EduSync – Smart Learning Management & Assessment Platform

1. Introduction

In the digital learning era, educational institutions and training platforms require centralized systems to manage content, monitor performance, and automate assessments. EduSync is a full-stack project built to simulate a real-world Learning Management System (LMS), incorporating modern cloud-based and DevOps practices. It serves as a capstone project for students to apply their knowledge in frontend, backend, automation, DevOps, and data engineering.

2. Objective

The goal is to build a responsive, cloud-integrated platform that:

- Enables students to take courses, assessments, and track their progress.
- Allows instructors to create and manage educational content.
- Uses Azure services to process, store, and analyze data.
- Implements full-stack automation, DevOps, and performance monitoring.

3. Requirements

Functional Requirements:

- User authentication and role-based access (Student/Instructor)
- Course and assessment management
- Real-time tracking of test attempts
- Automated CI/CD with monitoring and alerting
- Data processing pipelines and reporting dashboards

Technical Stack:

Layer	Technologies
Frontend	React.js, Bootstrap
Backend	ASP.NET Core Web API, Entity Framework
Database	Azure SQL Database
Storage	Azure Blob Storage
Data Processing	Azure Data Factory, Event Hubs, Stream Analytics, Spark
Visualization	Power BI, MS Fabric
Infrastructure	Terraform (IaC)
Dev0ps	Azure DevOps

Monitoring	Azure Monitor, Application Insights
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4. Dataflow Diagram



5. Data Models

User Model

Field	Type	Description
UserId	GUID	Unique identifier
Name	string	Full name
Email	string	Email address
Role	string	Student / Instructor
PasswordHash	string	Secure password storage

Course Model

Field	Type	Description
CourseId	GUID	Unique identifier
Title	string	Course title
Description	string	Summary of content
InstructorId	GUID	FK to User
MediaUrl	string	Link to Blob Storage

Assessment Model

Field	Type	Description	
AssessmentId	GUID	Unique identifier	
CourseId	GUID	FK to Course	
Title	string	Test title	
Questions	JSON	Quiz content	
MaxScore	int	Maximum marks	

Result Model

Field	Туре	Description
ResultId	GUID	Unique identifier
AssessmentId	GUID	FK to Assessment
UserId	GUID	FK to User
Score	int	Achieved score
AttemptDate	datetime	Test attempt time

6. Use Case Summary

Use Case	Actor	Description	Technology
User Registration/Login	Student/Instructor	Register and log in to the system	React, API, Azure SQL
View Courses	Student	Browse and access courses	React, API
Upload Courses	Instructor	Upload content to Azure Blob	.NET API, Azure Blob
Attempt Quiz	Student	Take quiz and submit answers	React, Event Hub
View Assessment Results	Student/Instructor	View scores and analytics	API, SQL, Power BI
Real-time Quiz Analytics	System	Stream live quiz data	Event Hubs, Stream Analytics
Data ETL Pipeline	System	Collect and transform logs	Azure Data Factory
Performance Prediction	System	Analyze dropout risk	Azure Databricks
CI/CD Pipeline	DevOps	Auto build and deploy	Azure DevOps
Monitoring & Alerts	DevOps	Track health and auto alerts	Azure Monitor, App Insights

7. Use Case Detailed Requirements

Use Case	Actor	Preconditio n	Action Steps	Postconditi on	Expecte d Outcome
User Registration/Lo gin	Student/Instruc tor	User not authenticat ed	1. Navigate to login/registrat ion 2. Enter credentials 3. Submit	Token issued	User redirecte d to dashboa rd
View Courses	Student	User logged in	1. Open dashboard 2. View course list	Courses displayed	Student selects a course
Upload Courses	Instructor	Instructor logged in	1. Go to upload page 2. Fill details 3. Upload files 4. Submit	Course saved	Course is visible to students
Attempt Quiz	Student	Student enrolled in course	1. Open course 2. Start quiz 3. Submit answers	Answers stored	Score is calculate d

View	Student/Instruc	Quiz	1. Open result	Result	User
Assessment	tor	completed	history	fetched	views
Results			2. Select quiz		result
Real-time Quiz	System	Live quiz	1. Event Hub	Filtered	Insights
Analytics		responses	receives	data output	displaye
		sent	2. Stream		d in
			Analytics		dashboa
			processes		rd
Data ETL	System	Logs	1. ADF triggers	Data	Data
Pipeline		available	2. ETL jobs run	loaded into	ready for
				Synapse	reports
Performance	System	Historical	1. Run model	Predicted	Dropout
Prediction		data in	in Databricks	scores	trends
		Synapse	2. Generate	stored	identifie
			report		d
CI/CD Pipeline	DevOps	New code	1. Pipeline	Latest app	New
		committed	triggered	live	features
			2. Build, test,		are
			deploy		deploye
					d
Monitoring &	DevOps	App	1. Monitor	Incident	DevOps
Alerts		deployed	metrics	notification	team
			2. Trigger	sent	respond
			alerts on		S
			failures		

8. Expected Results

A fully functioning LMS accessible via the browser.

- Responsive UI built with React.js and connected to secure APIs.
- CI/CD-enabled DevOps setup for automated build and deployment.
- Azure Blob for scalable storage of course media.
- Streamed data via Event Hubs for real-time quiz monitoring.
- Processed and warehoused data in Synapse for Power BI visualization.
- SRE-driven monitoring using Azure Monitor and Application Insights.
- Final presentation dashboard hosted in MS Fabric.

9. Conclusion

EduSync offers students a hands-on, end-to-end project combining software development, cloud computing, data engineering, and DevOps. By completing this project, learners will develop both technical proficiency and a real-world understanding of how modern enterprise-grade educational platforms are built and maintained.