NAQEEBZ

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EDUCATION FOR EVERYONE

SYSTEM DESIGN DOCUMENT

INSAAF ACADEMY

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System Design Document

1. Introduction

The document covers the technical details of the project including detailed schema (database design), architecture and production environment requirements.

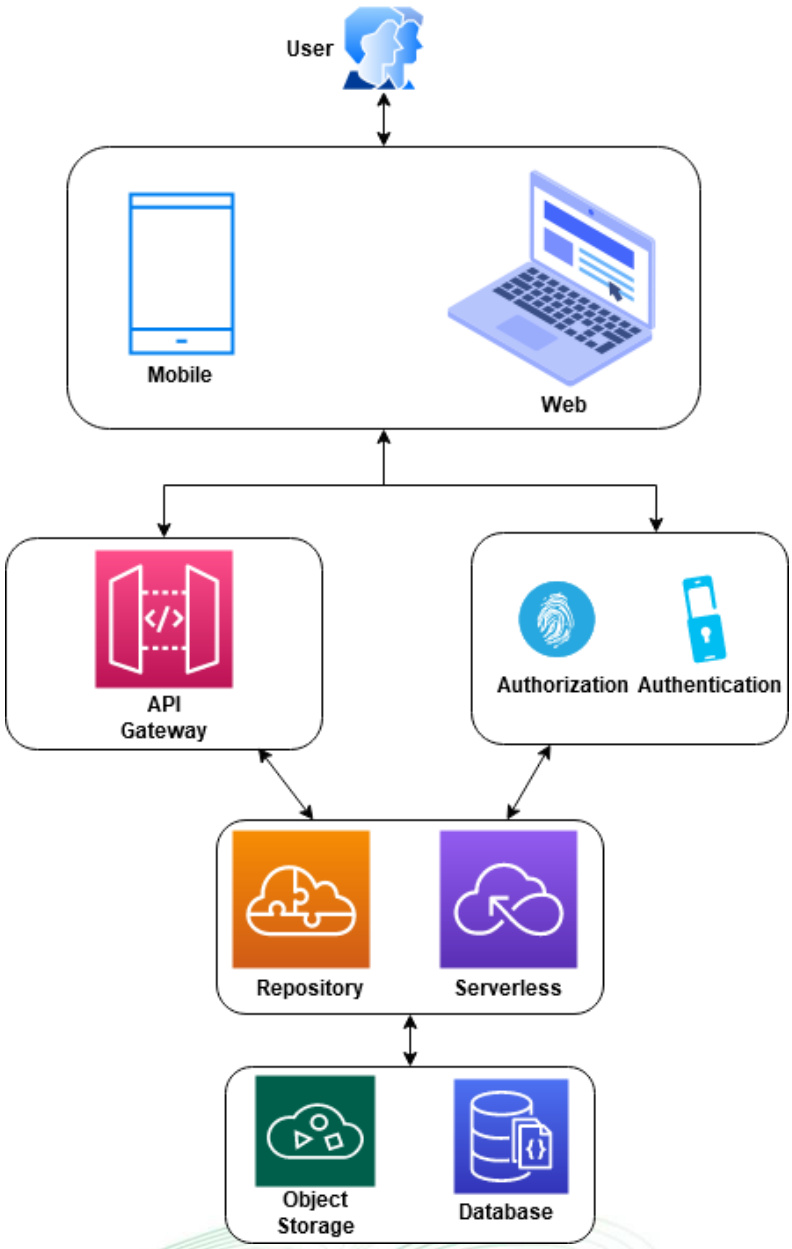
The database design covers the overall end-to-end data structure, format, relations and constraints. The architecture provides the overall approach used to develop the system for maximum performance, security and scalability. The production environment has to be set up based on the analysis of end user demographics, throughput and usage prediction.

The system is based on the academic content created by production team. The usability of the system depends upon the training of the client.

2. Architecture

We are going with a ***cloud-based architecture***, which is simple and scalable. We will benefit from load-balancers, web-servers, application servers and database. The architecture will benefit from the cloud features like elasticity, auto-provisioning, high availability and scalability.

We can view the architecture from a higher level of abstraction as,



API gateway makes it easy for developers to create and publish secure APIs. The APIs will act as a front door for applications to access data and business logic.

3. Data Model

The schema represents the structures of the database model generically. It will be converted to a non-sql document based structure when implemented in MongoDB. All the database entities and their field values and relationships are validated on execution. The constraints at application level will ensure data integrity.

a. Core Entities

Sr.	Entity	Attributes	Datatype (length)	Explanation
1.	Student	CNIC	Alphanumeric (20)	Primary Key
		parentID	Alphanumeric (10)	Foreign Key
		First_name	String (50)	
		Last_name	String (50)	
		Email	Alphanumeric (50)	
		Grade (Class)	Int (10)	
		School	String (50)	
		City	String (50)	
		Country	String (50)	
		DoB	DateTime	Date of birth
		Number_of_completed_courses	Int (10)	
		Gender	String (10)	
		Board	String (50)	Educational board
		Province	String (50)	
		District	String (50)	
2.	Course	Course_ID	Alphanumeric (20)	Primary Key
		Creator_ID	Alphanumeric (20)	Foreign Key, of Admin who has created this
		Class	Alphanumeric (20)	
		Status	Boolean	If course can be enrolled or not

		Title	Alphanumeric (30)	
		Description	Alphanumeric (MAX)	
		Image	Alphanumeric (MAX)	
3.	Chapter	Chapter_ID	Alphanumeric (20)	Auto-generated primary key
		cc_ID	Alphanumeric (20)	Foreign key from course
		title	String (MAX)	
		description	String (MAX)	
		number_of_ assessments	Integer (10)	
		number_of_videos	Integer (10)	Total number of video lectures
		topics	String[MAX]	List of topics in a chapter
4.	content_ type	Content_type_ID	Alphanumeric (20)	Auto-generated primary key
		Type	String (50)	
5.	Assessment	assessmentID	Alphanumeric (20)	Auto-generated primary key
		creatorID	Alphanumeric (20)	Foreign key of either Teacher or course coordinator
		chapterID	Alphanumeric (20)	Foreign key of chapter
		Questions	Alphanumeric []	List of question IDs
		date_created	DateTime	
		Type	String (50)	
		difficulty_level	String (50)	
		time	Integer (MAX)	Time allowed in seconds
		attempt_timestamp	DateTime	Date and time when it will be allowed to take the assessment
6.	Question_	QuestionID	Alphanumeric (20)	Auto-generated primary key

	Bank			
		created_by	Alphanumeric (20)	Foreign key of course coordinator or teacher who designed the question
		topic_Id	Alphanumeric (20)	Foreign key of the chapter content which the question covers
		Statement	String (MAX)	
		Answers	String[]	List of answers
		Correct Answer	String (MAX)	
		difficulty_level	String (20)	
		explanation	String (MAX)	
		type	String (20)	
		tags	String[]	List of tags which identify the question
		subject	String (30)	
		class	String (30)	
		topic	String (30)	
		date_created	DateTime	
7.	Result	result_ID	Alphanumeric (20)	Auto-generated primary key
		enroll_ID	Alphanumeric	Foreign key from course enrollment
		date_recorded	DateTime	
		Score	Integer	
		comments	String (MAX)	
8.	Certificate	certificate_ID	Alphanumeric (20)	Auto-generated primary key
		Result_ID	Alphanumeric	Foreign key from result
		Issuance_date	DateTime	
		Claimed	Boolean	

		Badges	String (MAX)	
9.	Feedback	Feedback_ID	Alphanumeric (20)	Primary key
		Enroll_ID	Alphanumeric	Foreign key
		Rating_score	Integer	
		Submission_date	DateTime	
		Desc_comments	String (MAX)	
10.	Admin	AdminID	Alphanumeric (20)	Primary key
		Name	String (MAX)	
		Email	Alphanumeric (50)	
		Contact_number	Alphanumeric (20)	
		Cnic	Alphanumeric (20)	
11.	Parent	parentID	Alphanumeric (20)	Primary key
		Name	String (50)	
		Cnic	Alphanumeric (20)	
		Contact_number	Alphanumeric (20)	
12.	Teacher	teacherID	Alphanumeric (20)	Primary key
		Name	String (50)	
		Cnic	Alphanumeric (20)	
		Email	Alphanumeric (50)	
		Contact_number	Alphanumeric (20)	
		Province	String (50)	
		District	String (50)	
		City	String (50)	
13.	Functional Constraints	fcID	Alphanumeric (20)	Auto-generated primary key
		Passing_ Percentage	Integer	

		V_class_limit	Integer	Limit for max students allowed in a virtual class
14.	Forum	forumID	Alphanumeric (20)	Primary key
		courseID	Alphanumeric	Foreign key
		moderatorID	Alphanumeric	Foreign key
		Date_created	DateTime	
		Status	Boolean	
15.	Badge	Badge_Id	Alphanumeric (20)	Primary key
		Description	String (MAX)	
		Category	String (30)	
16.	Course_ Coordinator	CC_ID	Alphanumeric (20)	Primary key
		First_name	String (20)	
		Last_name	String (20)	
		Email	String (50)	
		Specialization_area	String (50)	
		Contact_number	Alphanumeric (20)	
17.	Notification	Notification_ID	Alphanumeric (20)	Primary key
		userID	Alphanumeric	Foreign key
		Description	String (MAX)	
		Notification_Date	DateTime	
		Status	String (30)	
		Type	String (30)	
		Event	String (50)	
		Target_Audience	Alphanumeric []	List of intended recipients

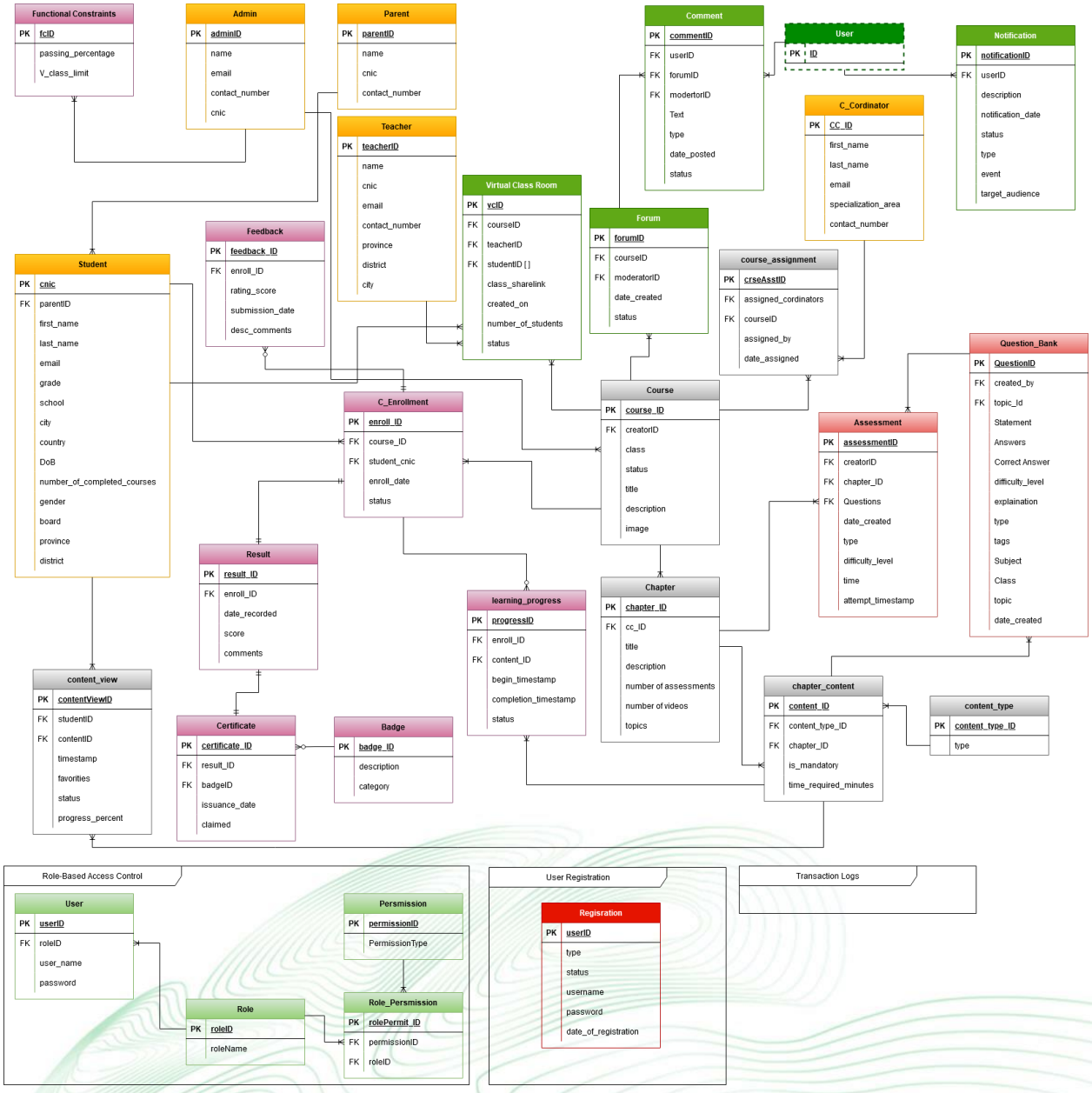
b. Associative Entities

Sr.				
1.	C_Enrollment	Enroll_ID	Alphanumeric (20)	Auto-generated primary key Association between student and course
		Course_ID	Alphanumeric (20)	Foreign Key from course
		Student_cnic	Alphanumeric (20)	Foreign Key from student
		Enroll_date	DateTime	
		Status	String (30)	In-progress, Completed
2.	chapter_content	content_ID	Alphanumeric (20)	Auto-generated primary key
		Type_ID	Alphanumeric	Foreign key of content type
		Chapter_ID	Alphanumeric	Foreign key of chapter
		Is_madatory	Boolean	Mandatory content has to be covered for progress
		Time_required_minutes	Integer (10)	
3.	learning_progress	progressID	Alphanumeric (20)	Auto-generated primary key
		Enroll_ID	Alphanumeric	Foreign key of enrollment record
		Content_ID	Alphanumeric	Foreign key of content
		Begin_ timestamp	DateTime	
		Completion_ timestamp	DateTime	
		Status	Boolean	
4.	content_view	contentViewID	Alphanumeric (20)	Auto-generated primary key
		Student_ID	Alphanumeric	Foreign key of student
		Content_ID	Alphanumeric	Foreign key of the content
		Timestamp	DateTime	Timestamp of last view
		Favorites	Boolean	
		Status	String (30)	
		Progress_ percent	Integer (10)	
5.	Virtual Class room	vcID	Alphanumeric (20)	Primary key
		courseID	Alphanumeric	Foreign key

		teacherID	Alphanumeric	Foreign key
		studentID	Alphanumeric[]	List of students in virtual class room
		Class_ sharelink	Alphanumeric (MAX)	Link for the class that can be shared
		Created_on	DateTime	
		Number_of_ Students	Integer	
		Status	Boolean	
6.	Comment	CommentID	Alphanumeric (20)	Primary key
		userID	Alphanumeric	Foreign key of the comment poster
		forumID	Alphanumeric	Foreign key of the forum
		moderatorID	Alphanumeric	Foreign key of the moderator
		Text	String (MAX)	
		Type	String (50)	Either question or answer
		Date_posted	DateTime	
		Status	String (50)	Approved, under-review, posted
7.	Course_ Assignment	crseAsstID	Alphanumeric (20)	Primary key
		Assigned_ Coordinators	Alphanumeric	Foreign key
		courseID	Alphanumeric	Foreign key
		Assigned_by	Alphanumeric	Foreign key of the admin who assigns the course to coordinator
		Date_assigned	DateTime	

c. Database Schema

The schema is built using the entity relationship model and can be implemented in the no-SQL database such as MongoDB. This is just a logical model to understand the data, its types and the relationships.



4. Production environment requirements

A production environment must have following features,

1. Reliable
2. Secure
3. Handle failure
4. Scalable

Sr.	Resource Type	Quantity	Pre-Requisites	Features
1.	Application-servers	1	All webservers must be load balanced Configured to run MERN stack application Linux environment	Scalable Secure
2.	Database server	1	Ready for no-sql document based deployment	Configurable and secure
3	Video Server	1	Vimeo Pro account	Customizable and secure
4	Live session	1	Application for executing Live Sessions	Reliable, Secure with good performance