

Deploy Education App to Kubernetes

Course Name: DevOps

Institution Name: Medicaps University – Datagami -
Skill Based Course

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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.

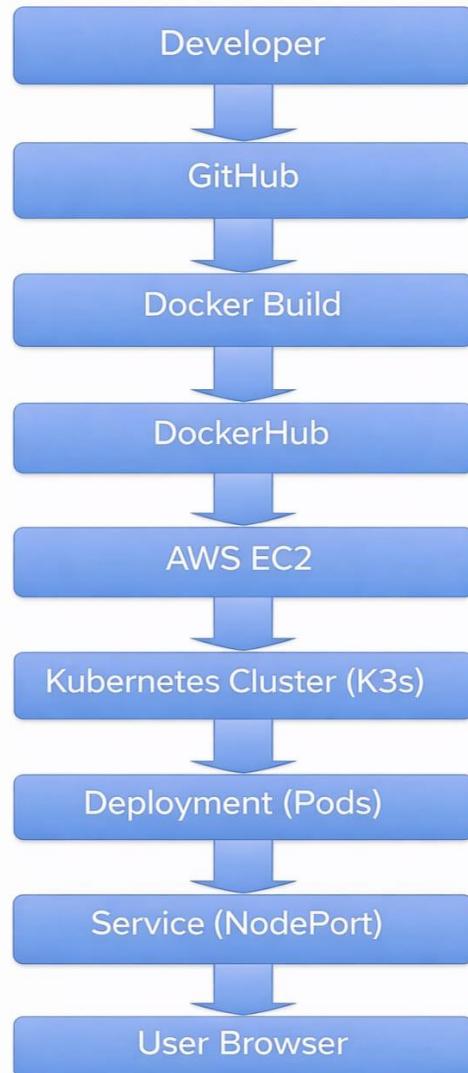
Proposed Solution :-

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 :-

ubuntu@ip-172-31-46-39:~\$ kubectl describe deployment quiz-app

```
Name:           quiz-app
Namespace:      default
CreationTimestamp: Tue, 17 Feb 2026 09:43:32 +0000
Labels:          <none>
Annotations:    deployment.kubernetes.io/revision: 5
Selector:        app=quiz
Replicas:       2 desired | 2 updated | 2 total | 2 available | 0 unavailable
StrategyType:   RollingUpdate
MinReadySeconds: 0
RollingUpdateStrategy: 1 max unavailable, 1 max surge
Pod Template:
  Labels:  app=quiz
  Annotations:  kubectl.kubernetes.io/restartedAt: 2026-02-19T13:39:52Z
  Containers:
    quiz-container:
      Image:  sumandevops/quiz-app:v2
      Port:   5000/TCP
      Host Port:  0/TCP
      Environment:  <none>
      Mounts:  <none>
      Volumes: <none>

```

i-0461db41613681a14 (quiz-app-devops)

PublicIPs: 3.110.127.99 PrivateIPs: 172.31.46.39



Volumes: <none>

Node-Selectors: <none>

Tolerations: <none>

Conditions:

Type	Status	Reason
Available	True	MinimumReplicasAvailable
Progressing	True	NewReplicaSetAvailable

OldReplicaSets: quiz-app-69c48685d8 (0/0 replicas created), quiz-app-75c44967c9 (0/0 replicas created), quiz-app-949bf4bfd (0/0 replicas created)

NewReplicaSet: quiz-app-6dd5d798df5 (2/2 replicas created)

Events:

Type	Reason	Age	From	Message
Normal	ScalingReplicaSet	43m	deployment-controller	Scaled up replica set quiz-app-949bf4bfd from 0 to 1
Normal	ScalingReplicaSet	43m	deployment-controller	Scaled up replica set quiz-app-949bf4bfd from 1 to 2
Normal	ScalingReplicaSet	35m (x2 over 47h)	deployment-controller	Scaled up replica set quiz-app-75c44967c9 from 1 to 2
Normal	ScalingReplicaSet	35m	deployment-controller	Scaled down replica set quiz-app-949bf4bfd from 2 to 0
Normal	ScalingReplicaSet	35m (x2 over 43m)	deployment-controller	Scaled down replica set quiz-app-75c44967c9 from 2 to 1
Normal	ScalingReplicaSet	35m	deployment-controller	Scaled up replica set quiz-app-6d5d798df5 from 0 to 1
Normal	ScalingReplicaSet	35m	deployment-controller	Scaled up replica set quiz-app-6d5d798df5 from 1 to 2
Normal	ScalingReplicaSet	35m	deployment-controller	Scaled down replica set quiz-app-75c44967c9 from 1 to 0

ubuntu@ip-172-31-46-39:~\$

i-0461db41613681a14 (quiz-app-devops)

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```
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-tb8g1   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
```

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... star

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aws Search [Alt+S] Ask Amazon Q Asia Pacific (Mumbai) Vandana (1311-2750-8342) suman

```
Swap usage: 0%           IPv4 address for ens5: 172.31.46.39

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Last login: Thu Feb 19 10:44:35 2026 from 13.233.177.5
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-b8lb6   1/1     Running   0          45h
ubuntu@ip-172-31-46-39:~$
```

Instances | EC2 | ap-south-1 EC2 Instance Connect | ap-south-1

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https://ubuntu.com/aws/pro

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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:~$ kubectl get deployment
NAME            READY   UP-TO-DATE   AVAILABLE   AGE
quiz-app        2/2     2           2           2d5h
ubuntu@ip-172-31-46-39:~$
```

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Instances | EC2 | ap-south-1 EC2 Instance Connect | ap-south-1

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```

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:~$ 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:~$
```

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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... [Alt+S] ⌂

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aws Search [Alt+S] ⌂

Learn more about enabling ESM Apps service at <https://ubuntu.com/esm>

```
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=sumananddevops/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-tb8q1   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:~$
```

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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... [Alt+S] ⌂

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Learn more about enabling ESM Apps service at <https://ubuntu.com/esm>

```
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=sumananddevops/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-tb8q1   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:~$ kubectl get pods
NAME           READY   STATUS    RESTARTS   AGE
quiz-app-6d5d798df5-tb8q1   1/1     Running   0          6m46s
quiz-app-6d5d798df5-x5k5p   1/1     Running   0          6m46s
ubuntu@ip-172-31-46-39:~$
```

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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... ☆

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aws Search [Alt+S] Ask Amazon Q Asia Pacific (Mumbai)

```
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:~$ 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



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... ☆

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```
https://ubuntu.com/ubuntu/pro
Expanded Security Maintenance for Applications is not enabled.

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To see these additional updates run: apt list --upgradable

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Learn more about enabling ESM Apps service at https://ubuntu.com/esm

Last login: Thu Feb 19 10:44:35 2026 from 13.233.177.5
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-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



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... ☆

You are signed in as...

All Bookmarks

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Search Ask Amazon Q [Alt+S] Asia Pacific (Mumbai)

```
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-75c44967c9-21qgb   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:~$ 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
ubuntu@ip-172-31-46-39:~$
```

i-0461db41613681a14 (quiz-app-devops)

Public IPs: 3.110.127.99 Private IPs: 172.31.46.39



Instances | EC2 | ap-south-1 | EC2 Instance Connect | ap-south-1 | Login

Not secure 3.110.127.99:30007/login

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All Bookmarks

Testprep

User Login

You have been logged out.

Username:

Password:

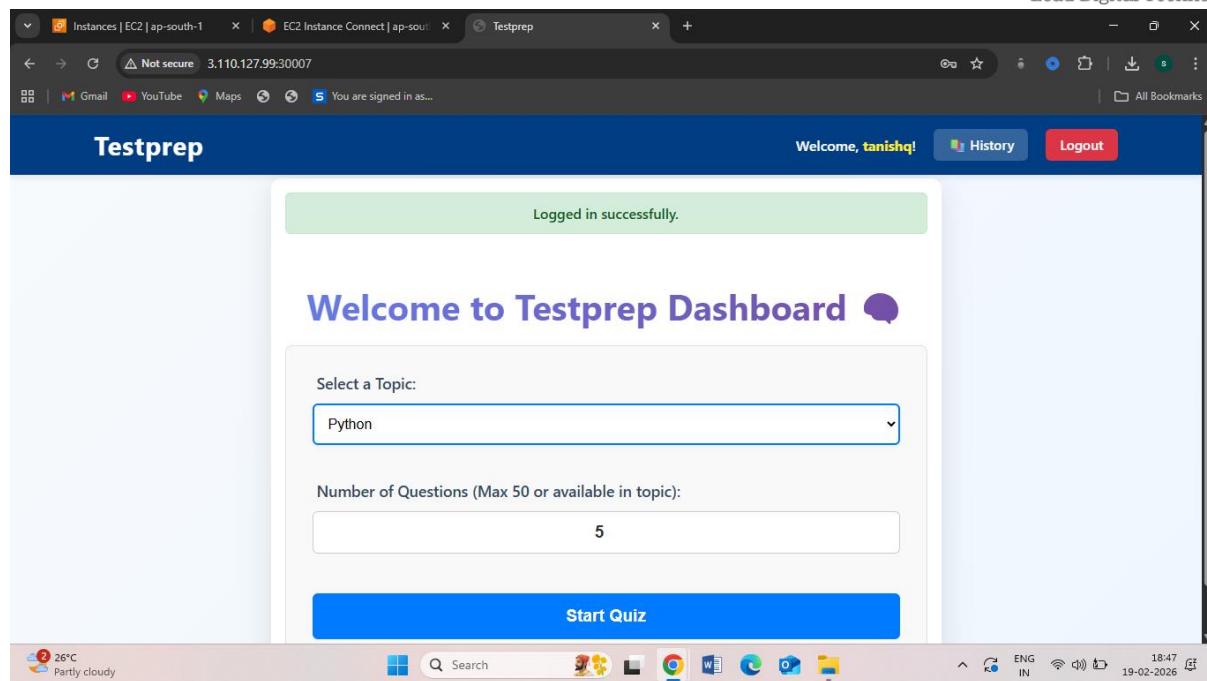
Log In

Don't have an account? [Sign Up here.](#)

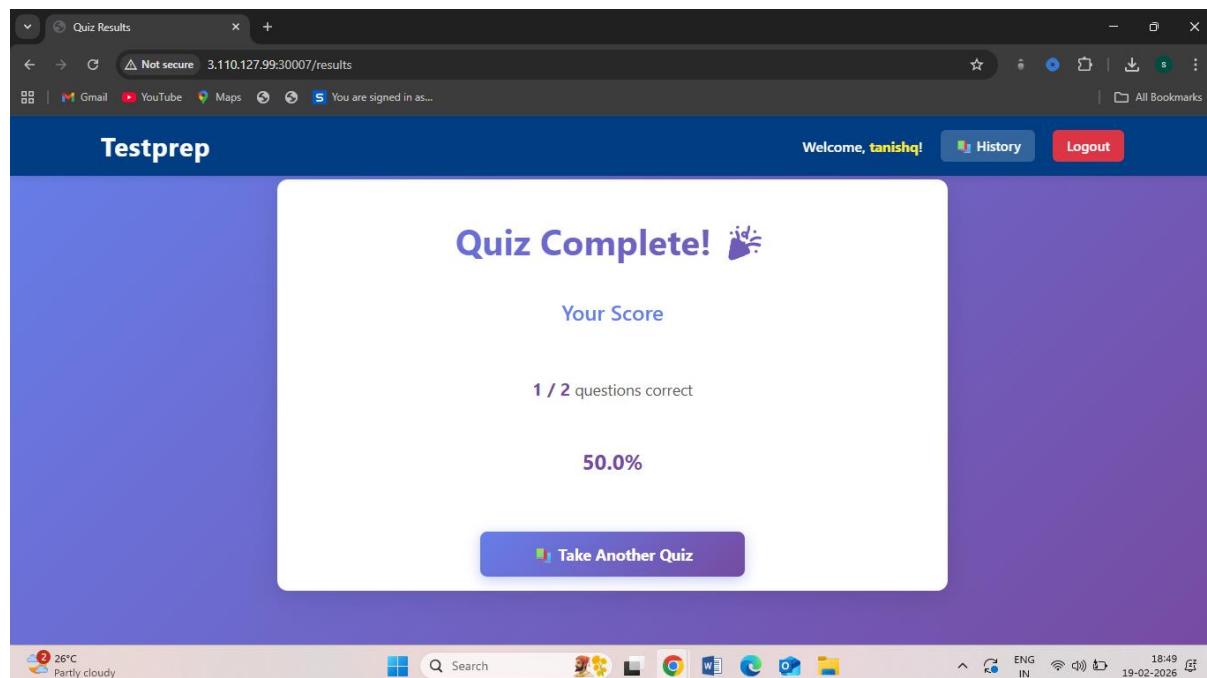
26°C Partly cloudy

Search

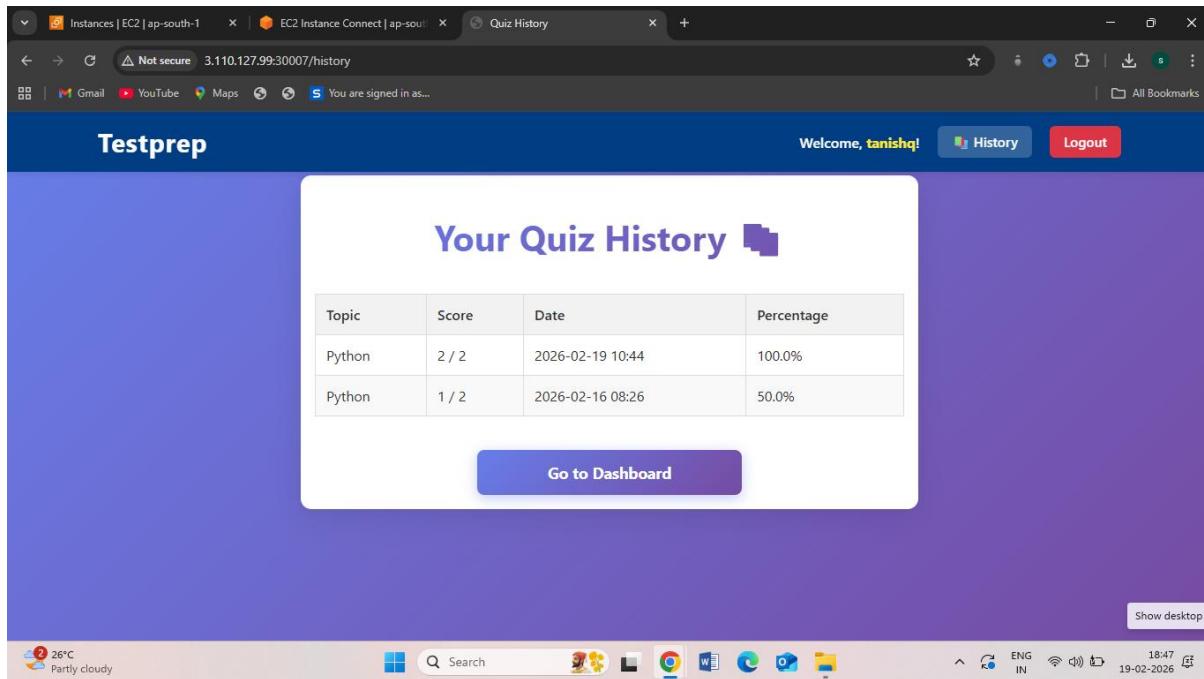
18:47 19-02-2026



The screenshot shows a web browser window titled "Testprep". At the top, there's a green banner with the text "Logged in successfully.". Below it, the main title "Welcome to Testprep Dashboard" is displayed in blue. A dropdown menu labeled "Select a Topic:" contains the option "Python". A text input field for "Number of Questions (Max 50 or available in topic):" has the value "5" entered. A large blue button labeled "Start Quiz" is centered below these fields. The browser's status bar at the bottom shows weather information (26°C, Partly cloudy), system icons, and the date/time (19-02-2026, 18:47).



The screenshot shows a web browser window titled "Quiz Results". The main content area displays a white box with the heading "Quiz Complete! 🎉". Inside this box, the text "Your Score" is shown above the results: "1 / 2 questions correct" and "50.0%". A blue button labeled "Take Another Quiz" is at the bottom. The browser's status bar at the bottom shows weather information (26°C, Partly cloudy), system icons, and the date/time (19-02-2026, 18:49).



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.