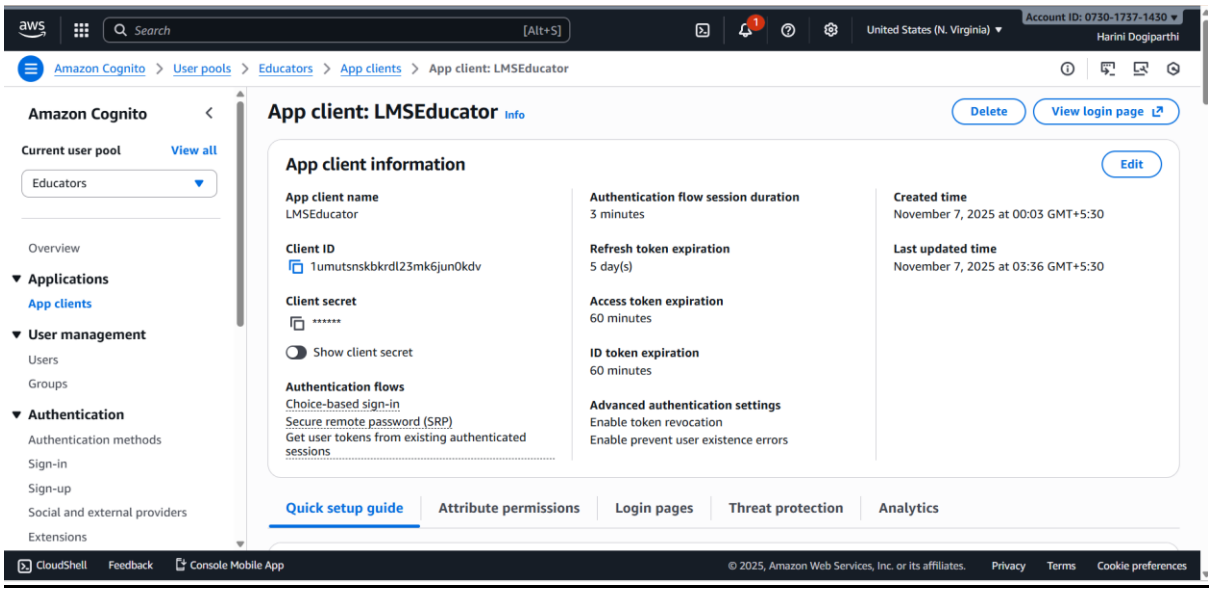
Educator userpool



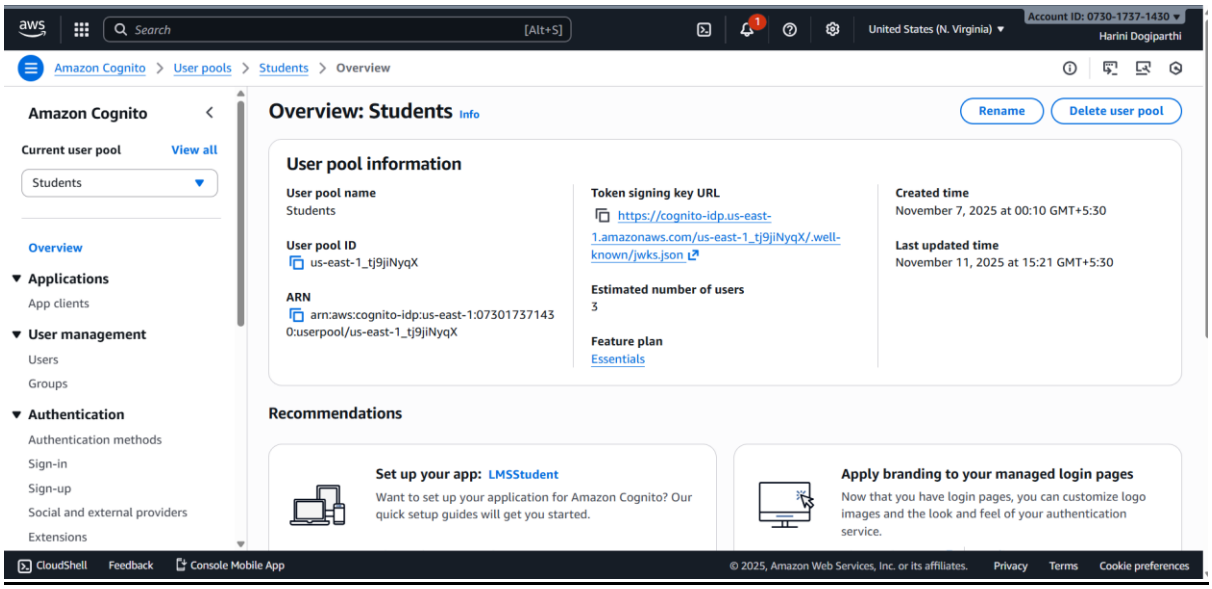
Self registration disabled since only admin can create the educator



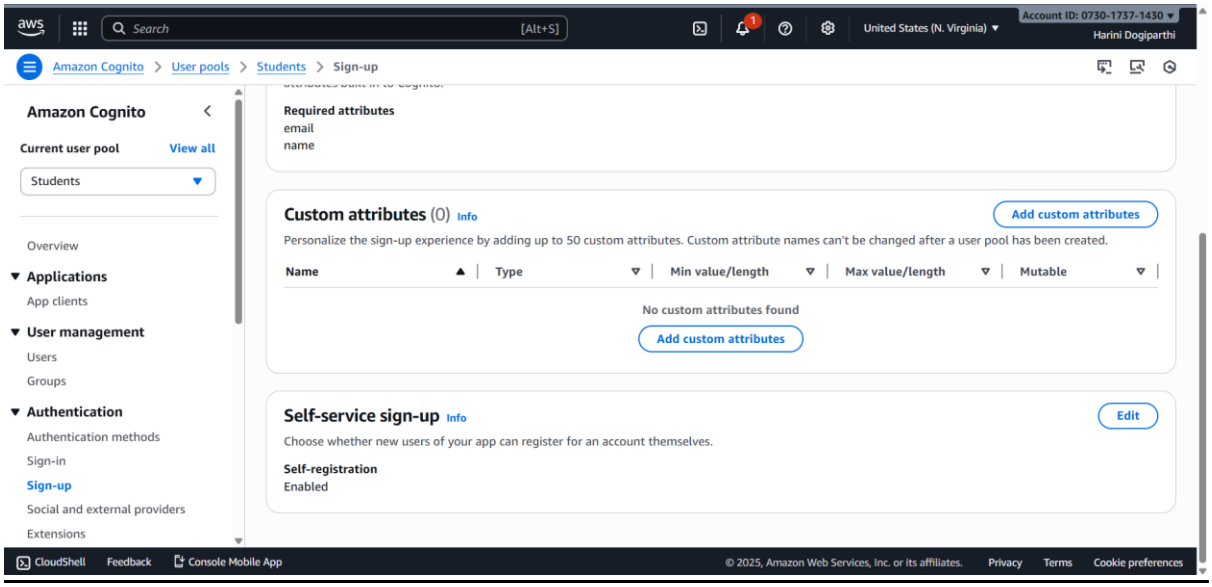
App client for Educator



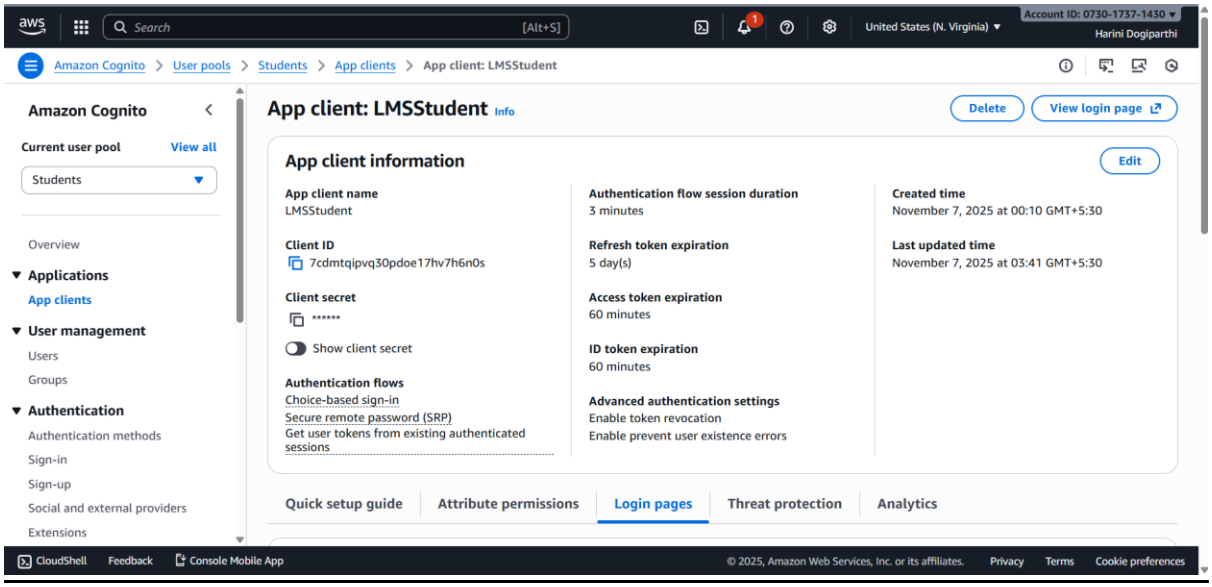
Students userpool



Self registration enabled for students

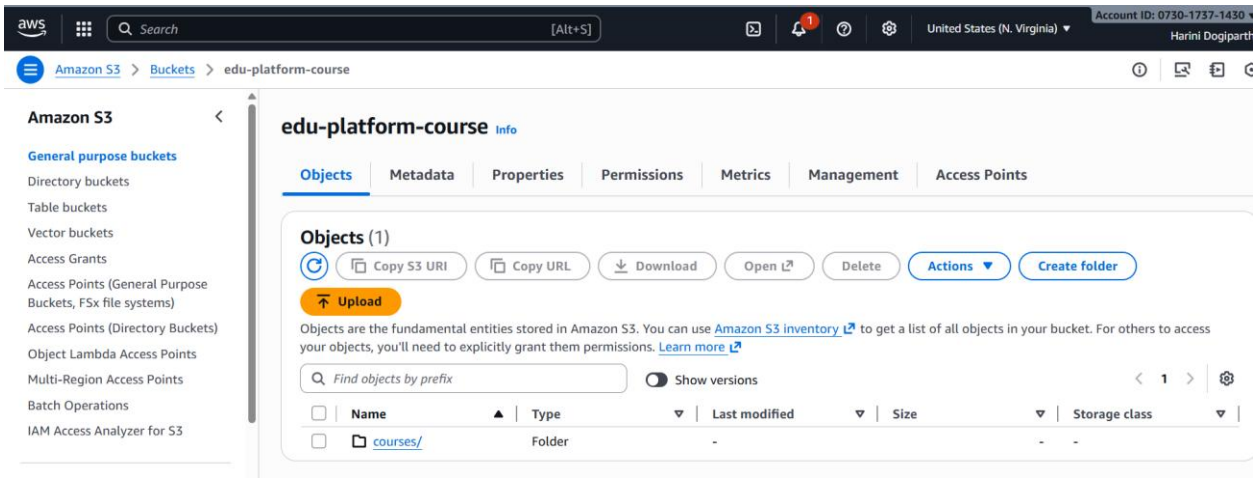


App client for Student



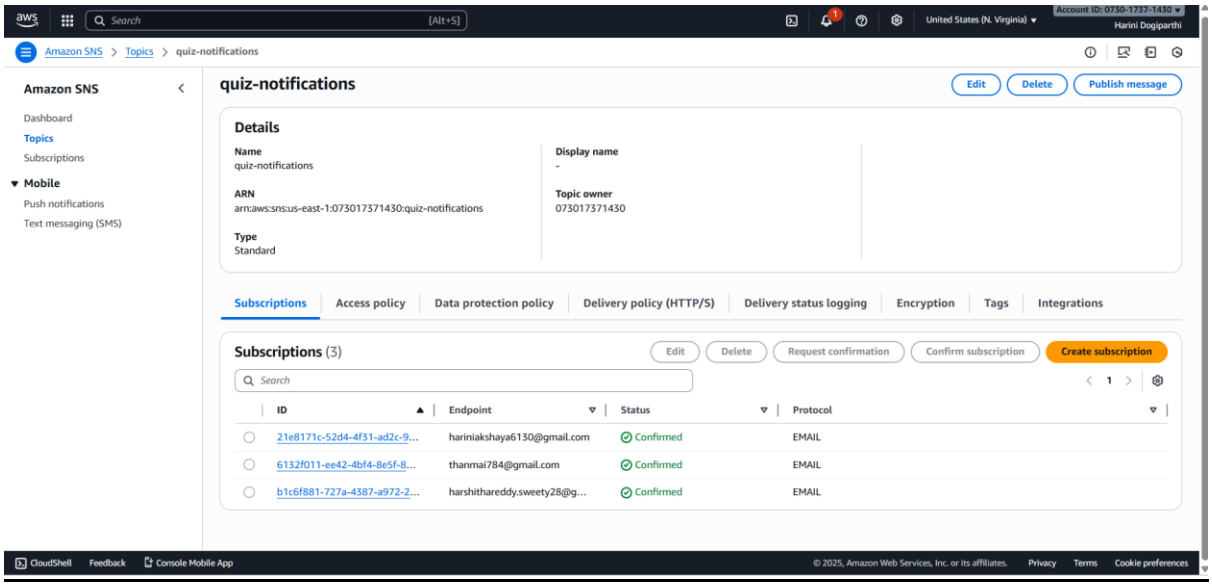
(ii) AWS S3

Edu-platform-course bucket with courses folder to store video and material uploaded by educator



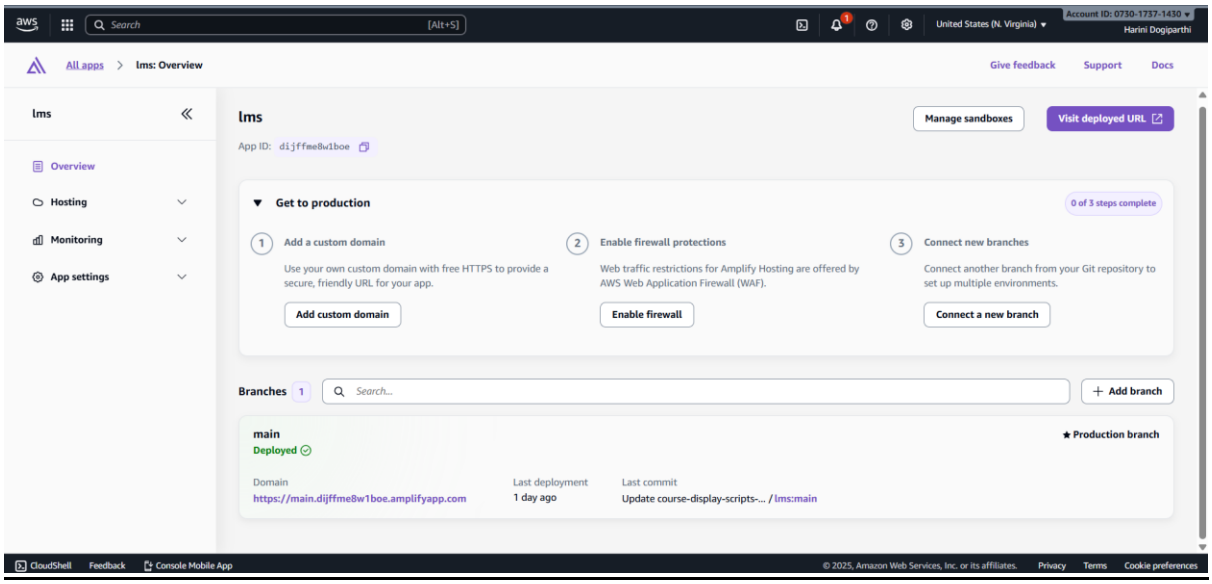
(iii) SNS (Simple Notification Service)

SNS quiz-notifications topic created to send notifications to students when quiz created by educator



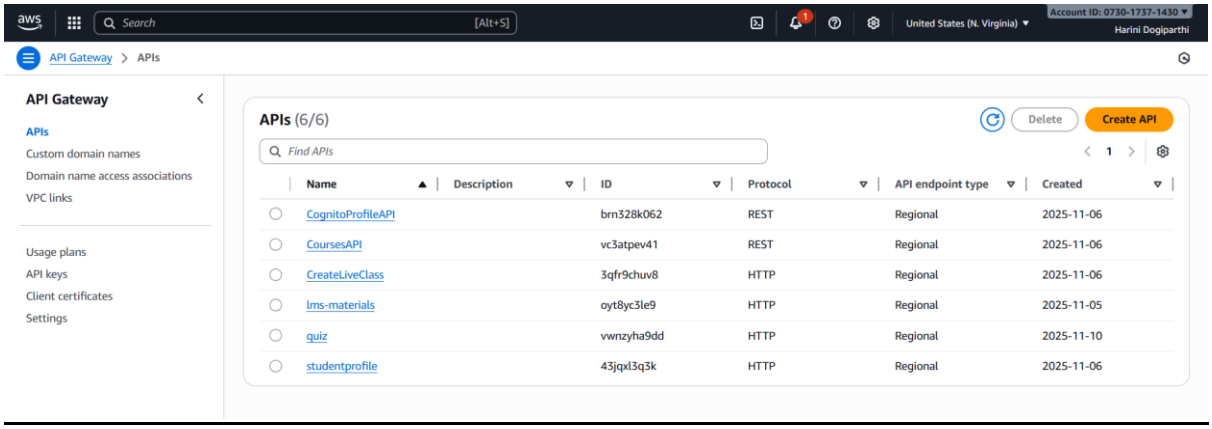
(iv) AWS Amplify

Used to host the website

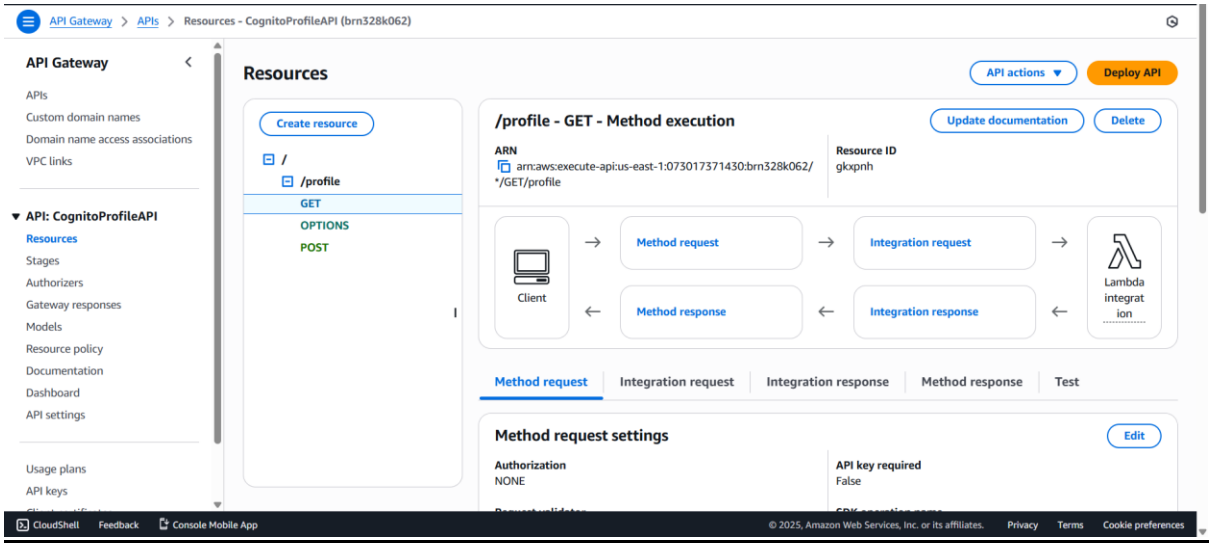


(v) API GATEWAY

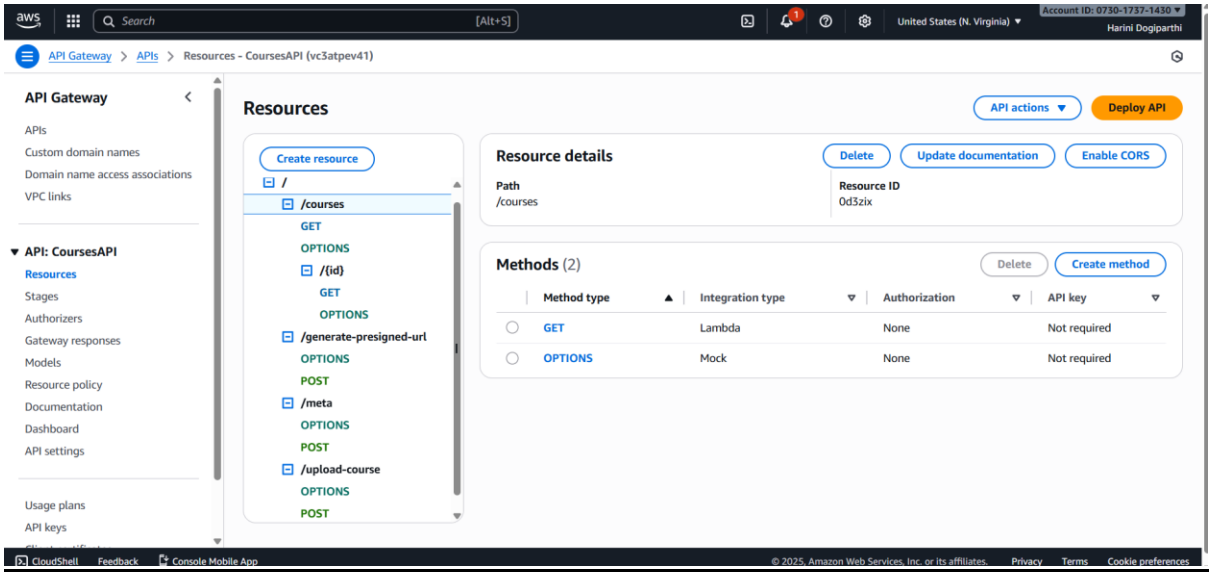
6 APIs are created to connect with frontend pages



CognitoProfileAPI

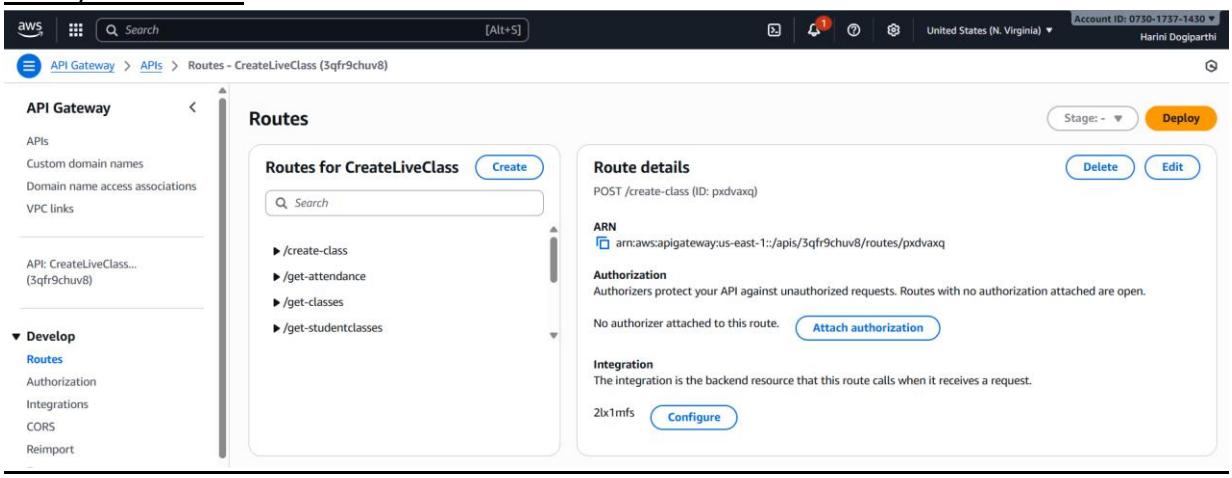


CoursesAPI

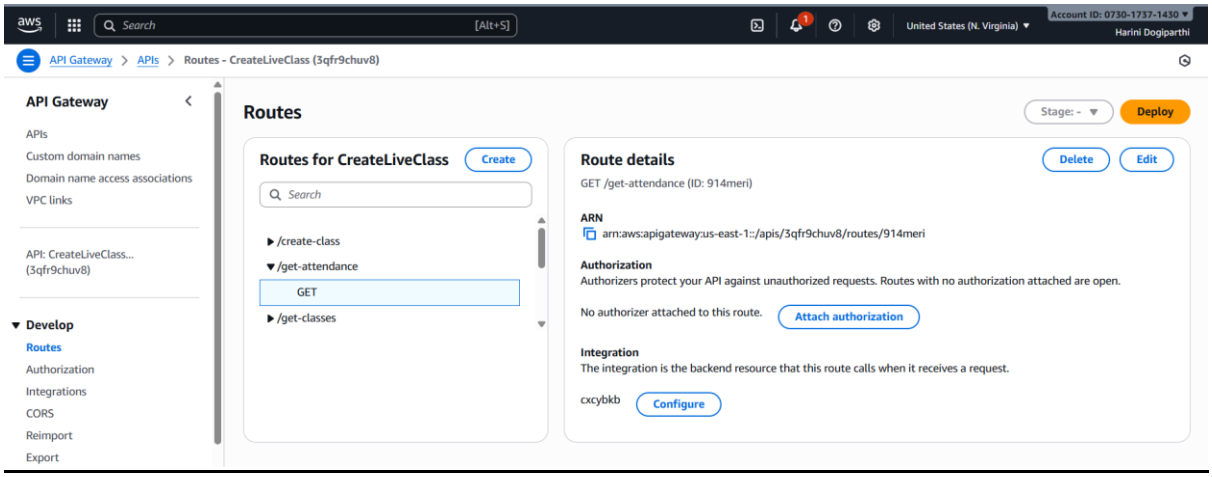


Routes for CreateLiveClass

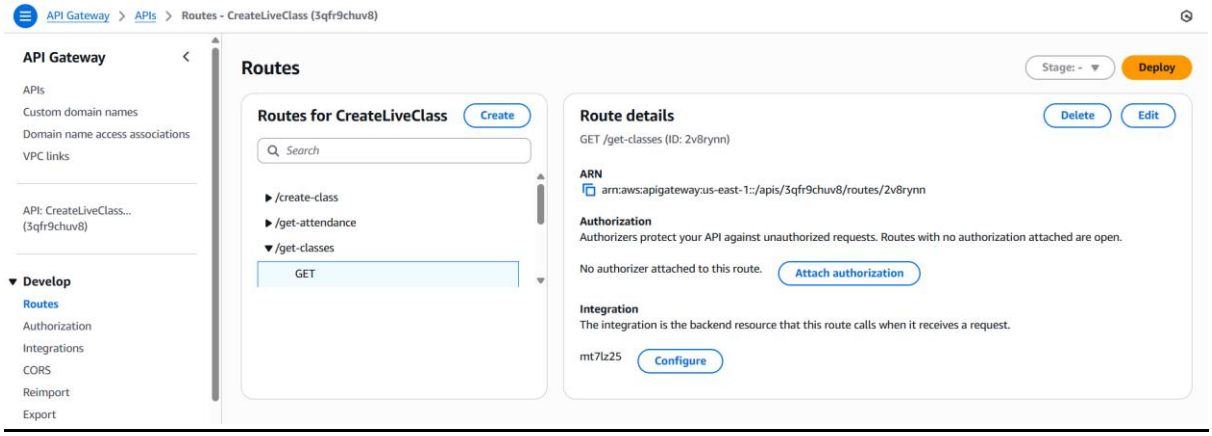
POST /create-class



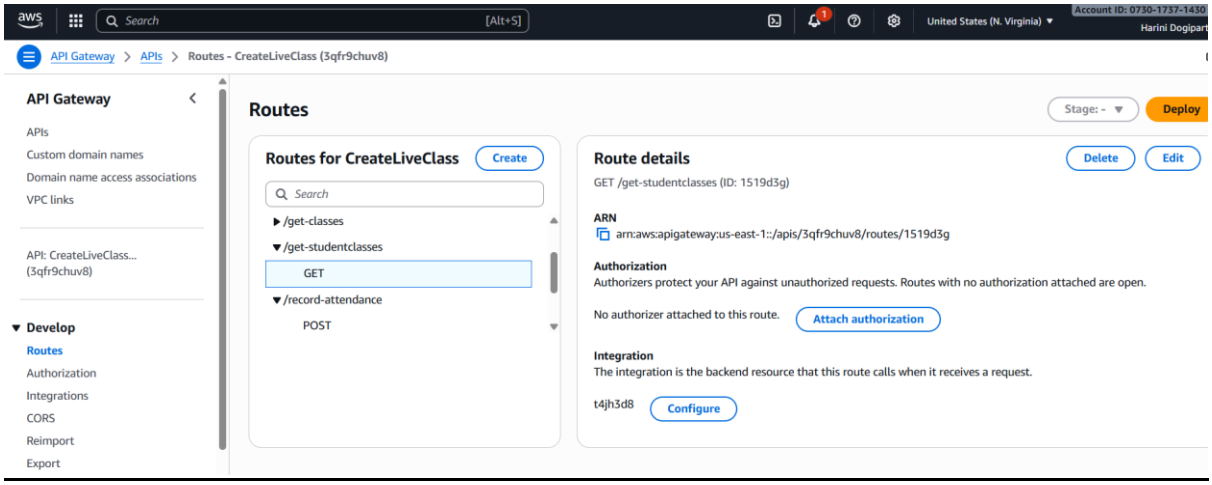
GET /get-attendance



GET /get-classes

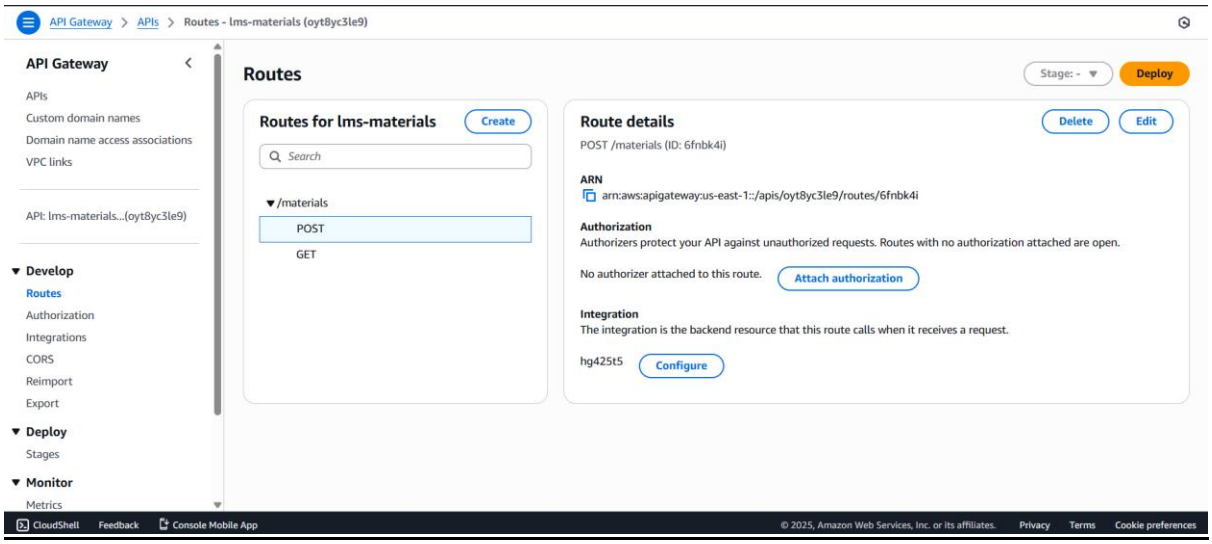


GET /get-studentclasses

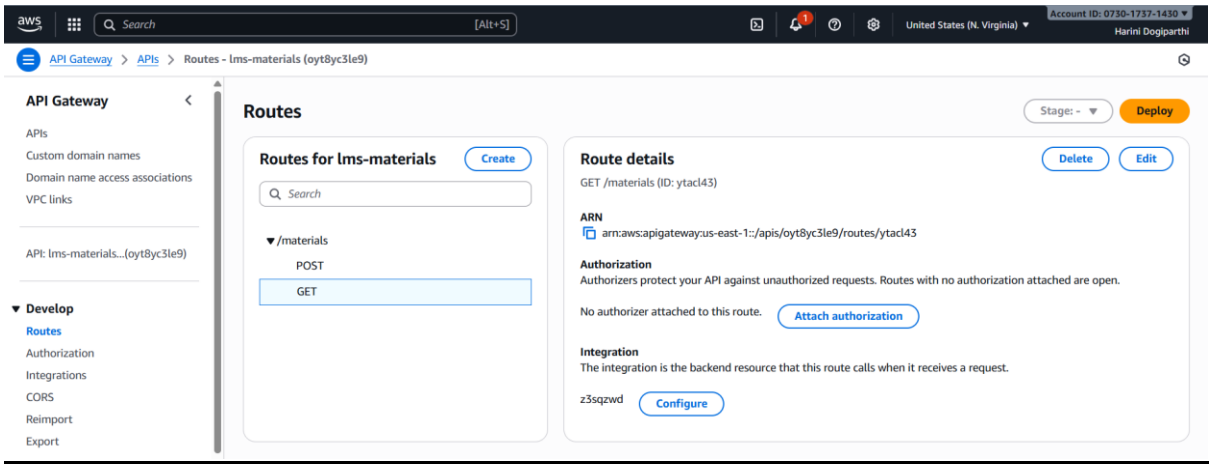


Routes for lms-materials

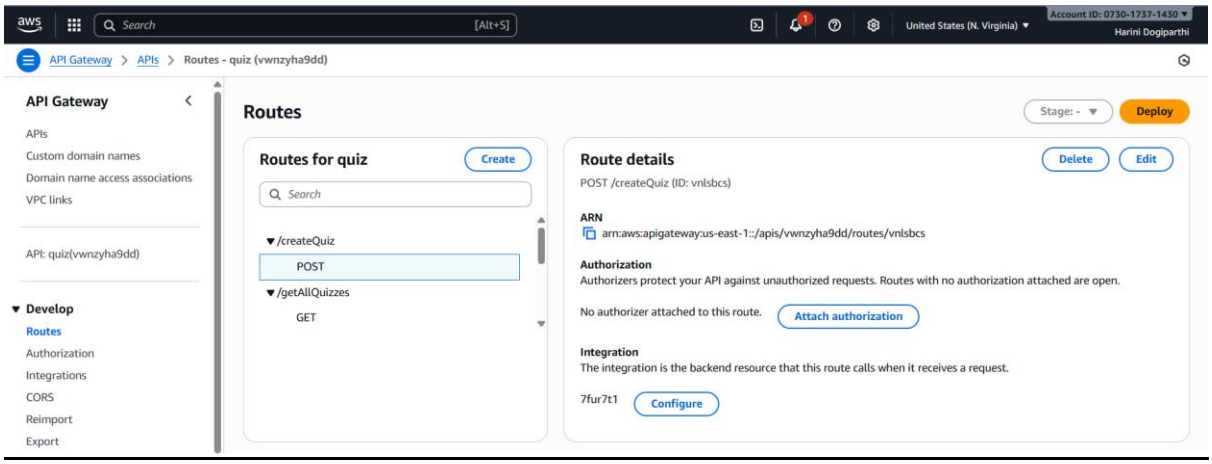
POST /materials



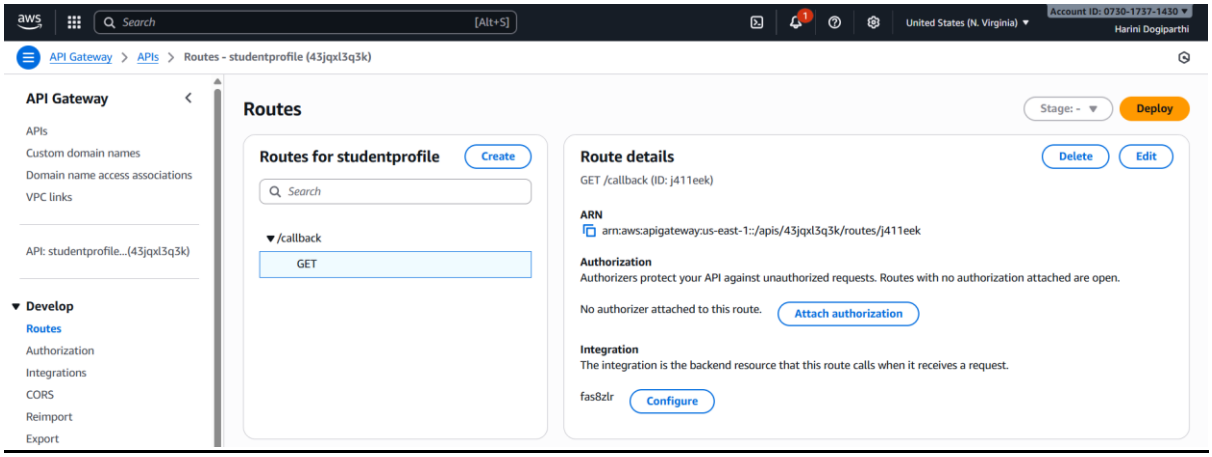
GET /materials



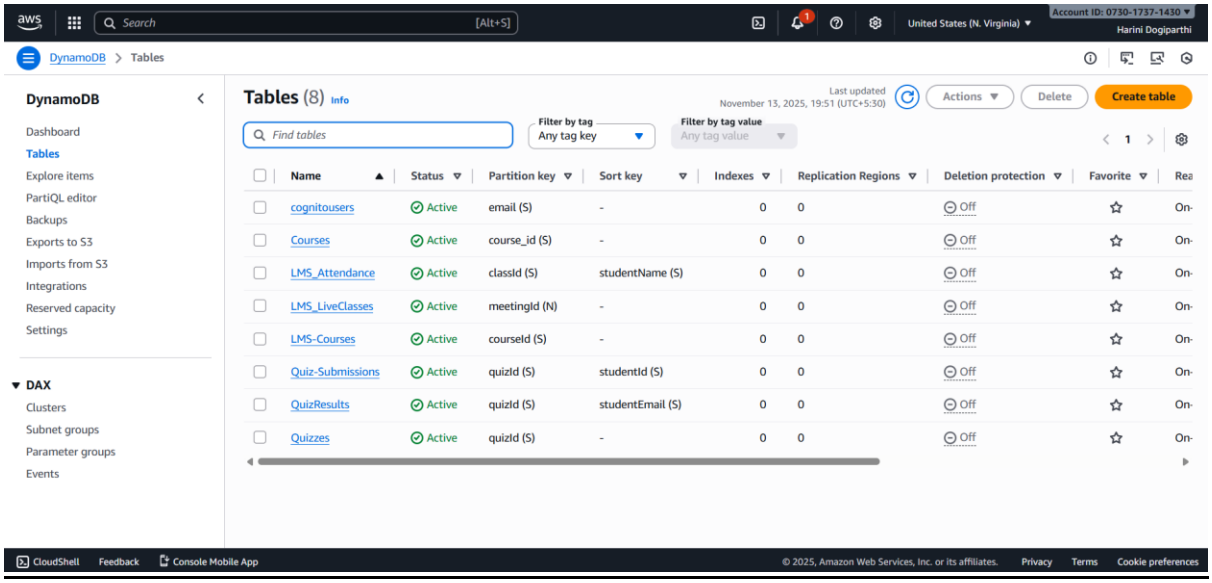
Routes - quiz



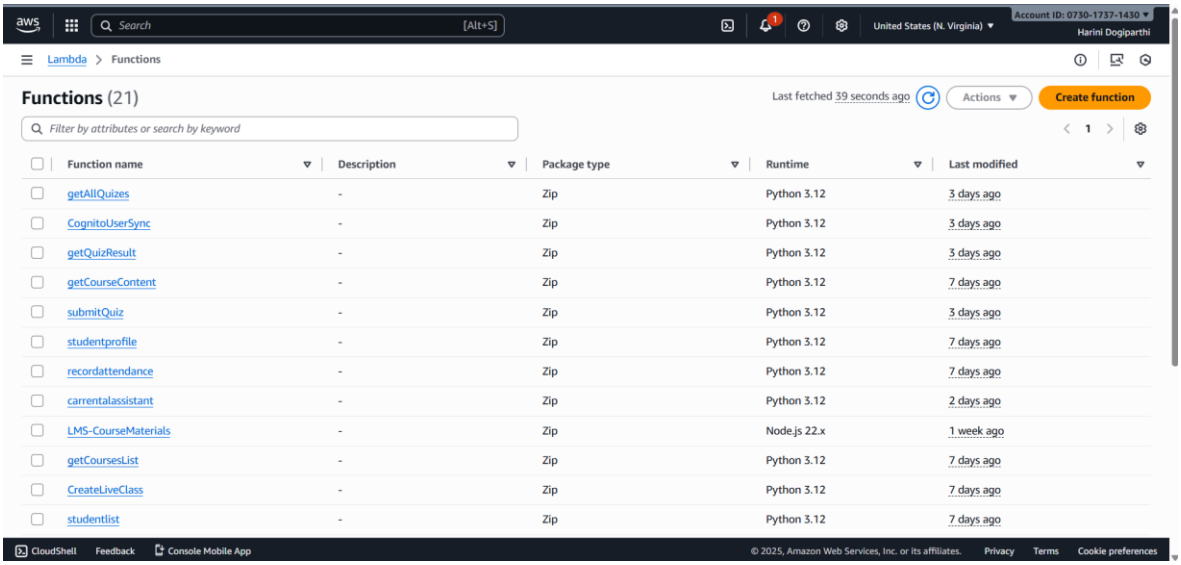
Routes for studentprofile



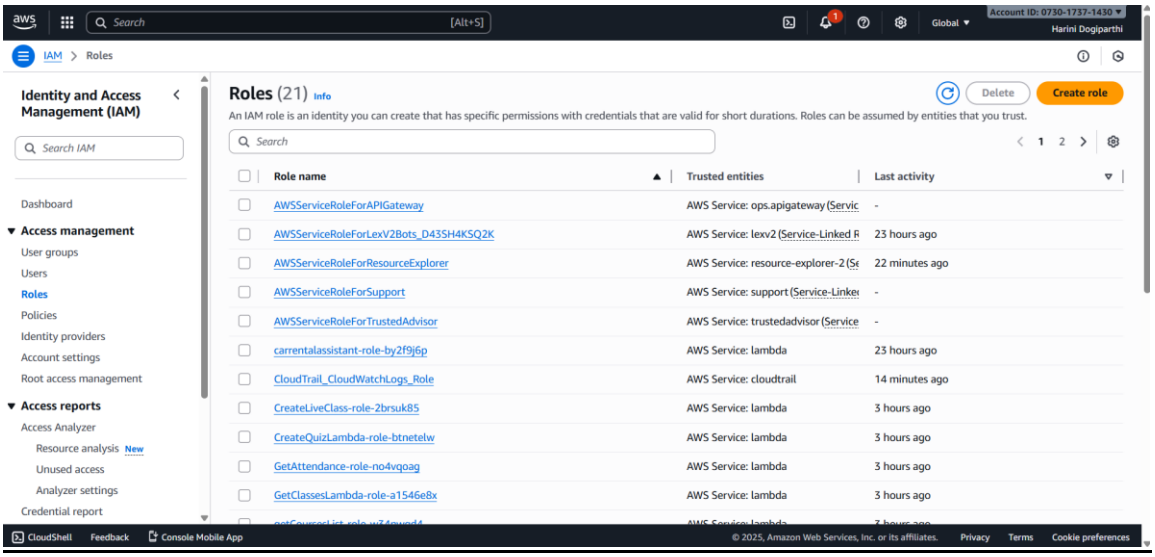
(vi) DYNAMO DB



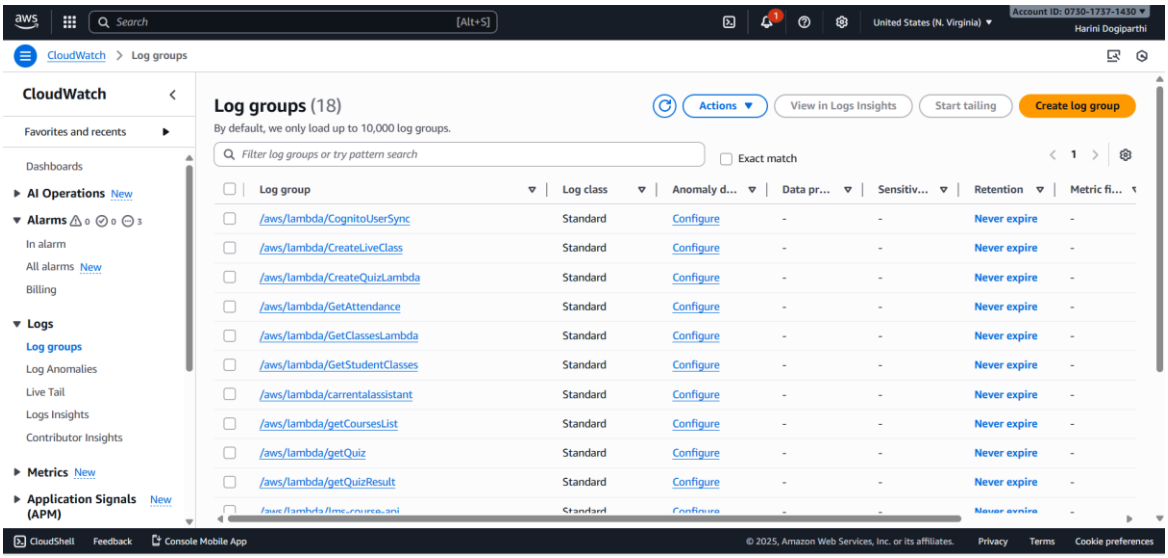
(vii) LAMBDA

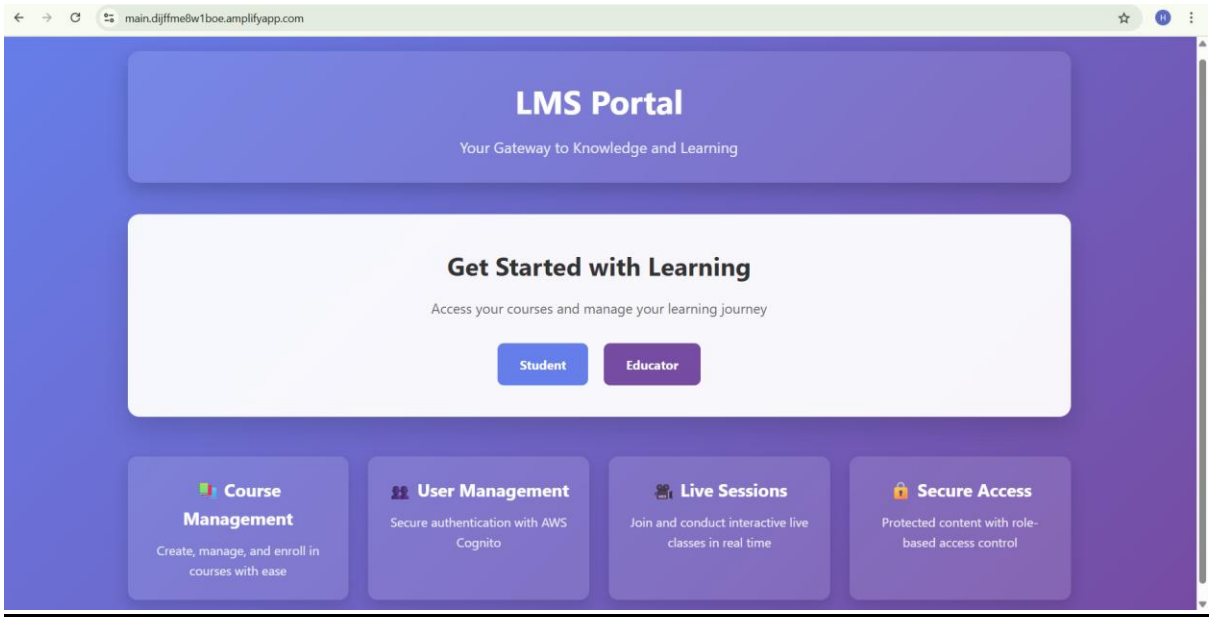


(viii) IAM

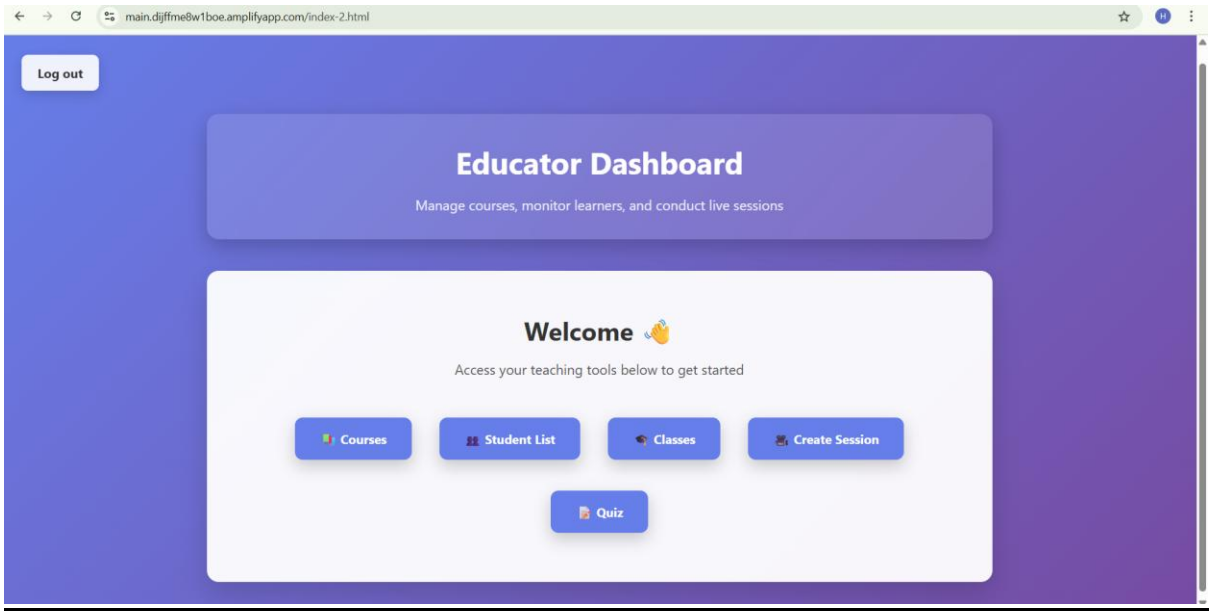


(ix) CLOUDWATCH





EDUCATOR SIDE




Back
Courses
+ Add Course
Certified Courses
Python
Learn Python for general-purpose programming.
Start
C++
Understand the fundamentals of C++ programming.
Start
Uploaded Courses
cloud
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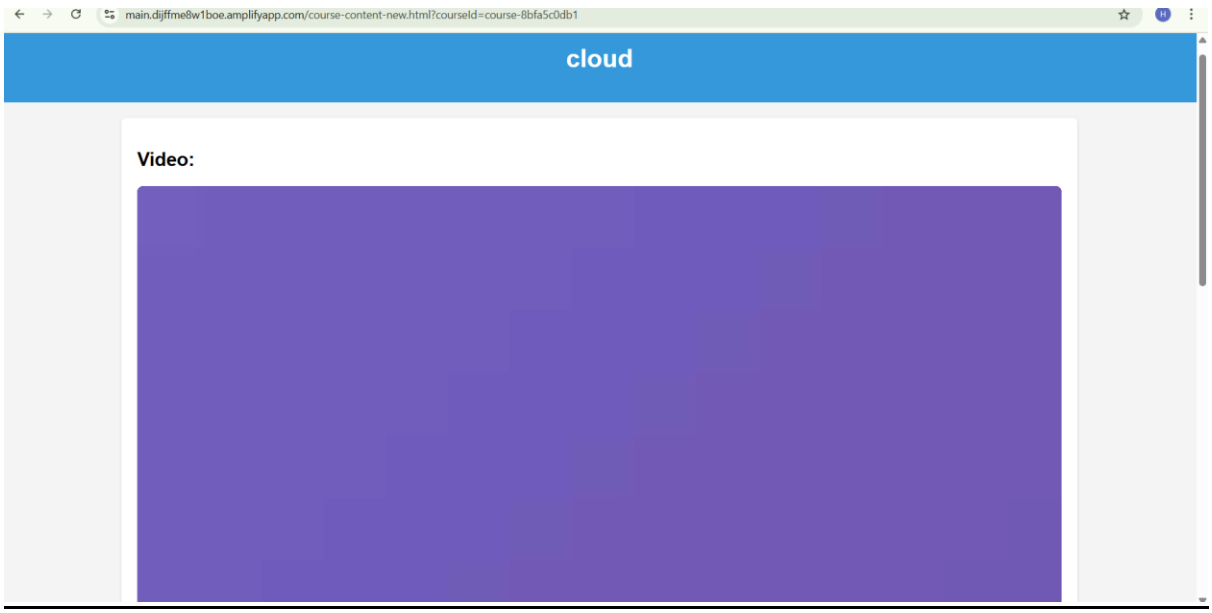
Start
XYZ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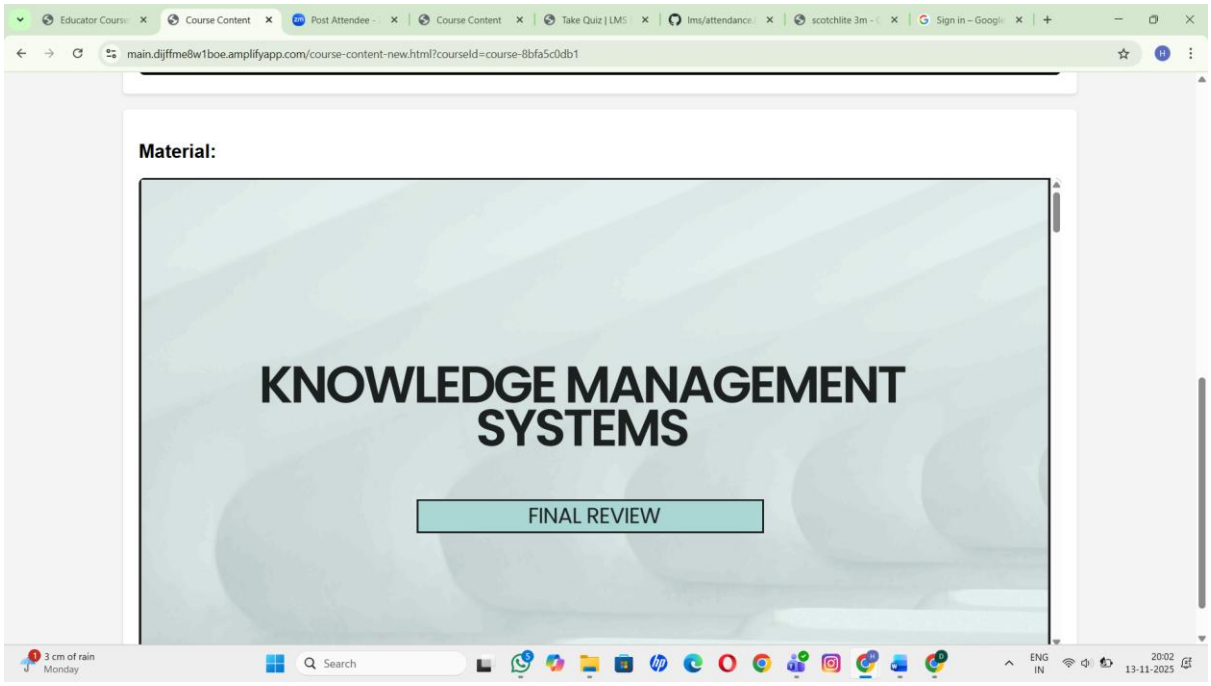
cloud
Video: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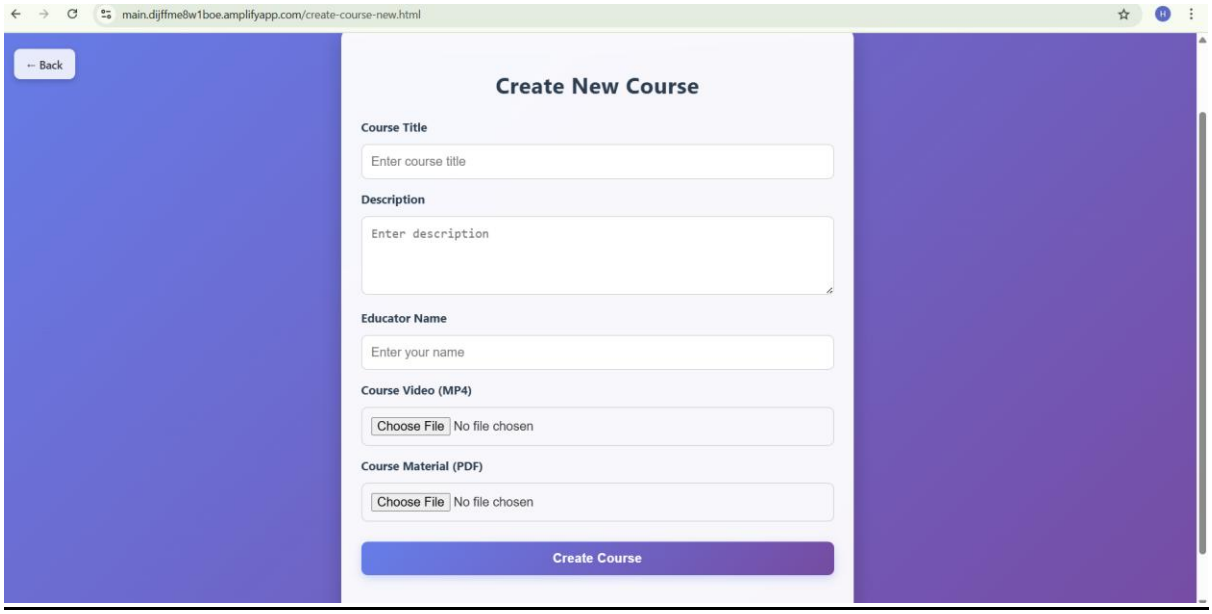
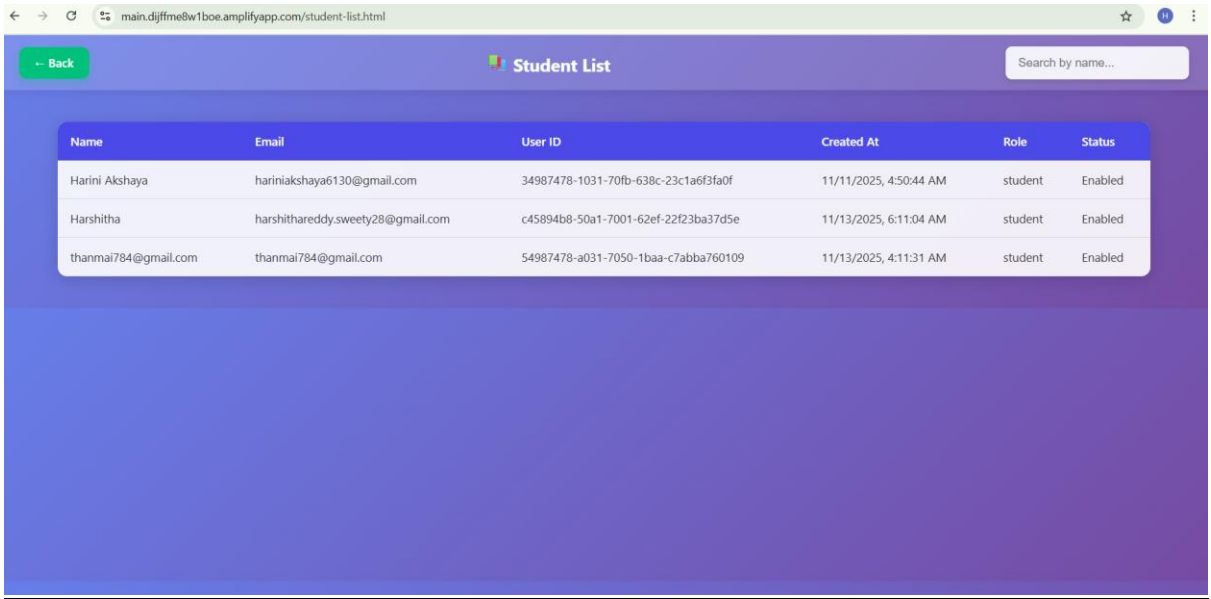
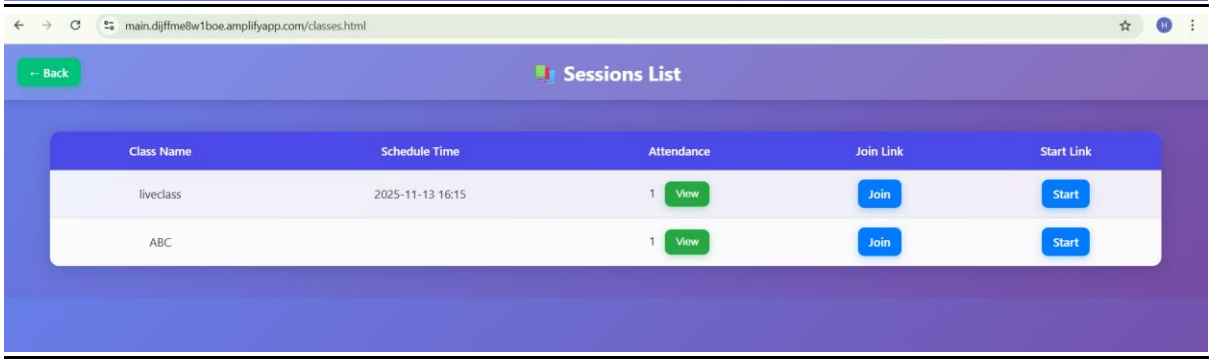
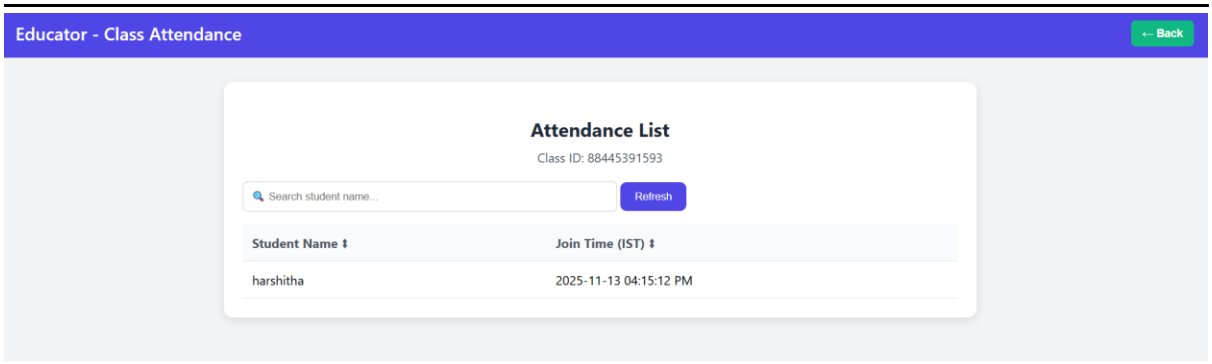
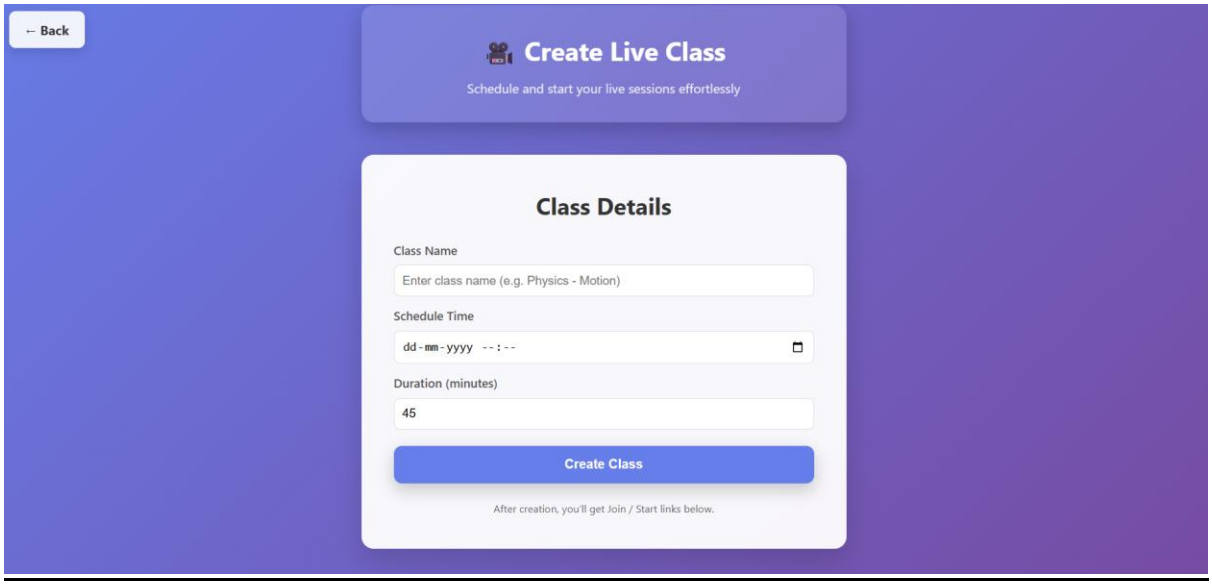
Material:
KNOWLEDGE MANAGEMENT SYSTEMS
FINAL REVIEW

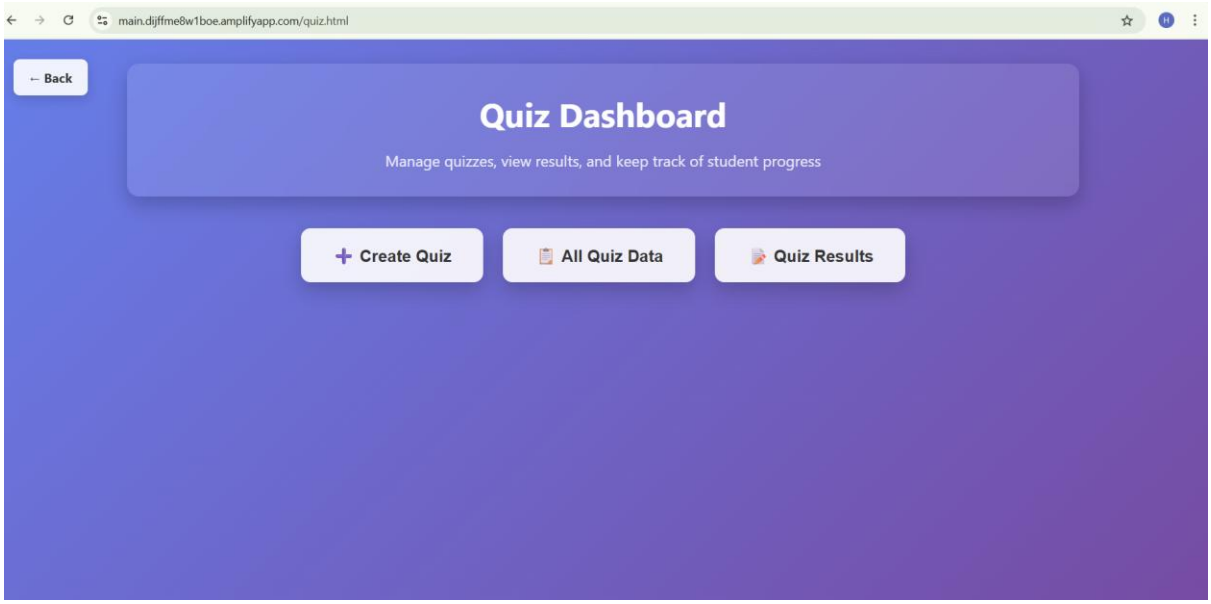

main.dijffme8w1boe.amplifyapp.com/create-course-new.html
← Back
Create New Course
Course Title
Enter course title
Description
Enter description
Educator Name
Enter your name
Course Video (MP4)
Choose File No file chosen
Course Material (PDF)
Choose File No file chosen
Create Course

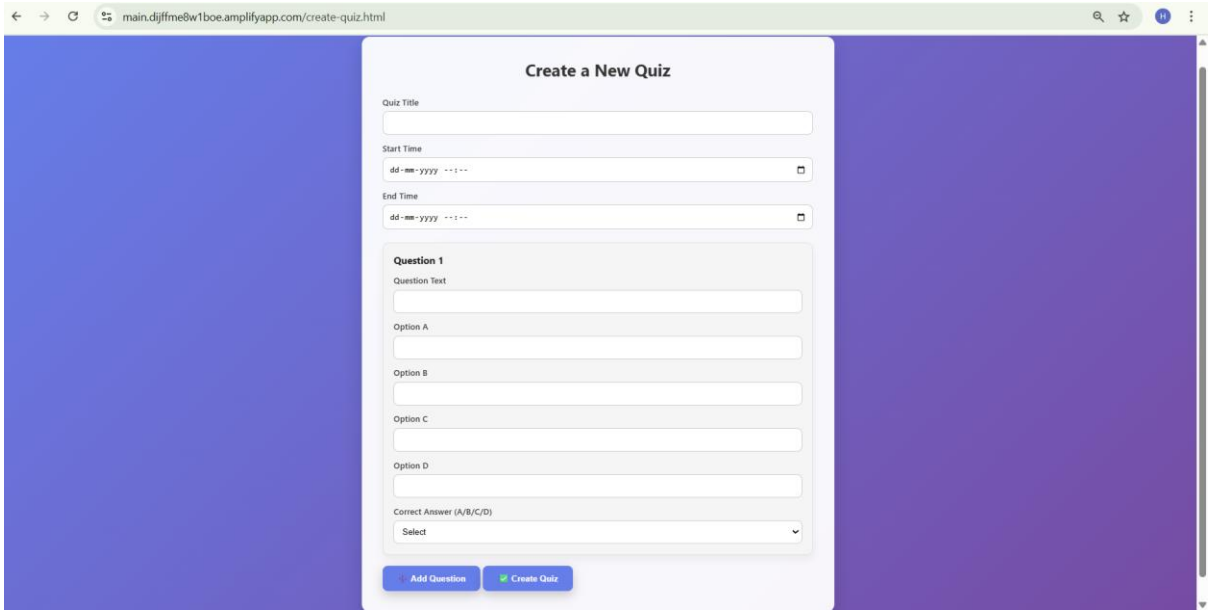

main.dijffme8w1boe.amplifyapp.com/student-list.html
← Back
Student List
Search by name...
Name
Email
User ID
Created At
Role
Status
Harini Akshaya
hariniakshaya6130@gmail.com
34987478-1031-70fb-638c-23c1a6f3fa0f
11/11/2025, 4:50:44 AM
student
Enabled
Harshitha
harshithareddy.sweety28@gmail.com
c45894b8-50a1-7001-62ef-22f23ba37d5e
11/13/2025, 6:11:04 AM
student
Enabled
thanmai784@gmail.com
thanmai784@gmail.com
54987478-a031-7050-1baa-c7abba760109
11/13/2025, 4:11:31 AM
student
Enabled

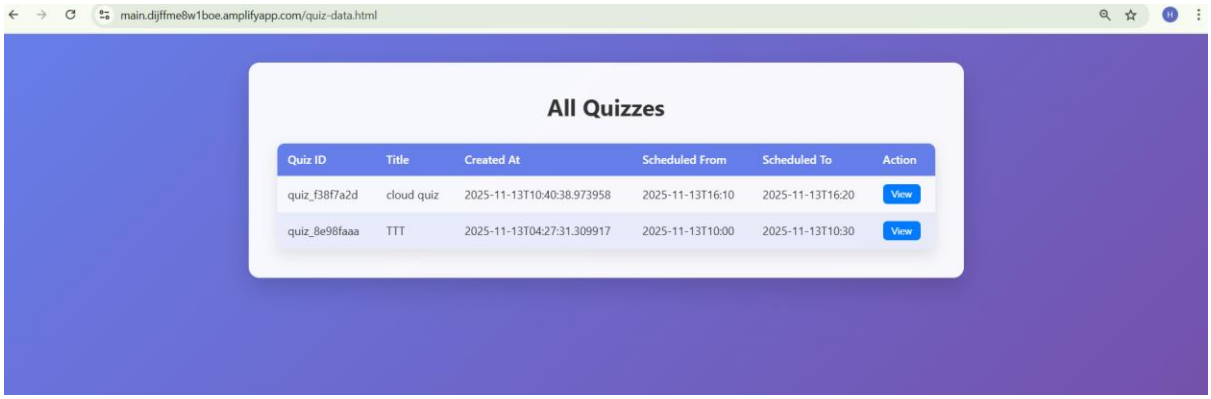

main.dijffme8w1boe.amplifyapp.com/classes.html
← Back
Sessions List
Class Name
Schedule Time
Attendance
Join Link
Start Link
liveclass
2025-11-13 16:15
1
View
Join
Start
ABC
1
View
Join
Start

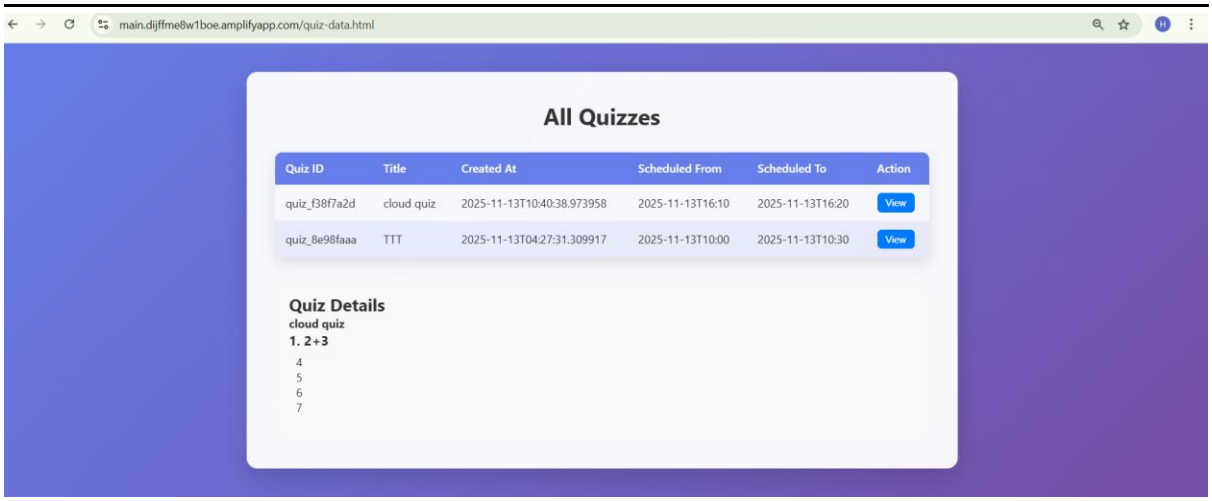

Educator - Class Attendance
← Back
Attendance List
Class ID: 88445391593
Search student name...
Refresh
Student Name
Join Time (IST)
harshitha
2025-11-13 04:15:12 PM

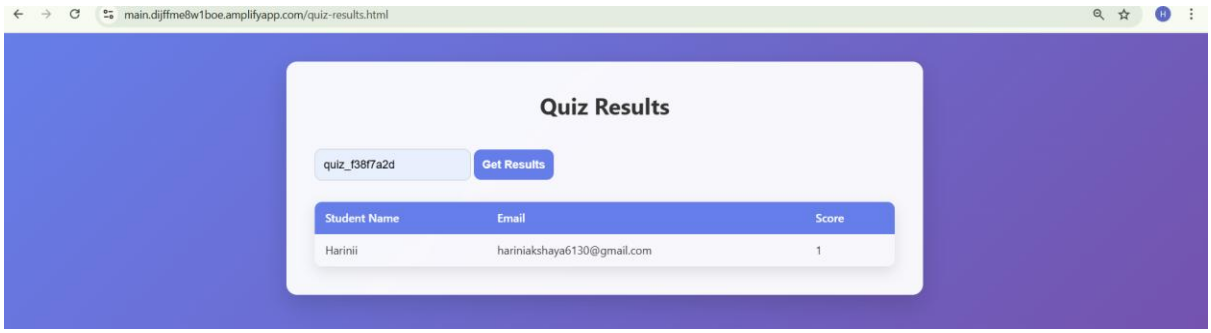

← Back
Create Live Class
Schedule and start your live sessions effortlessly
Class Details
Class Name
Enter class name (e.g. Physics - Motion)
Schedule Time
dd-mm-yyyy --:--
Duration (minutes)
45
Create Class
After creation, you'll get Join / Start links below.


main.dijffme8w1boe.amplifyapp.com/quiz.html
← Back
Quiz Dashboard
Manage quizzes, view results, and keep track of student progress
Create Quiz
All Quiz Data
Quiz Results

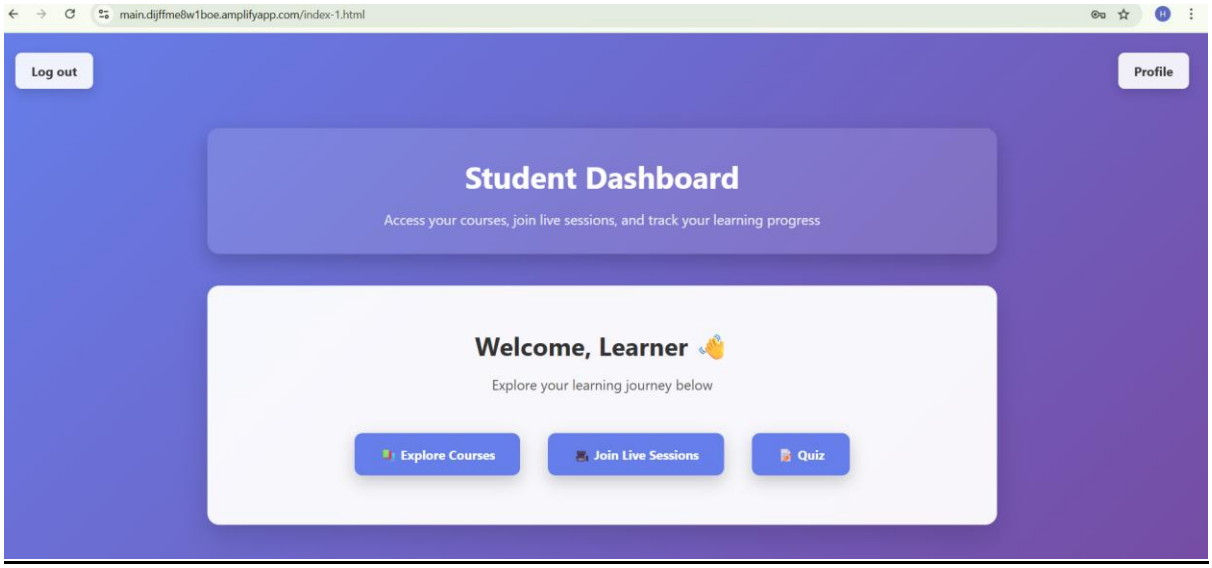

main.dijffme8w1boe.amplifyapp.com/create-quiz.html
Create a New Quiz
Quiz Title
Start Time
dd-mm-yyyy --:--
End Time
dd-mm-yyyy --:--
Question 1
Question Text
Option A
Option B
Option C
Option D
Correct Answer (A/B/C/D)
Select
Add Question
Create Quiz

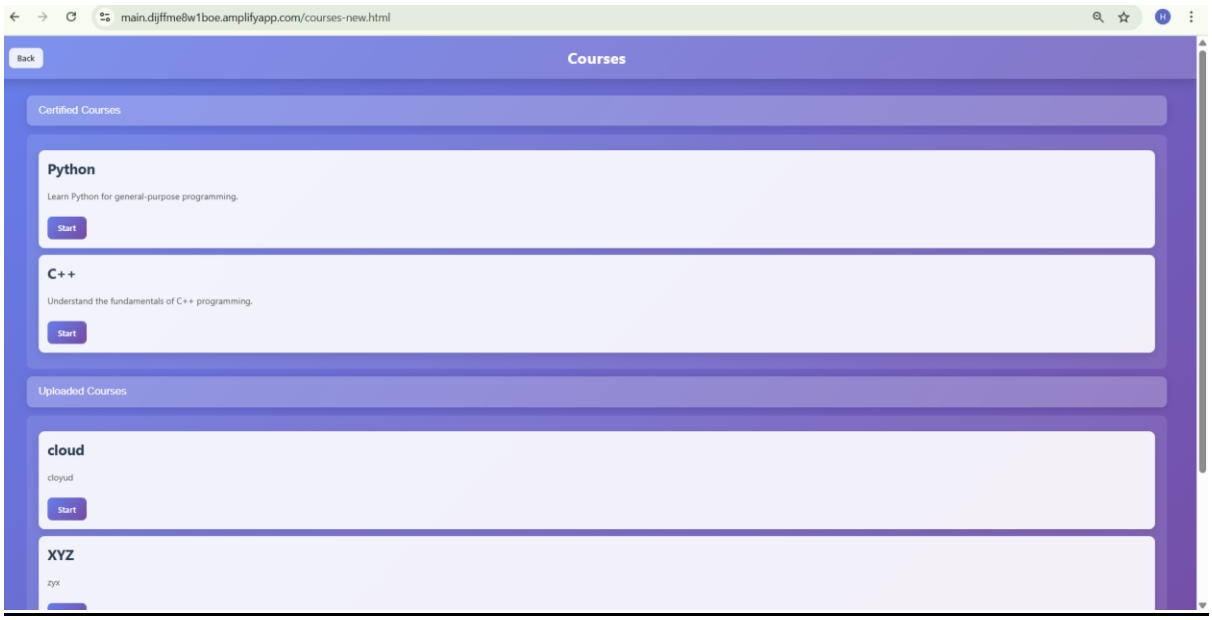

main.dijffme8w1boe.amplifyapp.com/quiz-data.html
All Quizzes
Quiz ID
Title
Created At
Scheduled From
Scheduled To
Action
quiz_f38f7a2d
cloud quiz
2025-11-13T10:40:38.973958
2025-11-13T16:10
2025-11-13T16:20
View
quiz_8e98faaa
TTT
2025-11-13T04:27:31.309917
2025-11-13T10:00
2025-11-13T10:30
View

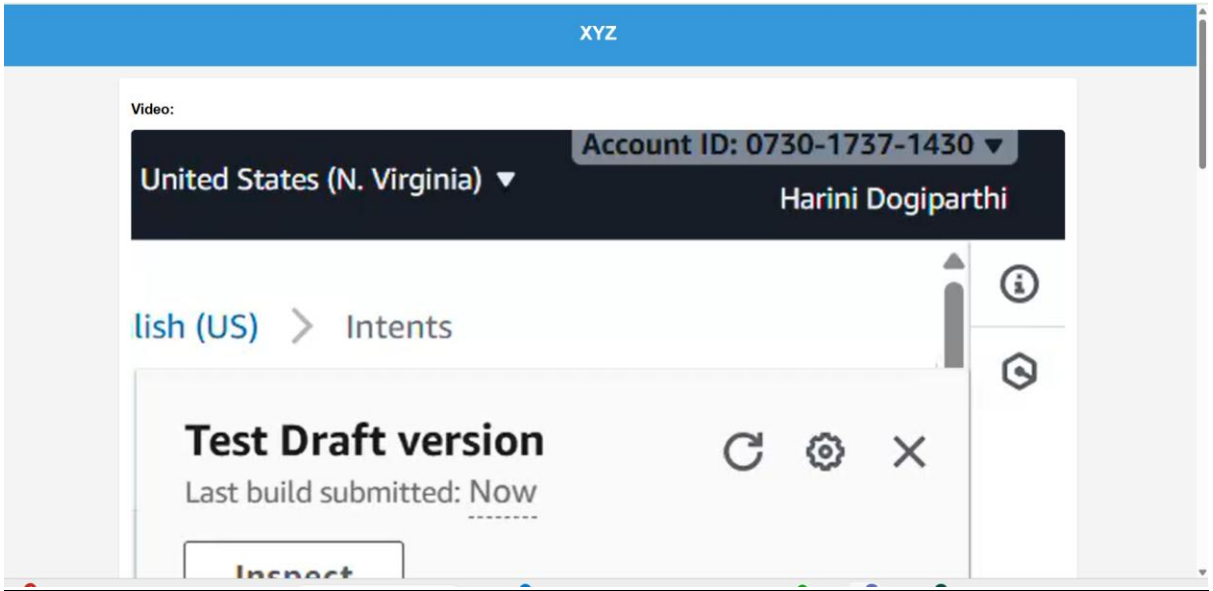

main.dijffme8w1boe.amplifyapp.com/quiz-data.html
All Quizzes
Quiz ID
Title
Created At
Scheduled From
Scheduled To
Action
quiz_f38f7a2d
cloud quiz
2025-11-13T10:40:38.973958
2025-11-13T16:10
2025-11-13T16:20
View
quiz_8e98faaa
TTT
2025-11-13T04:27:31.309917
2025-11-13T10:00
2025-11-13T10:30
View
Quiz Details
cloud quiz
1. 2+3
4
5
6
7

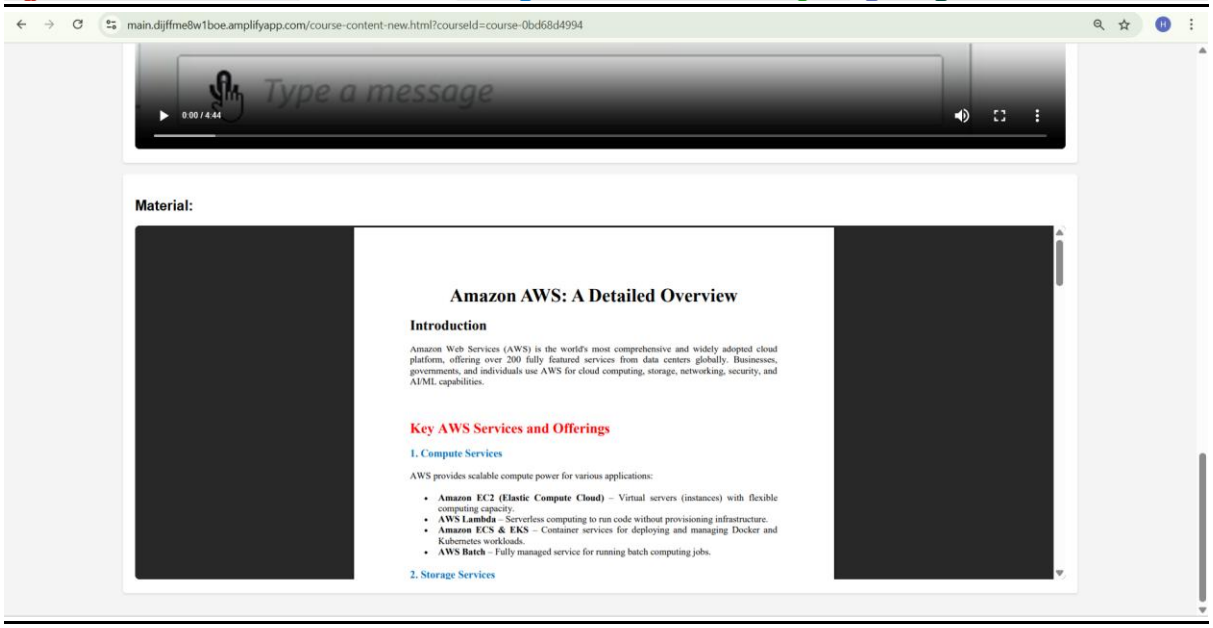

main.dijffme8w1boe.amplifyapp.com/quiz-results.html
Quiz Results
quiz_f38f7a2d
Get Results
Student Name
Email
Score
Harinii
hariniakshaya6130@gmail.com
1

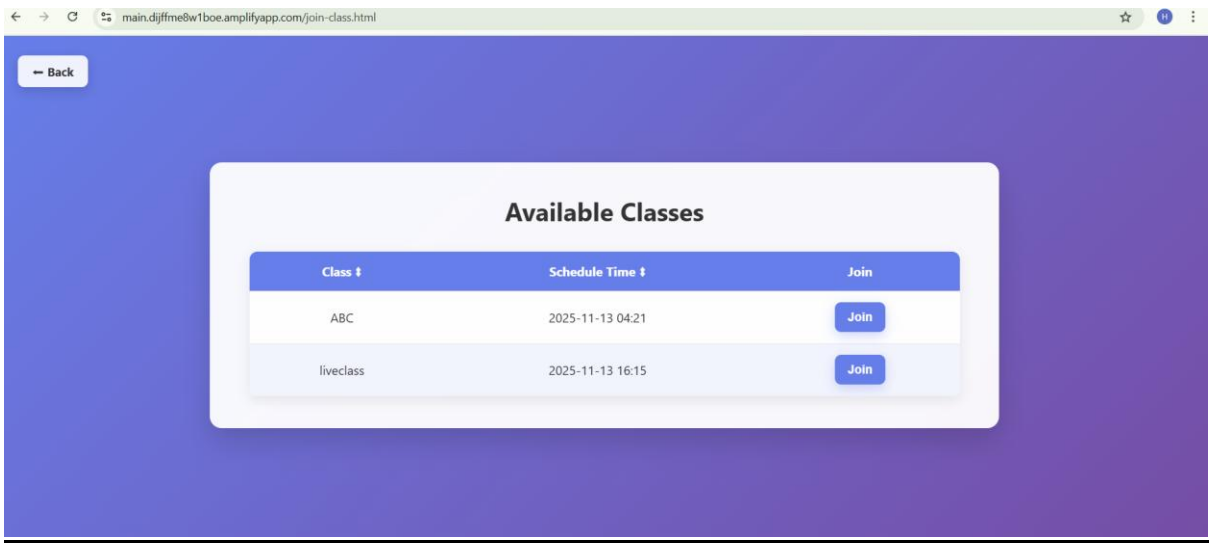
STUDENT SIDE

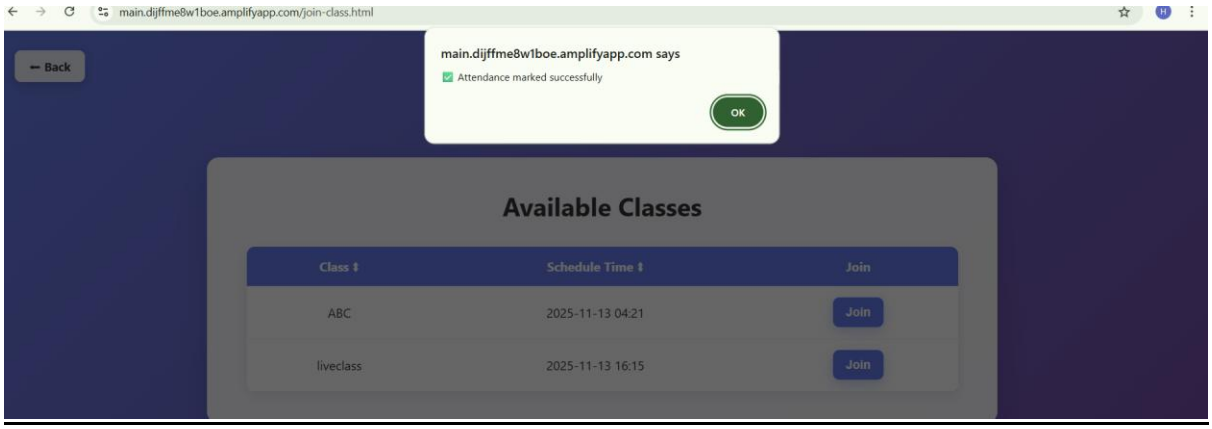


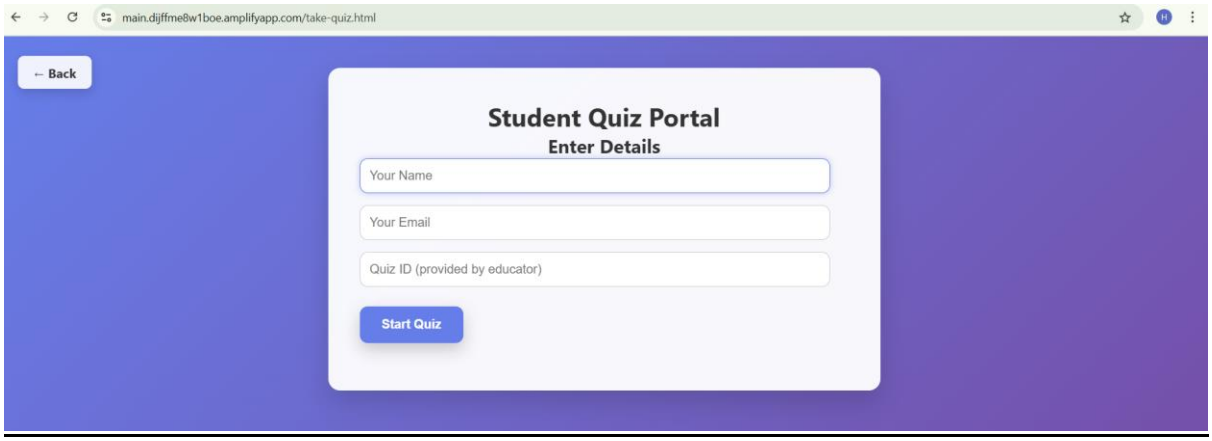


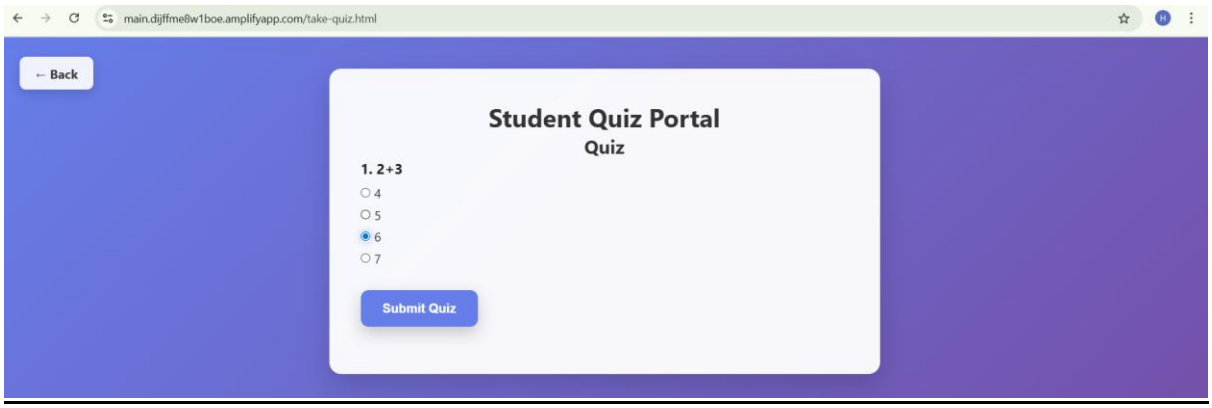

XYZ
Video:
Account ID: 0730-1737-1430
United States (N. Virginia)
Harini Dogiparthi
lish (US) > Intents
Test Draft version
Last build submitted: Now
Inspect

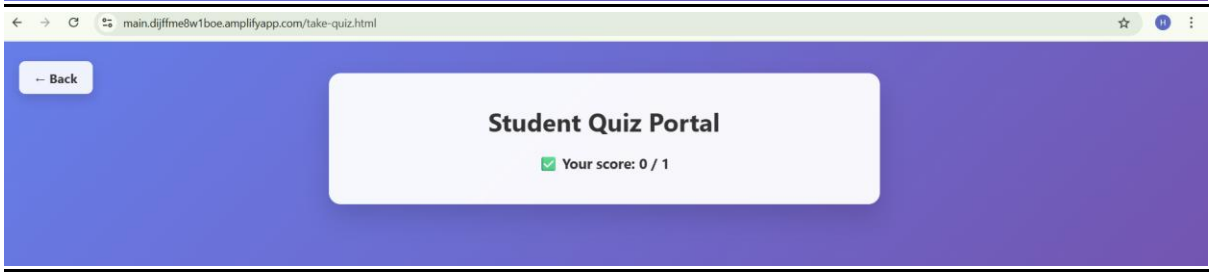

main.dijffme8w1boe.amplifyapp.com/course-content-new.html?courseId=course-0bd68d4994
Type a message
0:00 / 4:44
Material:
Amazon AWS: A Detailed Overview
Introduction
Amazon Web Services (AWS) is the world's most comprehensive and widely adopted cloud platform, offering over 200 fully featured services from data centers globally. Businesses, governments, and individuals use AWS for cloud computing, storage, networking, security, and AI/ML capabilities.
Key AWS Services and Offerings
1. Compute Services
AWS provides scalable compute power for various applications:
Amazon EC2 (Elastic Compute Cloud) – Virtual servers (instances) with flexible computing capacity.
AWS Lambda – Serverless computing to run code without provisioning infrastructure.
Amazon ECS & EKS – Container services for deploying and managing Docker and Kubernetes workloads.
AWS Batch – Fully managed service for running batch computing jobs.
2. Storage Services


main.dijffme8w1boe.amplifyapp.com/join-class.html
← Back
Available Classes
Class
Schedule Time
Join
ABC
2025-11-13 04:21
Join
liveclass
2025-11-13 16:15
Join


main.dijffme8w1boe.amplifyapp.com/join-class.html
← Back
main.dijffme8w1boe.amplifyapp.com says
Attendance marked successfully
OK
Available Classes
Class
Schedule Time
Join
ABC
2025-11-13 04:21
Join
liveclass
2025-11-13 16:15
Join


main.dijffme8w1boe.amplifyapp.com/take-quiz.html
← Back
Student Quiz Portal
Enter Details
Your Name
Your Email
Quiz ID (provided by educator)
Start Quiz


main.dijffme8w1boe.amplifyapp.com/take-quiz.html
← Back
Student Quiz Portal
Quiz
1. 2+3
4
5
6
7
Submit Quiz


main.dijffme8w1boe.amplifyapp.com/take-quiz.html
← Back
Student Quiz Portal
Your score: 0 / 1

Coding of the project

I. CognitoUserSync

```
import boto3
import os
from datetime import datetime

# Initialize AWS clients
dynamodb = boto3.resource('dynamodb')
sns = boto3.client('sns')

# Environment variables
table_name = os.environ.get('USER_TABLE', 'cognitousers')
sns_topic_arn = os.environ.get('SNS_TOPIC_ARN')

table = dynamodb.Table(table_name)

def lambda_handler(event, context):
    print("EVENT:", event)

    try:
        user_email = event['request']['userAttributes'].get('email')
        user_name = event['request']['userAttributes'].get('name', '')
        user_id = event['userName']

        # 1. Save user to DynamoDB
        table.put_item(
            Item={
                'email': user_email,
                'user_id': user_id,
                'name': user_name,
```

```
            'role': 'student',
            'status': 'Enabled',
            'created_at': datetime.utcnow().isoformat()
        }
    )
    print(f" User {user_email} stored in DynamoDB")

    # 2. Subscribe new student to SNS topic (email notification)
    if user_email and sns_topic_arn:
        sns.subscribe(
            TopicArn=sns_topic_arn,
            Protocol='email',
            Endpoint=user_email
        )
        print(f"Subscribed {user_email} to SNS topic")
    else:
        print(" Missing email or SNS_TOPIC_ARN")

    return event

  except Exception as e:
    print(f" Error: {str(e)}")
    raise e
```

II. studentlist

```
import json
import boto3
from boto3.dynamodb.conditions import Attr

dynamodb = boto3.resource('dynamodb')
table = dynamodb.Table('cognitousers')
```

```
def lambda_handler(event, context):
    print(" 🟢 Incoming event:", json.dumps(event))  # 👈 ADD THIS LINE

    try:
        # Scan all users where role = 'student'
        response = table.scan(
            FilterExpression=Attr('role').eq('student')
        )
        students = response.get('Items', [])

        return {
            'statusCode': 200,
            'headers': {
                'Access-Control-Allow-Origin': '*',
                'Access-Control-Allow-Methods': 'GET, OPTIONS',
                'Access-Control-Allow-Headers': 'Content-Type'
            },
            'body': json.dumps(students)
        }
    except Exception as e:
        return {
            'statusCode': 500,
            'body': json.dumps({'error': str(e)})
        }
```

III. presignedurl

```
import json
import boto3
import uuid
```

```
# Initialize S3 client
s3 = boto3.client("s3")
BUCKET_NAME = "edu-platform-course"  # 👈 change if your bucket name is different

def lambda_handler(event, context):
    try:
        # Generate unique course ID
        course_id = f"course-{uuid.uuid4().hex[:10]}"

        # Define file keys
        video_key = f"courses/{course_id}/video.mp4"
        material_key = f"courses/{course_id}/material.pdf"

        # Generate presigned URLs
        video_url = s3.generate_presigned_url(
            "put_object",
            Params={
                "Bucket": BUCKET_NAME,
                "Key": video_key,
                "ContentType": "video/mp4"
            },
            ExpiresIn=604800
        )

        material_url = s3.generate_presigned_url(
            "put_object",
            Params={
                "Bucket": BUCKET_NAME,
                "Key": material_key,
                "ContentType": "application/pdf"
            },
```

```
            ExpiresIn=604800
        )

        # Prepare final response
        response_body = {
            "course_id": course_id,
            "urls": {
                "video": {"key": video_key, "url": video_url},
                "material": {"key": material_key, "url": material_url}
            }
        }

        # Return success
        return {
            "statusCode": 200,
            "headers": {
                "Access-Control-Allow-Origin": "*",
                "Access-Control-Allow-Headers": "*",
                "Access-Control-Allow-Methods": "OPTIONS,POST,GET"
            },
            "body": json.dumps(response_body)
        }

    except Exception as e:
        print("Error generating presigned URL:", str(e))
        return {
            "statusCode": 500,
            "headers": {"Access-Control-Allow-Origin": "*"},
            "body": json.dumps({"error": str(e)})
        }
```

IV. UploadCourseData

```
import json
import boto3
import os
import time

s3 = boto3.client('s3')
dynamodb = boto3.resource('dynamodb')

BUCKET_NAME = os.environ.get('COURSES_BUCKET', 'edu-platform-course')
TABLE_NAME = os.environ.get('COURSES_TABLE', 'Courses')
table = dynamodb.Table(TABLE_NAME)

def lambda_handler(event, context):
    print("Received event:", event)

    body = event.get("body")
    if isinstance(body, str):
        try:
            body = json.loads(body)
        except Exception:
            pass
    elif isinstance(event, dict):
        body = event

    if not body or not isinstance(body, dict):
        return error_response("Missing request body")

    required = ["course_id", "title", "description", "educator", "video_key", "material_key"]
    missing = [k for k in required if k not in body or not body[k]]
    if missing:
```

```
        return error_response(f"Missing required fields: {missing}")

    try:
        # Generate accessible URLs for playback
        video_url = s3.generate_presigned_url(
            'get_object',
            Params={'Bucket': BUCKET_NAME, 'Key': body["video_key"]},
            ExpiresIn=604800  # 7 days
        )
        material_url = s3.generate_presigned_url(
            'get_object',
            Params={'Bucket': BUCKET_NAME, 'Key': body["material_key"]},
            ExpiresIn=604800
        )

        course_item = {
            "course_id": body["course_id"],
            "title": body["title"],
            "description": body["description"],
            "educator": body["educator"],
            "video_key": body["video_key"],
            "material_key": body["material_key"],
            "video_url": video_url,
            "material_url": material_url,
            "created_at": time.strftime("%Y-%m-%dT%H:%M:%S")
        }

        table.put_item(Item=course_item)
        print("✅ Course saved:", course_item)

        return {
```

```
            "statusCode": 200,
            "headers": cors_headers(),
            "body": json.dumps({
                "message": "Course saved successfully",
                "course_id": body["course_id"]
            })
        }
    except Exception as e:
        print("❌ Error:", str(e))
        return error_response(str(e), 500)

def error_response(msg, code=400):
    return {
        "statusCode": code,
        "headers": cors_headers(),
        "body": json.dumps({"error": msg})
    }

def cors_headers():
    return {
        "Access-Control-Allow-Origin": "*",
        "Access-Control-Allow-Headers": "*",
        "Access-Control-Allow-Methods": "OPTIONS,POST"
    }
```

V. saveCourseMetadata

```
import json
import boto3
import time

dynamodb = boto3.resource('dynamodb')
TABLE_NAME = 'Courses'  # replace with your table
```

```
def lambda_handler(event, context):
    try:
        body = json.loads(event['body'])

        required_fields = ["course_id", "title", "description", "video_url", "material_url"]
        if not all(field in body for field in required_fields):
            return {
                "statusCode": 400,
                "body": json.dumps({"error": "Missing required fields"})
            }

        table = dynamodb.Table(TABLE_NAME)
        body["created_at"] = str(time.strftime("%Y-%m-%dT%H:%M:%S"))

        table.put_item(Item=body)

        return {
            "statusCode": 200,
            "headers": {"Access-Control-Allow-Origin": "*"},
            "body": json.dumps({"message": "Course metadata saved"})
        }

    except Exception as e:
        return {
            "statusCode": 500,
            "headers": {"Access-Control-Allow-Origin": "*"},
            "body": json.dumps({"error": str(e)})
        }
```

VI. GetAttendance

```
import json
import boto3

dynamodb = boto3.resource('dynamodb')
table = dynamodb.Table('LMS_Attendance')

def lambda_handler(event, context):
    try:
        class_id = event['queryStringParameters'].get('classId')

        if not class_id:
            return {"statusCode": 400, "body": json.dumps({"error": "classId required"})}

        response = table.query(
            KeyConditionExpression=boto3.dynamodb.conditions.Key('classId').eq(class_id)
        )

        items = response.get('Items', [])

        return {
            "statusCode": 200,
            "headers": {"Access-Control-Allow-Origin": "*"},
            "body": json.dumps(items)
        }

    except Exception as e:
        return {"statusCode": 500, "body": json.dumps({"error": str(e)})}
```

VII. CreateQuizLambda

```
import boto3
import os
import json
import uuid
from datetime import datetime

# Initialize AWS clients
dynamodb = boto3.resource('dynamodb')
sns = boto3.client('sns')

# Environment variables
QUIZZES_TABLE = os.environ.get('QUIZZES_TABLE', 'Quizzes')
SNS_TOPIC_ARN = os.environ.get('SNS_TOPIC_ARN')

quizzes_table = dynamodb.Table(QUIZZES_TABLE)

def lambda_handler(event, context):
    print("EVENT:", event)

    try:
        # Parse incoming request body
        body = json.loads(event['body'])
        title = body['title']
        questions = body['questions']   # List of {question, options, answer}
        start_time = body['start_time']
        end_time = body['end_time']
        created_by = body.get('created_by', 'educator@example.com')

        # Generate unique quiz ID
        quiz_id = f"quiz_{uuid.uuid4().hex[:8]}"
```

```
# ✅ Save quiz in DynamoDB
quizzes_table.put_item(
    Item={
        'quizId': quiz_id,
        'title': title,
        'questions': questions,
        'start_time': start_time,
        'end_time': end_time,
        'created_by': created_by,
        'created_at': datetime.utcnow().isoformat()
    }
)

# ✅ Send SNS Notification to all students, include quizId
if SNS_TOPIC_ARN:
    message = (
        f"📢 New Quiz Created!\n\n"
        f"Title: {title}\n"
        f"Quiz ID: {quiz_id}\n"
        f"Start Time: {start_time}\n"
        f"End Time: {end_time}\n\n"
        "Use this Quiz ID to take the quiz in your portal."
    )
    sns.publish(
        TopicArn=SNS_TOPIC_ARN,
        Subject="New Quiz Available!",
        Message=message
    )
    print(f"📨 SNS notification sent for quiz {quiz_id}")
else:
```

```
            print("⚠️ SNS_TOPIC_ARN not set. Skipping notification.")

        # Return success response
        return {
            'statusCode': 200,
            'headers': {'Content-Type': 'application/json'},
            'body': json.dumps({'quizId': quiz_id, 'message': 'Quiz created and notification sent!'})
        }

    except Exception as e:
        print("❌ Error:", str(e))
        return {
            'statusCode': 500,
            'body': json.dumps({'error': str(e)})
        }
```

VIII. GetStudentClasses

```
import json
import boto3
from decimal import Decimal

def convert_decimal(obj):
    if isinstance(obj, list):
        return [convert_decimal(i) for i in obj]
    elif isinstance(obj, dict):
        return {k: convert_decimal(v) for k, v in obj.items()}
    elif isinstance(obj, Decimal):
        return int(obj) if obj % 1 == 0 else float(obj)
    return obj
```

```
def lambda_handler(event, context):
    dynamodb = boto3.resource("dynamodb")
    table = dynamodb.Table("LMS_LiveClasses")

    response = table.scan()
    items = response.get("Items", [])
    items = sorted(items, key=lambda x: x.get("schedule_time", x.get("created_at", "")))
    safe_items = convert_decimal(items)

    student_view = []
    for it in safe_items:
        student_view.append({
            "meetingId": it.get("meetingId"),
            "class_name": it.get("class_name") or it.get("topic") or "",
            "join_url": it.get("join_url", ""),
            "schedule_time": it.get("schedule_time", ""),
            "created_at": it.get("created_at", "")
        })

    return {
        "statusCode": 200,
        "headers": {"Content-Type": "application/json", "Access-Control-Allow-Origin": "*"},
        "body": json.dumps(student_view, default=str)
    }
```

IX. <u>GetClassesLambda</u>

```
import json
import boto3
from decimal import Decimal

def convert_decimal(obj):
```

```
    if isinstance(obj, list):
        return [convert_decimal(i) for i in obj]
    elif isinstance(obj, dict):
        return {k: convert_decimal(v) for k, v in obj.items()}
    elif isinstance(obj, Decimal):
        return int(obj) if obj % 1 == 0 else float(obj)
    return obj

def lambda_handler(event, context):
    dynamodb = boto3.resource("dynamodb")
    table = dynamodb.Table("LMS_LiveClasses")

    response = table.scan()
    items = response.get("Items", [])
    items = sorted(items, key=lambda x: x.get("created_at", ""), reverse=True)
    safe_items = convert_decimal(items)

    educator_view = []
    for it in safe_items:
        attendance = it.get("attendance") or []
        educator_view.append({
            "meetingId": it.get("meetingId"),
            "class_name": it.get("class_name") or it.get("topic") or "",
            "join_url": it.get("join_url", ""),
            "start_url": it.get("start_url", ""),
            "schedule_time": it.get("schedule_time", ""),
            "created_at": it.get("created_at", ""),
            "attendance_count": len(attendance)
        })

    return {
```

```
        "statusCode": 200,
        "headers": {"Content-Type": "application/json", "Access-Control-Allow-Origin": "*"},
        "body": json.dumps(educator_view, default=str)
    }
```

X. getQuiz

```
import boto3
import os
import json

dynamodb = boto3.resource('dynamodb')
QUIZZES_TABLE = os.environ.get('QUIZZES_TABLE', 'Quizzes')
quizzes_table = dynamodb.Table(QUIZZES_TABLE)

def lambda_handler(event, context):
    try:
        quiz_id = None
        if event.get('queryStringParameters'):
            quiz_id = event['queryStringParameters'].get('quizId')

        if not quiz_id:
            return {
                'statusCode': 400,
                'headers': {'Access-Control-Allow-Origin': '*'},
                'body': json.dumps({'error': 'Missing quizId'})
            }

        response = quizzes_table.get_item(Key={'quizId': quiz_id})
        item = response.get('Item')

        if not item:
```

```
    return {
        'statusCode': 404,
        'headers': {'Access-Control-Allow-Origin': '*'},
        'body': json.dumps({'error': f'Quiz {quiz_id} not found'})
    }

questions = item.get('questions', [])
if not isinstance(questions, list):
    questions = []

# ✅ Convert options to array if they are dict
for q in questions:
    opts = q.get('options', [])
    if isinstance(opts, dict):  # from createQuiz, options may be {"A": "4", "B": "1"}
        q['options'] = list(opts.values())
    elif isinstance(opts, str):
        q['options'] = opts.split(',')
    elif not isinstance(opts, list):
        q['options'] = []

quiz_data = {
    'quizId': item['quizId'],
    'title': item.get('title', ''),
    'questions': questions
}

return {
    'statusCode': 200,
    'headers': {
        'Access-Control-Allow-Origin': '*',
        'Content-Type': 'application/json'
```

```
        },
        'body': json.dumps(quiz_data)
    }

  except Exception as e:
    print("Error:", str(e))
    return {
        'statusCode': 500,
        'headers': {'Access-Control-Allow-Origin': '*'},
        'body': json.dumps({'error': str(e)})
    }
```

XI. CreateLiveClass

```
import os
import json
import uuid
import boto3
import requests
from datetime import datetime
from requests.auth import HTTPBasicAuth

ZOOM_ACCOUNT_ID = os.getenv("ZOOM_ACCOUNT_ID")
ZOOM_CLIENT_ID = os.getenv("ZOOM_CLIENT_ID")
ZOOM_CLIENT_SECRET = os.getenv("ZOOM_CLIENT_SECRET")
TABLE_NAME = os.getenv("DYNAMODB_TABLE", "LMS_LiveClasses")

dynamodb = boto3.resource("dynamodb")
table = dynamodb.Table(TABLE_NAME)

def lambda_handler(event, context):
  try:
    body = json.loads(event.get("body", "{}"))
```

```
    class_name = body.get("class_name") or body.get("topic") or "Untitled Class"
    # schedule_time expects ISO 8601 (e.g. "2025-11-04T10:00:00")
    schedule_time = body.get("schedule_time", "")
    # If schedule_time provided, use it as Zoom start_time, else create instant meeting (type 1)
    meeting_type = 2 if schedule_time else 1

    token_url = "https://zoom.us/oauth/token"
    data = {"grant_type": "account_credentials", "account_id": ZOOM_ACCOUNT_ID}

    token_resp = requests.post(
        token_url,
        data=data,
        auth=HTTPBasicAuth(ZOOM_CLIENT_ID, ZOOM_CLIENT_SECRET),
        timeout=10
    )
    if token_resp.status_code != 200:
        return {"statusCode": token_resp.status_code, "body": json.dumps({"error": "Failed to get
token","details": token_resp.text})}

    access_token = token_resp.json().get("access_token")
    if not access_token:
        return {"statusCode": 400, "body": json.dumps({"error": "Missing Zoom access token"})}

    headers = {"Authorization": f"Bearer {access_token}", "Content-Type": "application/json"}

    meeting_data = {
        "topic": class_name,
        "type": meeting_type,
        "duration": int(body.get("duration", 45)),
        "timezone": body.get("timezone", "UTC"),
        "settings": {
```

```
            "host_video": True,
            "participant_video": True,
            "join_before_host": False
        }
    }
    if schedule_time:
        # Zoom expects RFC3339 (with timezone); assume schedule_time is local ISO without Z
        # If schedule_time already contains timezone info, leave it; otherwise append Z to treat as UTC
        if schedule_time.endswith("Z") or "+" in schedule_time or "-" in schedule_time[-6:]:
            meeting_data["start_time"] = schedule_time
        else:
            meeting_data["start_time"] = schedule_time + "Z"

    zoom_resp = requests.post("https://api.zoom.us/v2/users/me/meetings", headers=headers, json=meeting_data, timeout=10)
    if zoom_resp.status_code not in (201, 200):
        return {"statusCode": zoom_resp.status_code, "body": json.dumps({"error": "Zoom meeting creation failed", "details": zoom_resp.text})}

    meeting = zoom_resp.json()
    meeting_id = int(meeting.get("id", 0))
    join_url = meeting.get("join_url", "")
    start_url = meeting.get("start_url", "")

    # store item in DynamoDB
    item = {
        "meetingId": meeting_id,
        "class_name": class_name,
        "join_url": join_url,
        "start_url": start_url,
        "schedule_time": schedule_time,
        "created_at": datetime.utcnow().isoformat(),
```

```
            "attendance": []  # initialize empty attendance list
        }
        table.put_item(Item=item)

        return {"statusCode": 200, "body": json.dumps({"message": "Meeting created successfully!",
"meetingId": meeting_id, "join_url": join_url, "start_url": start_url})}

    except Exception as e:
        return {"statusCode": 500, "body": json.dumps({"error": str(e)})}
```

XII. <u>getCoursesList</u>

```
import json
import boto3
from boto3.dynamodb.conditions import Key, Attr

dynamodb = boto3.resource("dynamodb")
table_name = "Courses"  # <-- change to your exact table name
table = dynamodb.Table(table_name)

def lambda_handler(event, context):
    try:
        # Scan the table to get all courses
        response = table.scan()
        courses = response.get("Items", [])

        return {
            "statusCode": 200,
            "headers": {
                "Access-Control-Allow-Origin": "*",
                "Access-Control-Allow-Methods": "GET,OPTIONS",
                "Access-Control-Allow-Headers": "Content-Type"
```

```
            },
            "body": json.dumps(courses)
        }

    except Exception as e:
        return {
            "statusCode": 500,
            "headers": {"Access-Control-Allow-Origin": "*"},
            "body": json.dumps({"error": str(e)})
        }
```

XIII. recordattendance

```
import json
import boto3
from datetime import datetime, timedelta

dynamodb = boto3.resource('dynamodb')
table = dynamodb.Table('LMS_Attendance')

def lambda_handler(event, context):
    try:
        body = json.loads(event.get('body', '{}'))
        class_id = str(body.get('classId'))
        student_name = body.get('studentName')

        if not class_id or not student_name:
            return {"statusCode": 400, "body": json.dumps({"error": "Missing classId or studentName"})}

        # Convert current UTC time to IST
        ist_time = datetime.utcnow() + timedelta(hours=5, minutes=30)
```

```
        join_time_ist = ist_time.strftime("%Y-%m-%d %I:%M:%S %p")

        table.put_item(Item={
            "classId": class_id,
            "studentName": student_name,
            "joinTimeIST": join_time_ist
        })

        return {
            "statusCode": 200,
            "headers": {
                "Access-Control-Allow-Origin": "*"
            },
            "body": json.dumps({"message": "Attendance recorded", "joinTimeIST": join_time_ist})
        }

    except Exception as e:
        return {"statusCode": 500, "body": json.dumps({"error": str(e)})}
```

XIV. <u>studentprofile</u>

```
import json
import base64
import urllib.parse
import urllib.request
import urllib.error
import boto3

# === Configure these ===
DOMAIN = "https://us-east-1tj9jinyqx.auth.us-east-1.amazoncognito.com"
CLIENT_ID = "7cdmtqipvq30pdoe17hv7h6n0s"
```

```
CLIENT_SECRET = "1kdv9d9mb5taha5cf8qun0b0hg2hqt6gmh2rr2a5h5korh1hsbdn"  # keep secret in env; None if public client

REDIRECT_URI = "https://main.dijffme8w1boe.amplifyapp.com/index-1.html"


# DynamoDB setup

dynamodb = boto3.resource("dynamodb")

table = dynamodb.Table("cognitousers")


# ============================================================


def decode_jwt_payload(token):

    try:

        parts = token.split('.')

        if len(parts) < 2:

            return {}

        payload_b64 = parts[1] + '=' * (-len(parts[1]) % 4)

        decoded_bytes = base64.urlsafe_b64decode(payload_b64)

        return json.loads(decoded_bytes.decode('utf-8'))

    except Exception:

        return {}


def fetch_userinfo(access_token):

    try:

        url = f"{DOMAIN.rstrip('/')}/oauth2/userInfo"

        headers = {"Authorization": f"Bearer {access_token}"}

        req = urllib.request.Request(url, headers=headers, method="GET")

        with urllib.request.urlopen(req, timeout=10) as resp:

            return json.loads(resp.read().decode())

    except Exception:

        return {}
```

```
def make_response(status, body):
    return {
        "statusCode": status,
        "headers": {
            "Access-Control-Allow-Origin": "*",
            "Access-Control-Allow-Methods": "GET,POST,OPTIONS",
            "Access-Control-Allow-Headers": "Content-Type,Authorization"
        },
        "body": json.dumps(body)
    }

def lambda_handler(event, context):
    try:
        # Support API Gateway style request
        code = None
        if isinstance(event, dict):
            qs = event.get("queryStringParameters") or {}
            code = qs.get("code") or event.get("code")

        if not code:
            return make_response(400, {"error": "Missing authorization code"})

        token_url = f"{DOMAIN.rstrip('/')}/oauth2/token"
        data = {
            "grant_type": "authorization_code",
            "client_id": CLIENT_ID,
            "code": code,
            "redirect_uri": REDIRECT_URI
        }
        encoded_creds = base64.b64encode(f"{CLIENT_ID}:{CLIENT_SECRET}".encode()).decode()
        headers = {
```

```
        "Content-Type": "application/x-www-form-urlencoded",
        "Authorization": f"Basic {encoded_creds}"
    }
    req = urllib.request.Request(token_url, data=urllib.parse.urlencode(data).encode(), headers=headers, method="POST")

    with urllib.request.urlopen(req, timeout=10) as resp:
        tokens = json.loads(resp.read().decode())

    id_token = tokens.get("id_token")
    access_token = tokens.get("access_token")

    if not id_token:
        return make_response(400, {"error": "Missing id_token"})

    decoded = decode_jwt_payload(id_token)
    email = decoded.get("email")

    profile = {
        "name": decoded.get("name"),
        "email": email,
        "username": decoded.get("cognito:username") or decoded.get("username") or decoded.get("sub")
    }

    # Fallback to userInfo if name missing
    if not profile.get("name") and access_token:
        ui = fetch_userinfo(access_token)
        if ui.get("name"):
            profile["name"] = ui["name"]

    # 🔹 Fallback to DynamoDB lookup if still missing name
```

```
        if profile.get("email") and not profile.get("name"):
            try:
                response = table.get_item(Key={"email": profile["email"]})
                if "Item" in response:
                    profile["name"] = response["Item"].get("name", "Unknown")
                else:
                    print(f"No DynamoDB record found for {profile['email']}")
            except Exception as e:
                print(f"DynamoDB lookup failed: {e}")

        return make_response(200, {"profile": profile, "decoded_token": decoded})

    except Exception as e:
        return make_response(500, {"error": str(e)})
```

XV. submitQuiz

```
import boto3
import os
import json
from datetime import datetime

dynamodb = boto3.resource('dynamodb')
QUIZZES_TABLE = os.environ.get('QUIZZES_TABLE', 'Quizzes')
QUIZ_RESULTS_TABLE = os.environ.get('QUIZ_RESULTS_TABLE', 'QuizResults')

quizzes_table = dynamodb.Table(QUIZZES_TABLE)
results_table = dynamodb.Table(QUIZ_RESULTS_TABLE)

def lambda_handler(event, context):
    try:
        body = json.loads(event['body'])
        quiz_id = body['quizId']
```

```
student_name = body['studentName']
student_email = body['studentEmail']
answers = body['answers']  # list of selected options

# Fetch quiz
quiz_data = quizzes_table.get_item(Key={'quizId': quiz_id}).get('Item')
if not quiz_data:
    return {'statusCode': 404, 'body': json.dumps({'error':'Quiz not found'})}

questions = quiz_data['questions']

# Compute score
score = 0
for i, q in enumerate(questions):
    correct_option_index = q['answer']  # assuming 'answer' stores index of correct option
    if i < len(answers) and answers[i] == q['options'][correct_option_index]:
        score += 1

# Store result
results_table.put_item(
    Item={
        'quizId': quiz_id,
        'studentEmail': student_email,
        'name': student_name,
        'score': score,
        'submitted_at': datetime.utcnow().isoformat()
    }
)

return {
    'statusCode': 200,
```

```
            'headers': {'Access-Control-Allow-Origin': '*','Content-Type':'application/json'},
            'body': json.dumps({'score': score})
        }

    except Exception as e:
        print("Error:", str(e))
        return {
            'statusCode': 500,
            'headers': {'Access-Control-Allow-Origin': '*'},
            'body': json.dumps({'error': str(e)})
        }
```

XVI. getCourseContent

```
import json
import boto3

dynamodb = boto3.resource("dynamodb")
table = dynamodb.Table("Courses")  # your table name

def lambda_handler(event, context):
    print("Received event:", event)  # helpful for debugging

    # Get course_id from pathParameters
    course_id = event.get("pathParameters", {}).get("id")

    if not course_id:
        return {
            "statusCode": 400,
            "headers": {
                "Access-Control-Allow-Origin": "*",
                "Access-Control-Allow-Methods": "GET,OPTIONS",
```

```
            "Access-Control-Allow-Headers": "Content-Type"
        },
        "body": json.dumps({"error": "Missing course_id"})
    }

try:
    response = table.get_item(Key={"course_id": course_id})
    item = response.get("Item")

    if not item:
        return {
            "statusCode": 404,
            "headers": {
                "Access-Control-Allow-Origin": "*",
                "Access-Control-Allow-Methods": "GET,OPTIONS",
                "Access-Control-Allow-Headers": "Content-Type"
            },
            "body": json.dumps({"error": "Course not found"})
        }

    return {
        "statusCode": 200,
        "headers": {
            "Access-Control-Allow-Origin": "*",
            "Access-Control-Allow-Methods": "GET,OPTIONS",
            "Access-Control-Allow-Headers": "Content-Type"
        },
        "body": json.dumps(item)
    }

except Exception as e:
```

```
        return {
            "statusCode": 500,
            "headers": {"Access-Control-Allow-Origin": "*"},
            "body": json.dumps({"error": str(e)})
        }
```

XVII. getQuizResult

```
import boto3
import os
import json
from decimal import Decimal

dynamodb = boto3.resource('dynamodb')
QUIZ_RESULTS_TABLE = os.environ.get('QUIZ_RESULTS_TABLE', 'QuizResults')
results_table = dynamodb.Table(QUIZ_RESULTS_TABLE)

def decimal_default(obj):
    if isinstance(obj, Decimal):
        return float(obj)
    raise TypeError

def lambda_handler(event, context):
    try:
        quiz_id = None
        if event.get('queryStringParameters'):
            quiz_id = event['queryStringParameters'].get('quizId')

        if not quiz_id:
            return {
                'statusCode': 400,
                'headers': {'Access-Control-Allow-Origin': '*'},
```

```
            'body': json.dumps({'error': 'Missing quizId'})
        }

    # Query all results for this quiz
    response = results_table.query(
        KeyConditionExpression=boto3.dynamodb.conditions.Key('quizId').eq(quiz_id)
    )

    results = response.get('Items', [])

    return {
        'statusCode': 200,
        'headers': {'Access-Control-Allow-Origin': '*','Content-Type':'application/json'},
        'body': json.dumps({'results': results}, default=decimal_default)
    }

  except Exception as e:
    print("Error:", str(e))
    return {
        'statusCode': 500,
        'headers': {'Access-Control-Allow-Origin': '*'},
        'body': json.dumps({'error': str(e)})
    }
```

XVIII. <u>getAllQuizes</u>

```
import boto3
import os
import json
from boto3.dynamodb.conditions import Key, Attr
from decimal import Decimal
```

```
dynamodb = boto3.resource('dynamodb')
QUIZZES_TABLE = os.environ.get('QUIZZES_TABLE', 'Quizzes')
quizzes_table = dynamodb.Table(QUIZZES_TABLE)

# Helper to convert DynamoDB items to JSON (Decimal -> int/float)
def decimal_to_native(obj):
    if isinstance(obj, list):
        return [decimal_to_native(i) for i in obj]
    elif isinstance(obj, dict):
        return {k: decimal_to_native(v) for k, v in obj.items()}
    elif isinstance(obj, Decimal):
        if obj % 1 == 0:
            return int(obj)
        else:
            return float(obj)
    else:
        return obj

def lambda_handler(event, context):
    try:
        # Scan all items in the Quizzes table
        response = quizzes_table.scan()
        items = response.get('Items', [])

        # Convert any Decimal types to native Python types
        quizzes = [decimal_to_native(q) for q in items]

        return {
            'statusCode': 200,
            'headers': {
                'Access-Control-Allow-Origin': '*',
```

```
            'Content-Type': 'application/json'
        },
        'body': json.dumps({'quizzes': quizzes})
    }

except Exception as e:
    print("Error:", str(e))
    return {
        'statusCode': 500,
        'headers': {'Access-Control-Allow-Origin': '*'},
        'body': json.dumps({'error': str(e)})
    }
```

References

(i) https://docs.amplify.aws/react/reference/amplify_outputs/
(ii) https://docs.aws.amazon.com/lambda/latest/dg/with-s3-example.html?
(iii) https://aws.amazon.com/textract/resources/
(iv) https://docs.aws.amazon.com/amazondynamodb/latest/developerguide/Streams.Lambda.html?
(v) https://dev.to/frosnerd/event-handling-in-aws-using-sns-sqs-and-lambda-2ng?