

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:

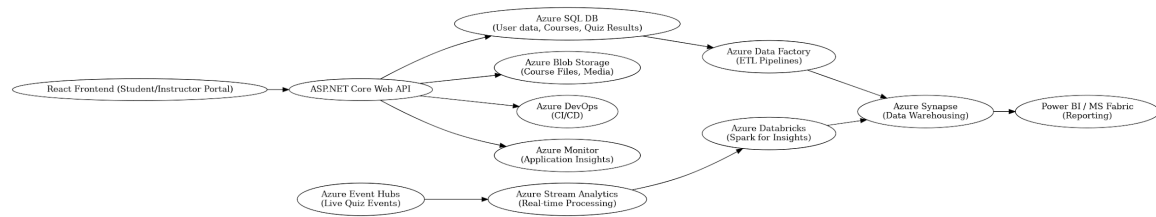
- User authentication and role-based access (Student/Instructor)
- Course and assessment management
- Real-time tracking of test attempts
- Automated CI/CD with monitoring and alerting
- Data processing pipelines and reporting dashboards

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)
DevOps	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	Type	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	Precondition	Action Steps	Postcondition	Expected Outcome
User Registration/Login	Student/Instructor	User not authenticated	1. Navigate to login/registration 2. Enter credentials 3. Submit	Token issued	User redirected to dashboard
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 calculated

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

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.