Deploy Education App to Kubernetes

Course Name: DevOps

Institution Name: Medicaps University – Datagami - Skill Based Course

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4.	Tanishq Sharma	EN22CS3011021
5.	Sujal Mukati	EN22CS301995

Group Name: 04D9

Project Number: 04

Industry Mentor Name: Vaibhav Sir

University Mentor Name: Dr. Ritesh Joshi Sir

Academic Year: 2025-26

Problem Statement & Objectives

Traditional application deployment methods often lead to environment mismatch, downtime during updates, and difficulty in scaling applications. Educational platforms require reliable deployment with continuous availability. This project addresses these challenges by using containerization and Kubernetes orchestration to deploy an Education Quiz Application with zero downtime.

- Containerize the education quiz application using Docker
- Deploy the application on Kubernetes cluster
- Host the application on AWS EC2 cloud infrastructure
- Expose the application externally using NodePort
- Implement rolling updates for seamless version upgrades
- Understand real-world DevOps deployment workflow

Scope of the Project

The project focuses on deployment and orchestration of a web-based education application. It includes containerization, Kubernetes deployment, service exposure, and rolling updates. The scope does not include advanced monitoring or large-scale distributed database design.

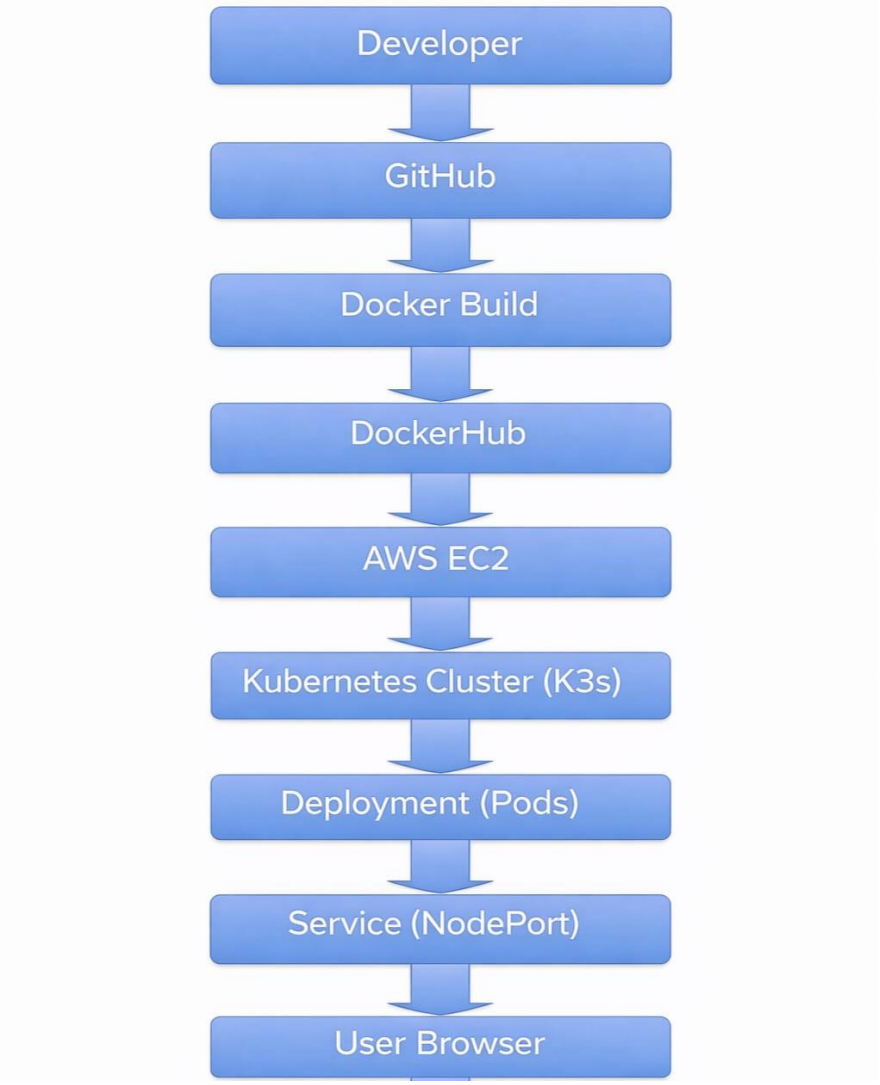
Proposed Solution :-

1. Key Features :-

- Containerized application deployment
- Kubernetes orchestration
- Multiple replicas for high availability
- NodePort service for external access
- Rolling updates for zero downtime
- Cloud-based hosting using AWS EC2

2. Overall Architecture / Workflow :-

The workflow of the system is:-

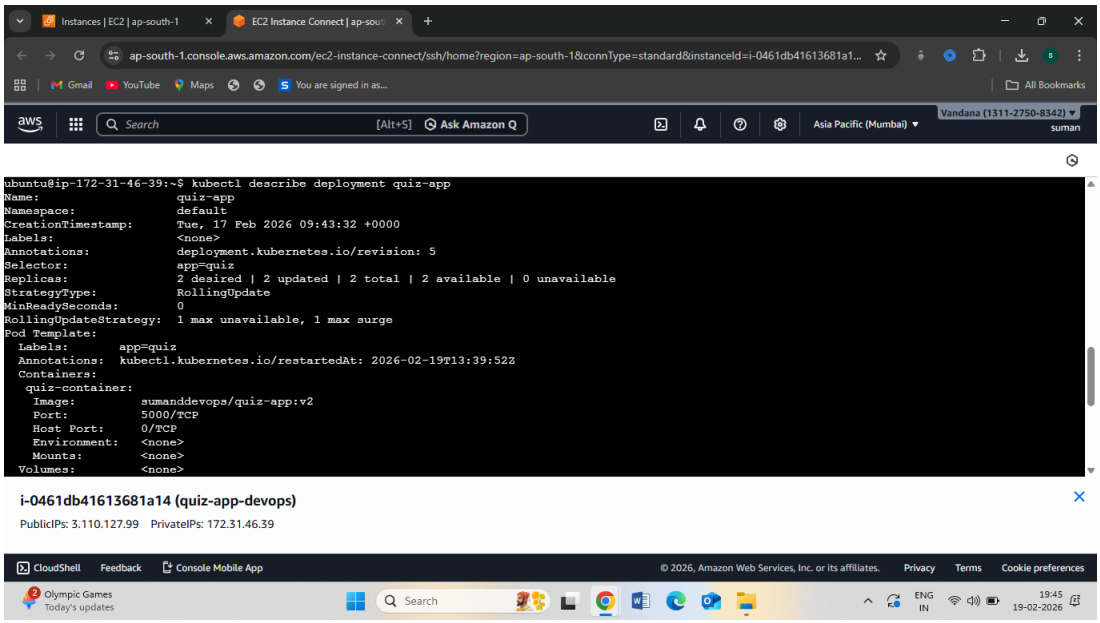


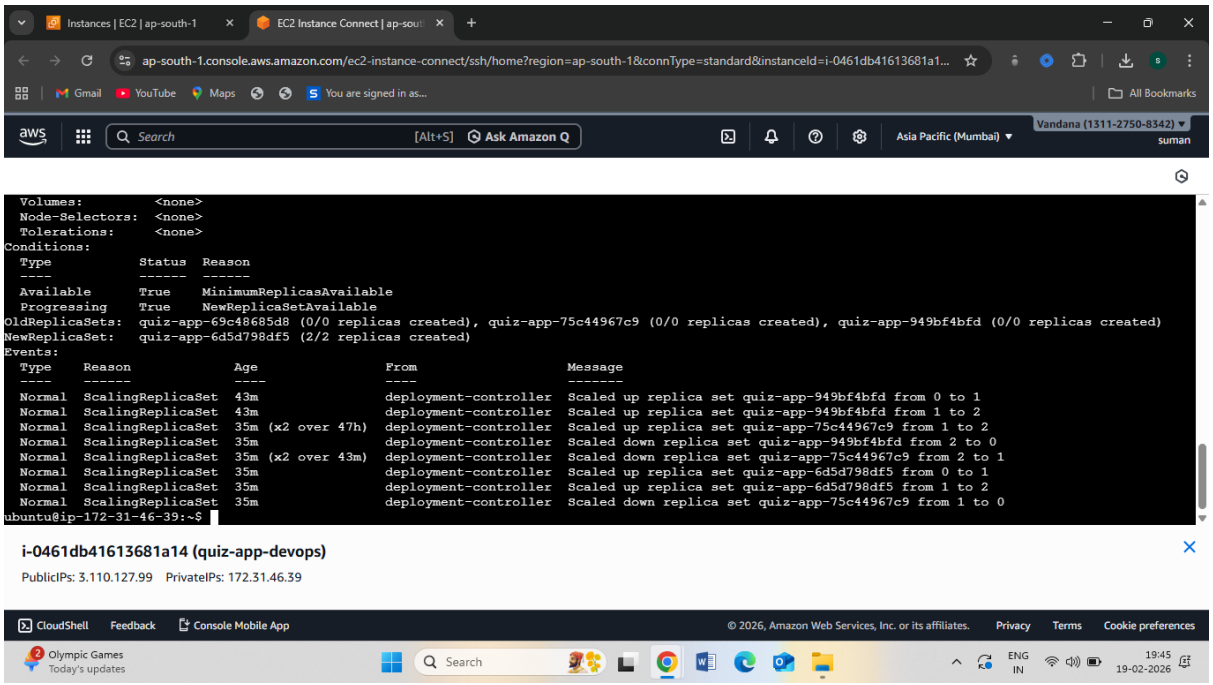
The application runs inside containers managed by Kubernetes, ensuring scalability and reliability.

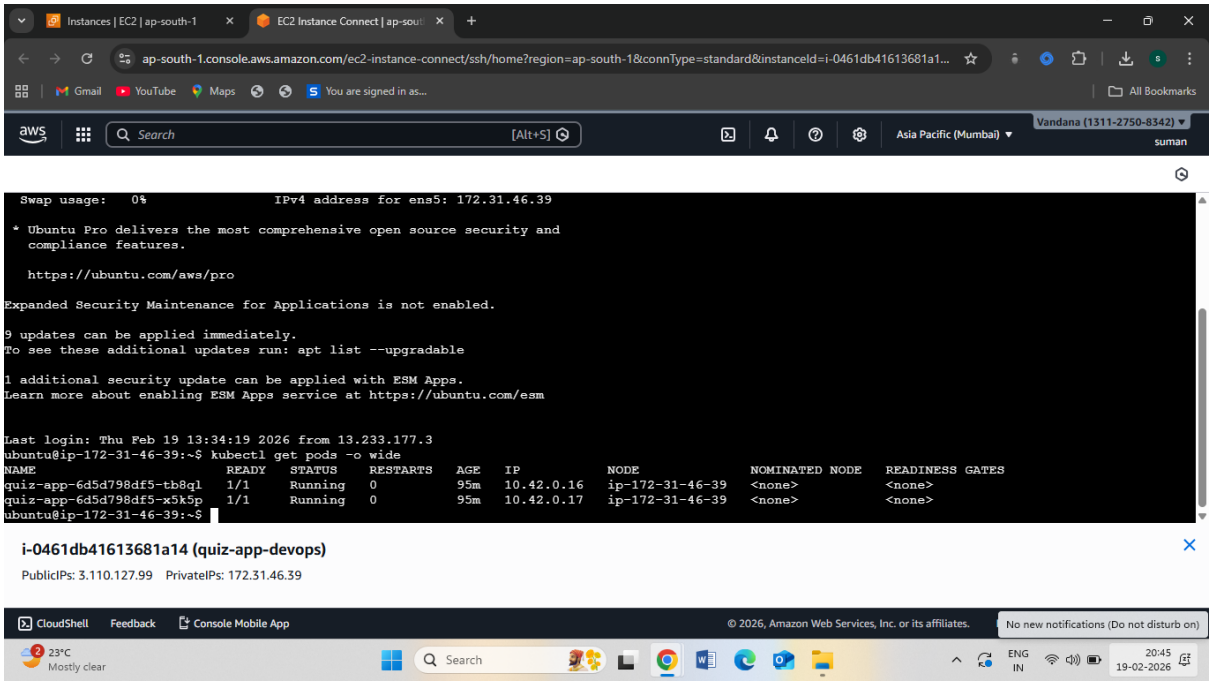
3. Tools & Technologies Used

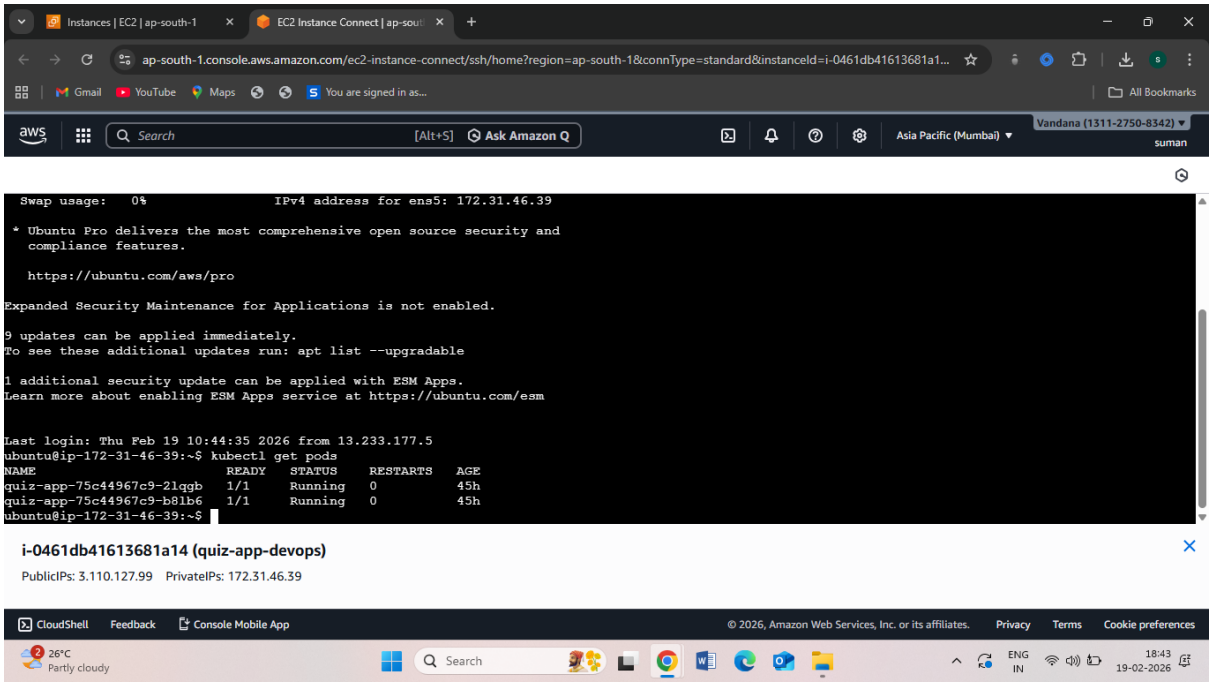
- Python Flask – Application development
- HTML/CSS – Frontend interface
- Docker – Containerization
- DockerHub – Image registry
- AWS EC2 – Cloud infrastructure
- Kubernetes (K3s) – Container orchestration
- kubectl – Cluster management

Results & Output :-






Swap usage: 0% IPv4 address for ens5: 172.31.46.39
* Ubuntu Pro delivers the most comprehensive open source security and compliance features.
https://ubuntu.com/aws/pro
Expanded Security Maintenance for Applications is not enabled.
9 updates can be applied immediately.
To see these additional updates run: apt list --upgradable
1 additional security update can be applied with ESM Apps.
Learn more about enabling ESM Apps service at https://ubuntu.com/esm
Last login: Thu Feb 19 13:34:19 2026 from 13.233.177.3
ubuntu@ip-172-31-46-39:~$ kubectl get pods -o wide
NAME READY STATUS RESTARTS AGE IP NODE NOMINATED NODE READINESS GATES
quiz-app-6d5d798df5-tb8ql 1/1 Running 0 95m 10.42.0.16 ip-172-31-46-39 <none> <none>
quiz-app-6d5d798df5-x5k5p 1/1 Running 0 95m 10.42.0.17 ip-172-31-46-39 <none> <none>
ubuntu@ip-172-31-46-39:~$
i-0461db41613681a14 (quiz-app-devops)
PublicIPs: 3.110.127.99 PrivateIPs: 172.31.46.39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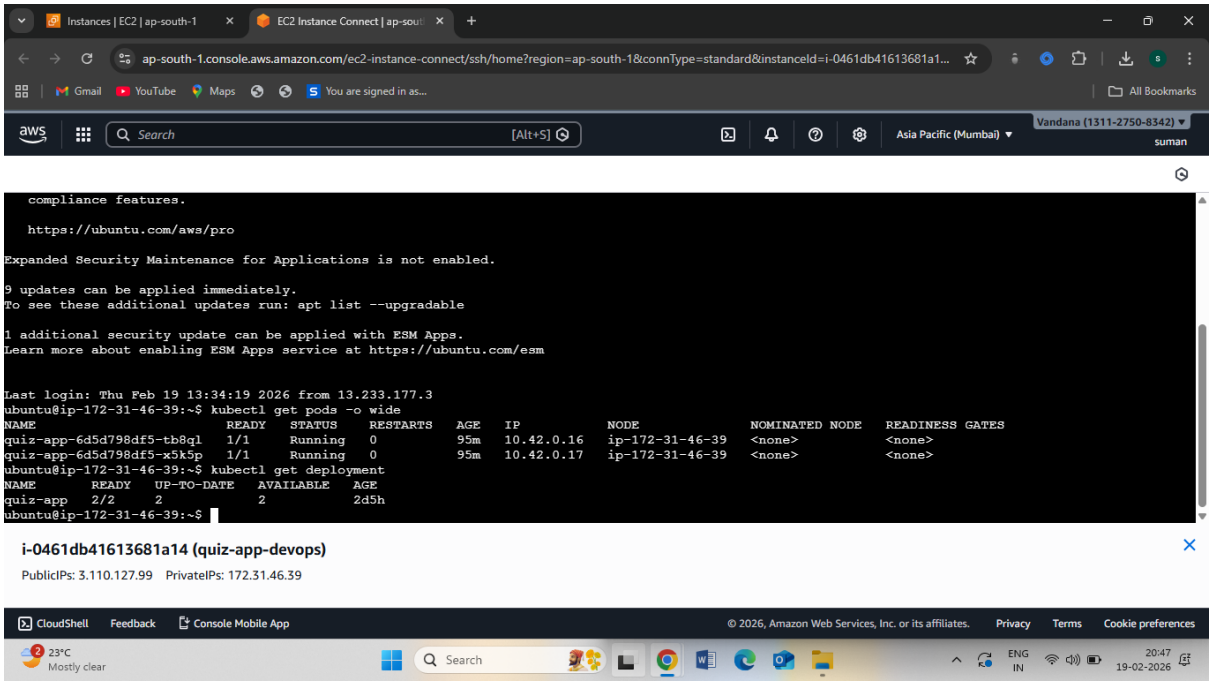
ubuntu@ip-172-31-46-39:~$ kubectl get pods
NAME READY STATUS RESTARTS AGE
quiz-app-75c44967c9-2lqgb 1/1 Running 0 45h
quiz-app-75c44967c9-b81b6 1/1 Running 0 45h
ubuntu@ip-172-31-46-39:~$
i-0461db41613681a14 (quiz-app-devops)
PublicIPs: 3.110.127.99 PrivateIPs: 172.31.46.39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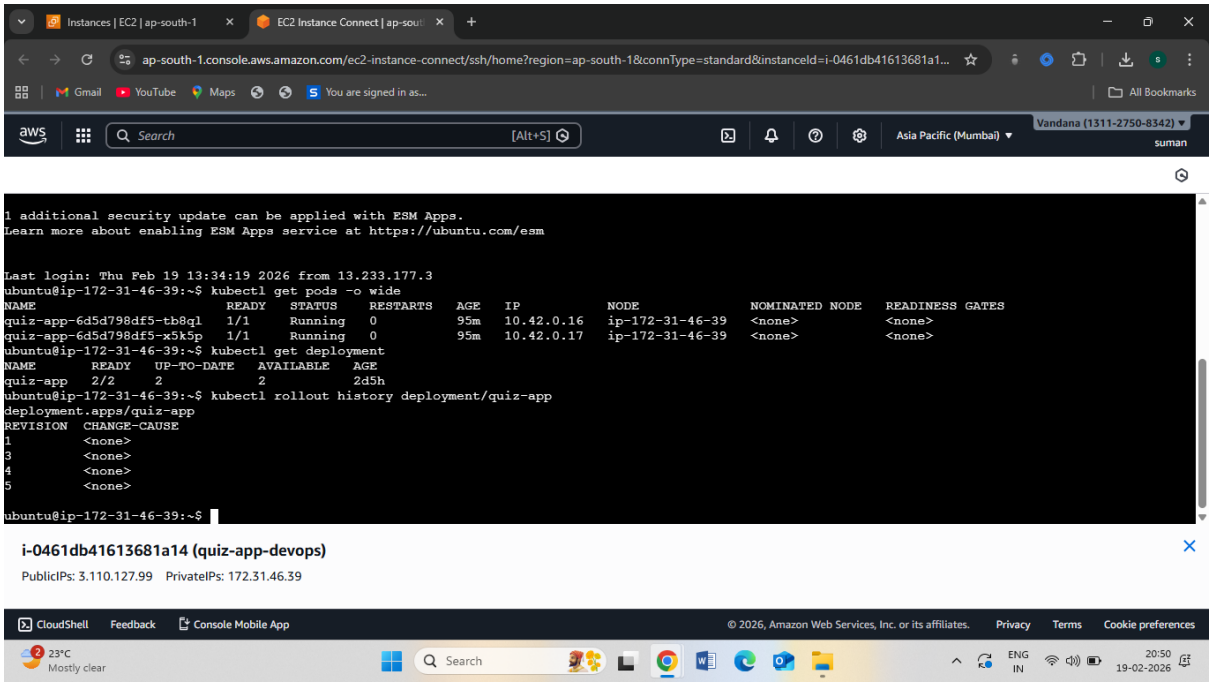
quiz-app-6d5d798df5-x5k5p 1/1 Running 0 95m 10.42.0.17 ip-172-31-46-39 <none> <none>
ubuntu@ip-172-31-46-39:~$ kubectl get deployment
NAME READY UP-TO-DATE AVAILABLE AGE
quiz-app 2/2 2 2 2d5h
ubuntu@ip-172-31-46-39:~$
i-0461db41613681a14 (quiz-app-devops)
PublicIPs: 3.110.127.99 PrivateIPs: 172.31.46.39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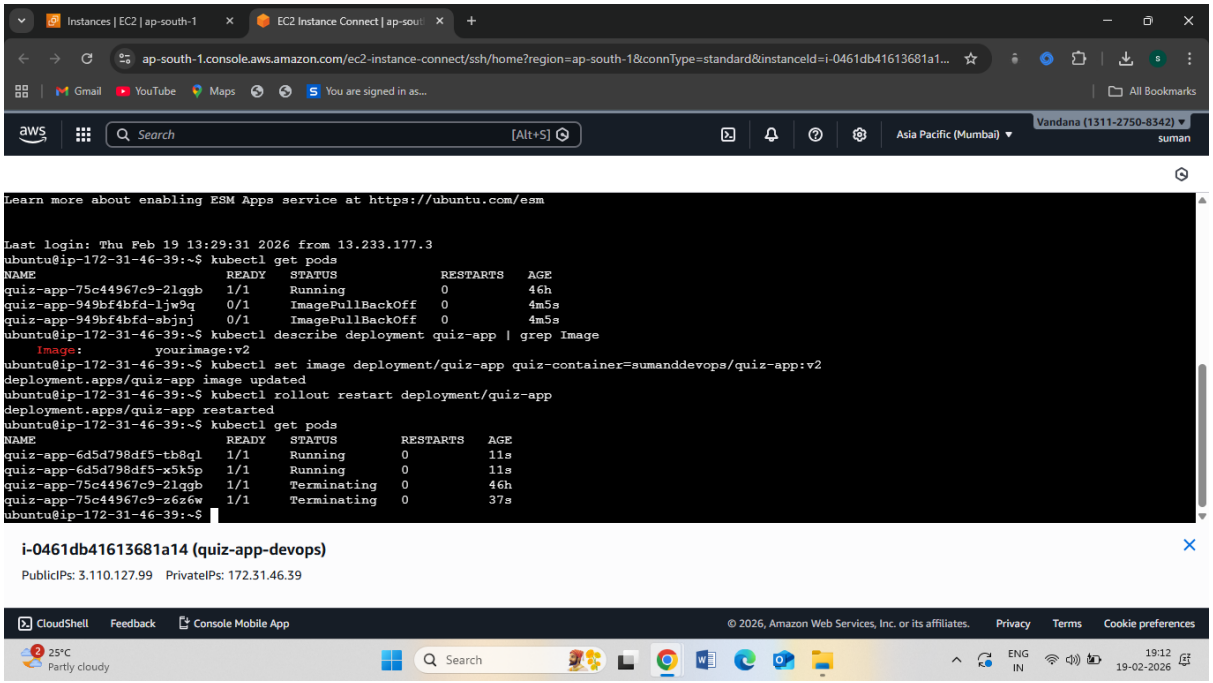
quiz-app-6d5d798df5-x5k5p 1/1 Running 0 95m 10.42.0.17 ip-172-31-46-39 <none> <none>
ubuntu@ip-172-31-46-39:~$ kubectl get deployment
NAME READY UP-TO-DATE AVAILABLE AGE
quiz-app 2/2 2 2 2d5h
ubuntu@ip-172-31-46-39:~$ kubectl rollout history deployment/quiz-app
deployment.apps/quiz-app
REVISION CHANGE-CAUSE
1 <none>
3 <none>
4 <none>
5 <none>
ubuntu@ip-172-31-46-39:~$
i-0461db41613681a14 (quiz-app-devops)
PublicIPs: 3.110.127.99 PrivateIPs: 172.31.46.39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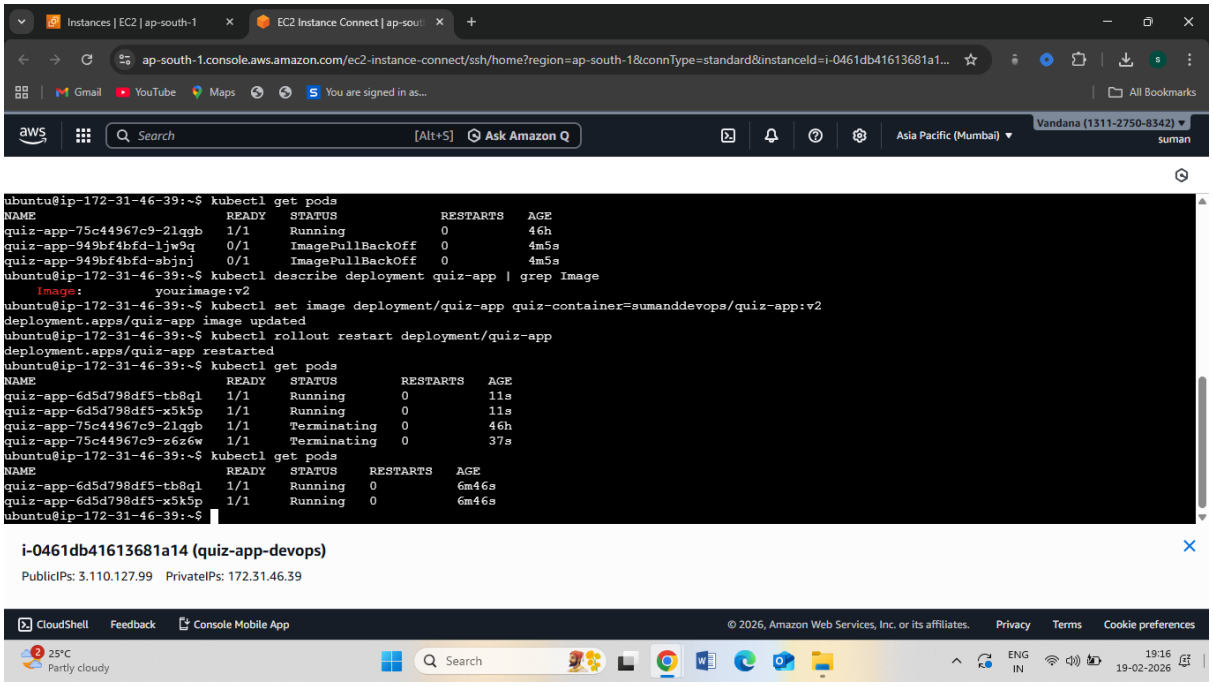
Last login: Thu Feb 19 13:29:31 2026 from 13.233.177.3
ubuntu@ip-172-31-46-39:~$ kubectl get pods
NAME READY STATUS RESTARTS AGE
quiz-app-75c44967c9-2lqgb 1/1 Running 0 46h
quiz-app-949bf4bfd-ljw9q 0/1 ImagePullBackOff 0 4m5s
quiz-app-949bf4bfd-sbjnj 0/1 ImagePullBackOff 0 4m5s
ubuntu@ip-172-31-46-39:~$ kubectl describe deployment quiz-app | grep Image
Image: yourimage:v2
ubuntu@ip-172-31-46-39:~$ kubectl set image deployment/quiz-app quiz-container=sumanddevops/quiz-app:v2
deployment.apps/quiz-app image updated
ubuntu@ip-172-31-46-39:~$ kubectl rollout restart deployment/quiz-app
deployment.apps/quiz-app restarted
ubuntu@ip-172-31-46-39:~$ kubectl get pods
NAME READY STATUS RESTARTS AGE
quiz-app-6d5d798df5-tb8ql 1/1 Running 0 11s
quiz-app-6d5d798df5-x5k5p 1/1 Running 0 11s
quiz-app-75c44967c9-2lqgb 1/1 Terminating 0 46h
quiz-app-75c44967c9-z6z6w 1/1 Terminating 0 37s
ubuntu@ip-172-31-46-39:~$
i-0461db41613681a14 (quiz-app-devops)
PublicIPs: 3.110.127.99 PrivateIPs: 172.31.46.39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quiz-app-949bf4bfd-ljw9q 0/1 ImagePullBackOff 0 4m5s
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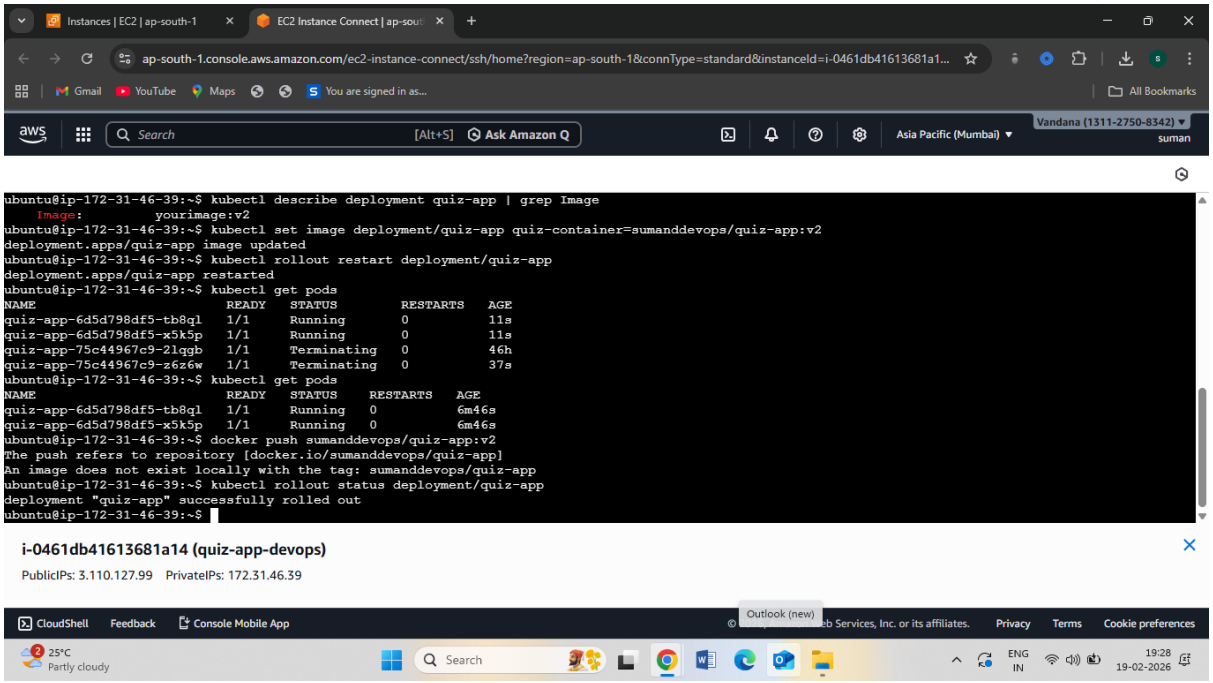
quiz-app-75c44967c9-z6z6w 1/1 Terminating 0 37s
ubuntu@ip-172-31-46-39:~$ kubectl get pods
NAME READY STATUS RESTARTS AGE
quiz-app-6d5d798df5-tb8ql 1/1 Running 0 6m46s
quiz-app-6d5d798df5-x5k5p 1/1 Running 0 6m46s
ubuntu@ip-172-31-46-39:~$
i-0461db41613681a14 (quiz-app-devops)
PublicIPs: 3.110.127.99 PrivateIPs: 172.31.46.39


Instances | EC2 | ap-south-1
EC2 Instance Connect | ap-south-1
ap-south-1.console.aws.amazon.com/ec2-instance-connect/ssh/home?region=ap-south-1&connType=standard&instanceId=i-0461db41613681a1...
Search
[Alt+S]
Ask Amazon Q
Asia Pacific (Mumbai)
Vandana (1311-2750-8342)
suman
ubuntu@ip-172-31-46-39:~$ kubectl describe deployment quiz-app | grep Image
Image: yourimage:v2
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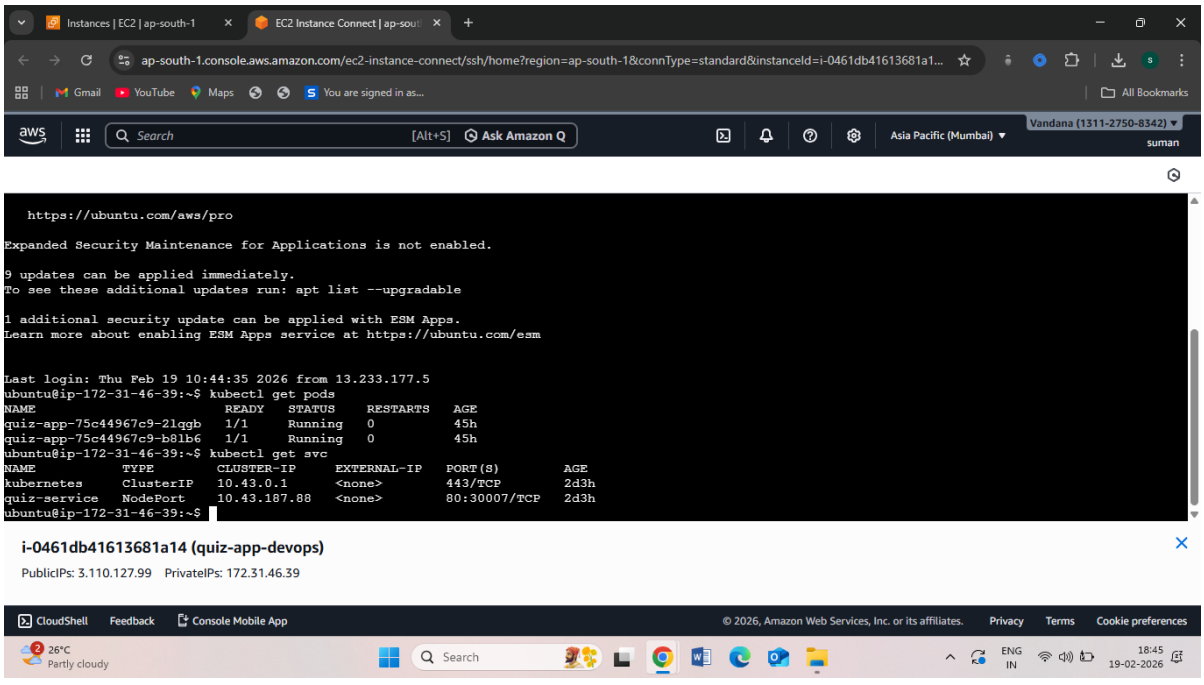
quiz-app-75c44967c9-2lqgb 1/1 Terminating 0 46h
quiz-app-75c44967c9-z6z6w 1/1 Terminating 0 37s
ubuntu@ip-172-31-46-39:~$ kubectl get pods
NAME READY STATUS RESTARTS AGE
quiz-app-6d5d798df5-tb8ql 1/1 Running 0 6m46s
quiz-app-6d5d798df5-x5k5p 1/1 Running 0 6m46s
ubuntu@ip-172-31-46-39:~$ docker push sumanddevops/quiz-app:v2
The push refers to repository [docker.io/sumanddevops/quiz-app]
An image does not exist locally with the tag: sumanddevops/quiz-app
ubuntu@ip-172-31-46-39:~$ kubectl rollout status deployment/quiz-app
deployment "quiz-app" successfully rolled out
ubuntu@ip-172-31-46-39:~$
i-0461db41613681a14 (quiz-app-devops)
PublicIPs: 3.110.127.99 PrivateIPs: 172.31.46.39
CloudShell
Feedback
Console Mobile App
Outlook (new)
Privacy
Terms
Cookie preferences
25°C
Partly cloudy
Search
ENG
IN
19:28
19-02-2026


Instances | EC2 | ap-south-1
EC2 Instance Connect | ap-south-1
ap-south-1.console.aws.amazon.com/ec2-instance-connect/ssh/home?region=ap-south-1&connType=standard&instanceId=i-0461db41613681a1...
Search
[Alt+S]
Ask Amazon Q
Asia Pacific (Mumbai)
Vandana (1311-2750-8342)
suman
https://ubuntu.com/aws/pro
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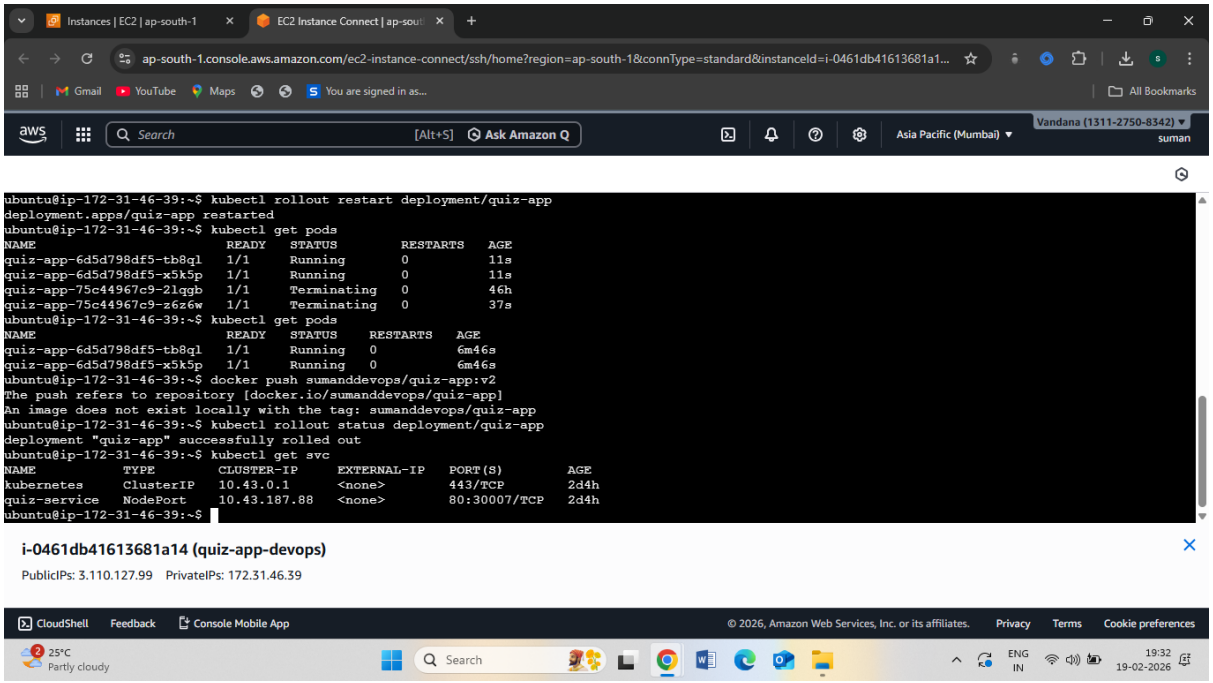
NAME READY STATUS RESTARTS AGE
quiz-app-75c44967c9-2lqgb 1/1 Running 0 45h
quiz-app-75c44967c9-b8lb6 1/1 Running 0 45h
ubuntu@ip-172-31-46-39:~$ kubectl get svc
NAME TYPE CLUSTER-IP EXTERNAL-IP PORT(S) AGE
kubernetes ClusterIP 10.43.0.1 <none> 443/TCP 2d3h
quiz-service NodePort 10.43.187.88 <none> 80:30007/TCP 2d3h
ubuntu@ip-172-31-46-39:~$
i-0461db41613681a14 (quiz-app-devops)
PublicIPs: 3.110.127.99 PrivateIPs: 172.31.46.39
CloudShell
Feedback
Console Mobile App
© 2026, Amazon Web Services, Inc. or its affiliates.
Privacy
Terms
Cookie preferences
26°C
Partly cloudy
Search
ENG
IN
18:45
19-02-2026


ubuntu@ip-172-31-46-39:~$ kubectl rollout restart deployment/quiz-app
deployment.apps/quiz-app restarted
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quiz-app-75c44967c9-z6z6w 1/1 Terminating 0 37s
ubuntu@ip-172-31-46-39:~$ kubectl get pods
NAME READY STATUS RESTARTS AGE
quiz-app-6d5d798df5-tb8ql 1/1 Running 0 6m46s
quiz-app-6d5d798df5-x5k5p 1/1 Running 0 6m46s
ubuntu@ip-172-31-46-39:~$ docker push sumanddevops/quiz-app:v2
The push refers to repository [docker.io/sumanddevops/quiz-app]
An image does not exist locally with the tag: sumanddevops/quiz-app
ubuntu@ip-172-31-46-39:~$ kubectl rollout status deployment/quiz-app
deployment "quiz-app" successfully rolled out
ubuntu@ip-172-31-46-39:~$ kubectl get svc
NAME TYPE CLUSTER-IP EXTERNAL-IP PORT(S) AGE
kubernetes ClusterIP 10.43.0.1 <none> 443/TCP 2d4h
quiz-service NodePort 10.43.187.88 <none> 80:30007/TCP 2d4h
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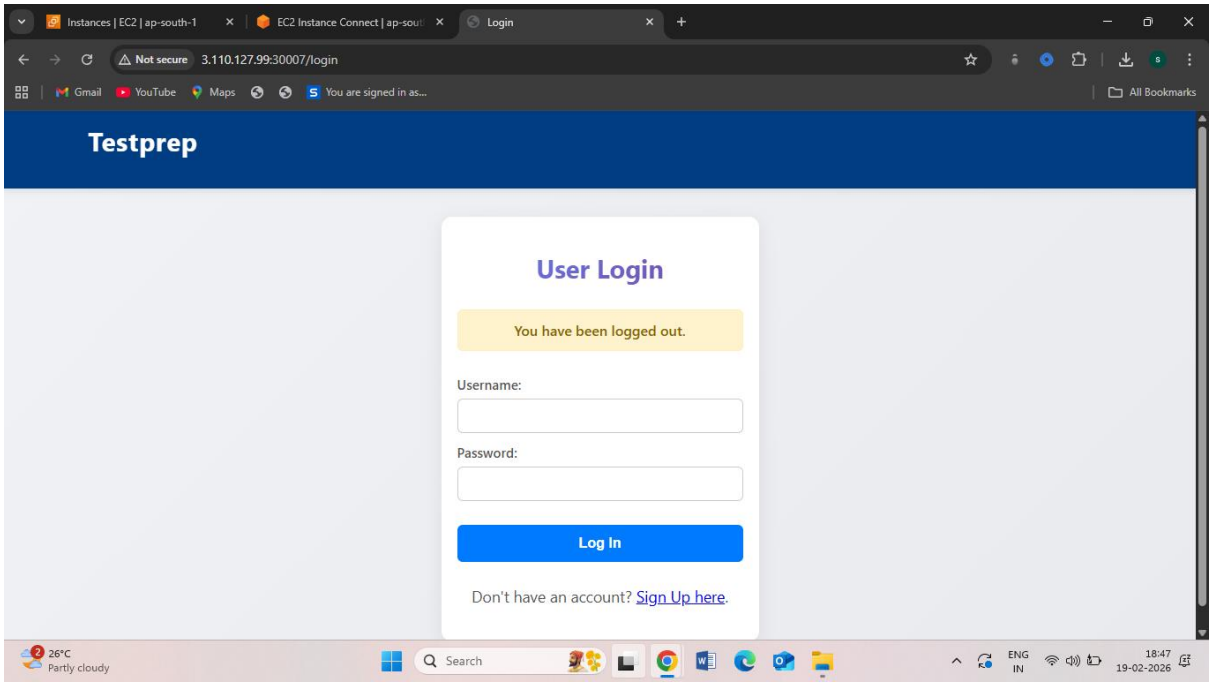
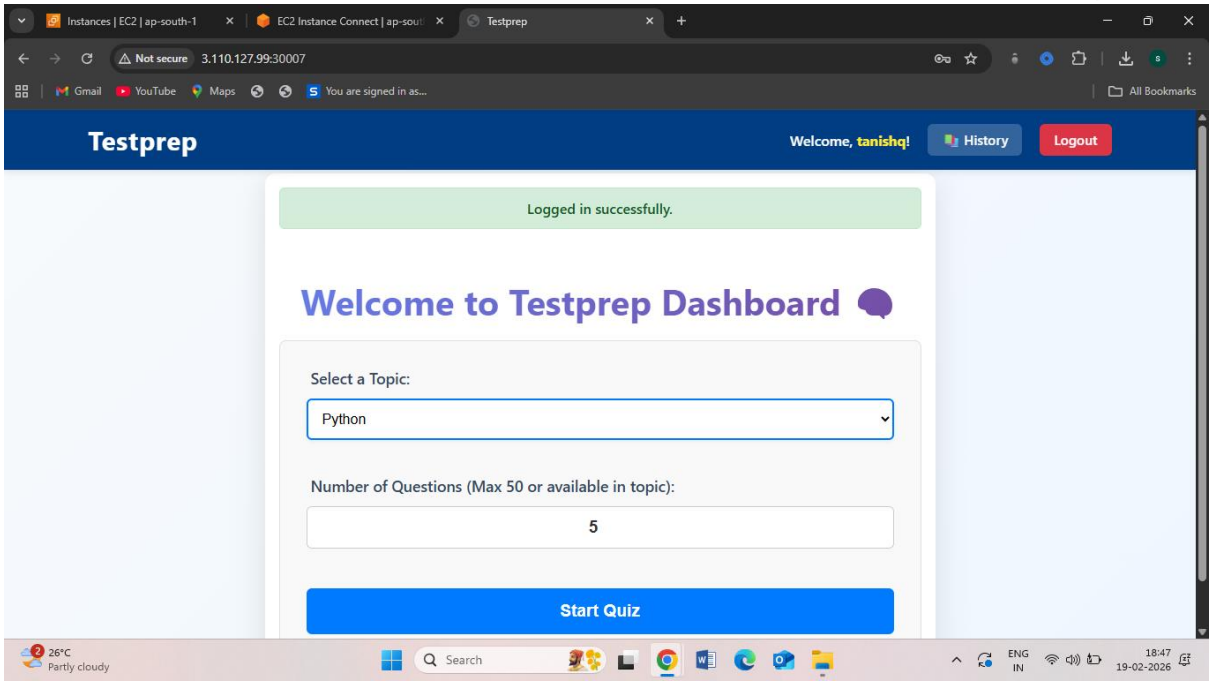
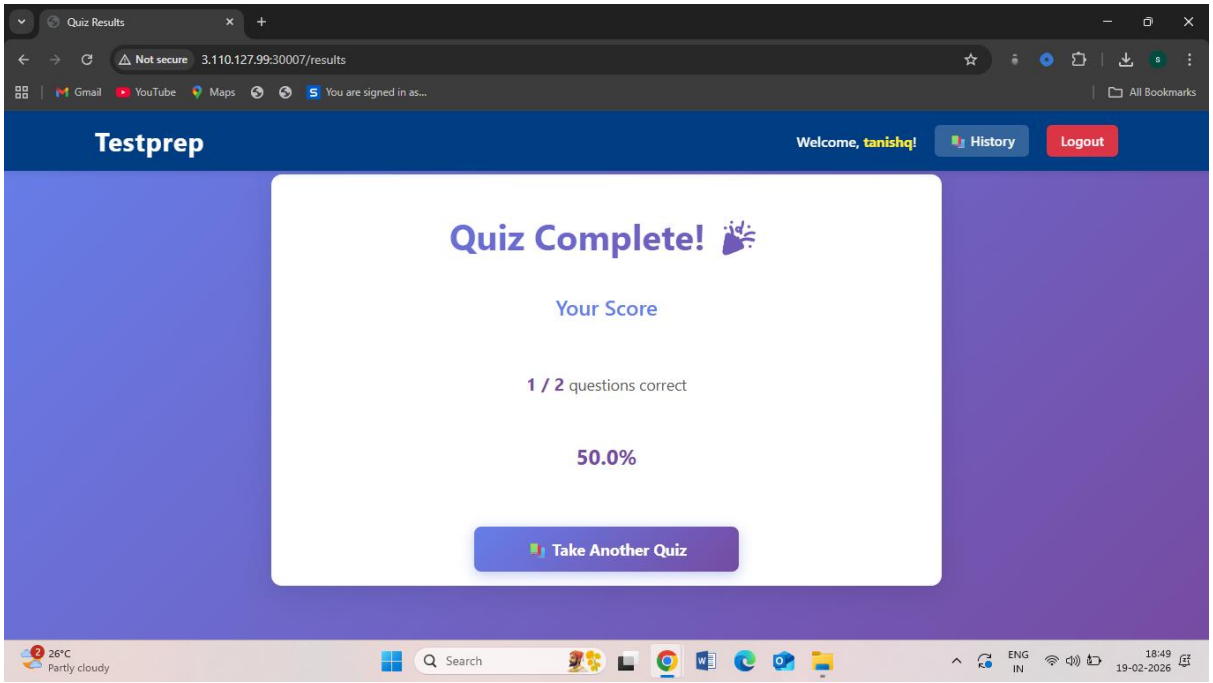
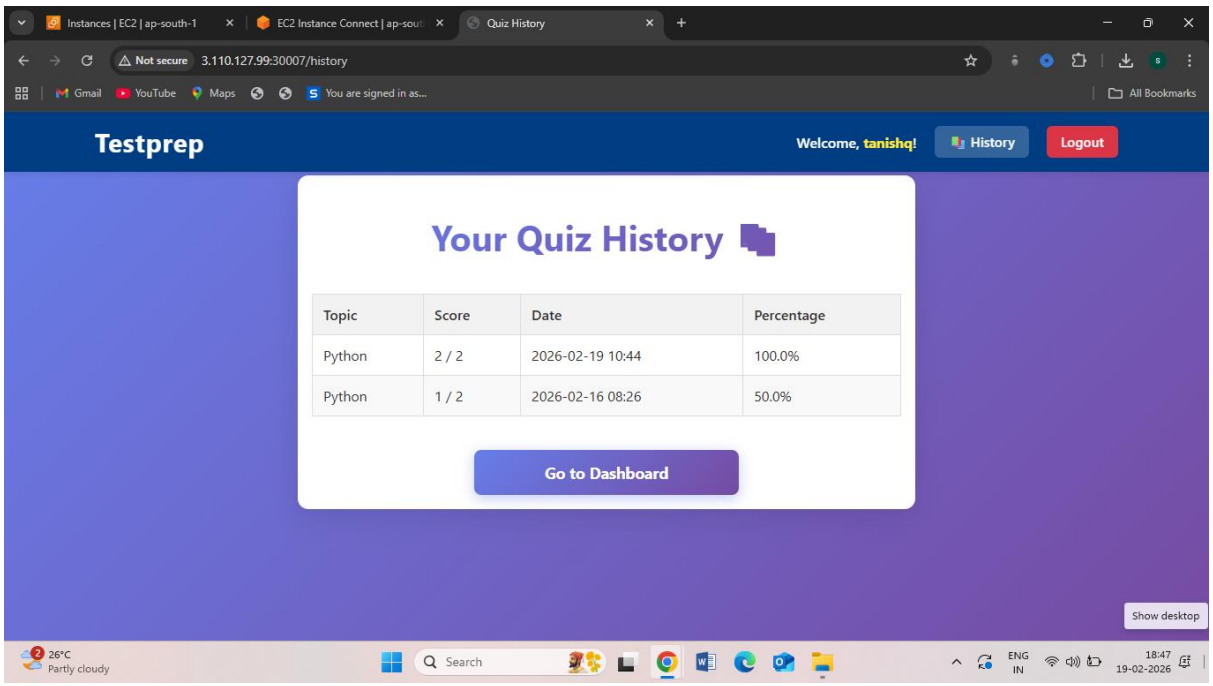

Testprep
User Login
You have been logged out.
Username:
Password:
Log In
Don't have an account? Sign Up here.


Testprep
Welcome, tanishq!
History
Logout
Logged in successfully.
Welcome to Testprep Dashboard
Select a Topic:
Python
Number of Questions (Max 50 or available in topic):
5
Start Quiz


Testprep
Welcome, tanishq!
History
Logout
Quiz Complete!
Your Score
1 / 2 questions correct
50.0%
Take Another Quiz



Conclusion :-

This project successfully demonstrates deployment of an education quiz application using Docker and Kubernetes on AWS cloud infrastructure. The implementation of rolling updates ensured continuous availability during application upgrades. The project provided practical experience in containerization, orchestration, and cloud deployment, highlighting the benefits of modern DevOps practices.

Future Scope & Enhancements :-

- Implement CI/CD automation using GitHub Actions or Jenkins.
- Deploy application using managed Kubernetes service (AWS EKS).
- Add monitoring using Prometheus and Grafana.
- Implement auto-scaling for dynamic workload handling.
- Enhance security using HTTPS and authentication mechanisms.