Dashboard For Real Data Analysis For Trainings

Software Requirement Specification (SRS)

Submitted By

Dipak A Vaidya

Under the supervision of

Priyanka Sinha

Center For Development Of Advanced Computing, Bengaluru

April 2024

Contents

Introduction

➢ 1.1 Purpose

This document outlines the requirements for creating a comprehensive dashboard that provides insights into CDAC's training programs. The dashboard will act as a central hub for accessing and analyzing information about training initiatives conducted across all CDAC branches in India. It aims to offer a complete picture of various programs, including PGD courses, workshops, HPC programs, cybersecurity education, WBL , and more.

At the national level, the dashboard will give detailed insights into key training metrics such as enrollment, completion rates, participant demographics, revenue, and program-specific data. This will help CDAC's management team make informed decisions and allocate resources effectively across all branches.

Additionally, the dashboard will allow individual branches to access and analyze branch-specific information tailored to their needs. Branch administrators can customize views, generate replan optimize its training initiatives and make informed decisions according to its requirements.

Furthermore, the dashboard will provide insights into student demographics, including caste and categorical data. It will also display historical data and insights for completed courses, allowing administrators to track trends over time and make strategic decisions based on past per orts, and analyze data relevant to their branch. This ensures that each branch c formance and outcomes.

➢ 1.2 Intended Audience

The primary audience for this SRS document and the "CDAC Insights Dashboard" project consists of CDAC administrators and management members. This includes:

1. CDAC project managers and stakeholders responsible for overseeing the development, deployment, and strategic direction of the CDAC Insights Dashboard.
2. Software development team members, including project managers, business analysts, software architects, and developers, actively involved in designing, implementing, and testing the CDAC Insights Dashboard.
3. Quality assurance (QA) team members responsible for ensuring that the CDAC Insights Dashboard meets specified requirements and adheres to rigorous quality standards through comprehensive testing and validation procedures.
4. Technical support and maintenance personnel tasked with the ongoing operation, maintenance, and support of the CDAC Insights Dashboard post-deployment.

This SRS document serves as a comprehensive guide for all CDAC administrators and management members involved in the CDAC Insights Dashboard project. It provides a clear outline of the system's scope, objectives, and technical specifications, aiming to facilitate the efficient and successful development and deployment of the CDAC Insights Dashboard for data analysis for trainings.

➢ 1.3 Scope

The CDAC Insights Dashboard project aims to develop a comprehensive web-based application that serves as a centralized platform for CDAC administrators to track, analyze, and manage student enrollment data, as well as demographic and categorical information, across all CDAC branches in India. The scope of the project includes:

Enrollment Tracking and Visualization:

- The dashboard will provide administrators with detailed insights into enrollment statistics, including enrollment numbers, completion rates, and program-specific data for various training initiatives offered by CDAC.
- Dynamic data visualization tools, such as line charts and bar graphs, will be utilized to present enrollment trends over time, enabling administrators to identify patterns and fluctuations in enrollment for each program.
- Administrators will have the ability to filter enrollment data based on parameters like course batch, student's state of origin, and student category to gain deeper insights into enrollment demographics.

Demographic and Categorical Data Analysis:

- The dashboard will offer insights into student demographics, including caste and categorical data, allowing administrators to gain a deeper understanding of the student population.
- Interactive charts and graphs , maps will be used to visualize demographic breakdowns and categorical data, providing administrators with valuable insights into various social and economic categories.

Course Management Insights:

- Administrators will be able to access historical data and insights for completed training courses, including completion rates and revenue generated.
- The dashboard will facilitate tracking trends over time and making strategic decisions based on past performance and outcomes.

Key Training Metrics at National Level:

- At the national level, the dashboard will provide detailed insights into key training metrics, such as enrollment, completion rates, participant demographics, revenue generated, and program-specific data.
- These insights will help CDAC's management team make informed decisions and allocate resources effectively across all branches.

Overall, the CDAC Insights Dashboard aims to provide CDAC administrators with a powerful tool for monitoring student enrollment, analyzing demographic trends, and making informed decisions to optimize training initiatives across all CDAC branches.

- **1.4 Definitions**

CDAC Insights Dashboard: A web-based application designed to track and manage enrollment data, demographic information, and course-related activities for various training programs offered by CDAC. In addition to Post-Graduation Diploma (PGD) courses, the dashboard also encompasses Work-Based Learning (WBL), High-Performance Computing (HPC), and Capacity Building Programs (CBP) offered by CDAC. It provides administrators with comprehensive insights into enrollment statistics, demographic breakdowns, completion rates, revenue generation, and program-specific data across all CDAC branches.

PGD Courses: Post-Graduation Diploma courses offered by CDAC, which constitute a significant portion of the training programs tracked by the dashboard. These courses serve as the primary focus for enrollment tracking and course management functionalities within the CDAC Insights Dashboard.

WBL (Work-Based Learning): Training programs offered by CDAC that involve hands-on learning experiences in real-world work environments. The CDAC

Insights Dashboard includes WBL programs in its scope, allowing administrators to track enrollment, analyze demographic data, and monitor program-specific metrics for these initiatives.

HPC (High-Performance Computing): Training programs offered by CDAC focusing on high-performance computing technologies and applications. The CDAC Insights Dashboard encompasses HPC programs, providing administrators with insights into enrollment trends, completion rates, and other relevant metrics for these specialized training initiatives.

CBP (Capacity Building Programs): Training programs offered by CDAC aimed at enhancing the capacity and skills of participants in specific domains. The CDAC Insights Dashboard covers CBP initiatives, enabling administrators to analyze enrollment data, track demographic trends, and evaluate the effectiveness of capacity-building efforts.

➢ 1.5 References

- Claude
- Editor | drawDB
- Web application dashboards as a tool for data visualization and enrichment | IEEE Conference Publication | IEEE Xplore
- Courses (cdac.in)
- https://mermaid.live

Overall Description

- ### 2.1 User Interface

The user interface of the CDAC Insights Dashboard will provide administrators with a user-friendly and intuitive platform for accessing and analyzing training data. Key features of the user interface include:

Dashboard Overview: Upon logging in, administrators will be greeted with a comprehensive overview of key training metrics, including enrollment numbers, completion rates, participant demographics, revenue generated, and program-specific data. This summary section will serve as a snapshot of the current state of training initiatives across all CDAC branches.

Interactive Data Visualization: The dashboard will utilize dynamic charts, graphs, and maps to visually represent training data in an interactive manner. Administrators can explore enrollment trends, demographic breakdowns, and categorical data using intuitive data visualization tools such as line charts, bar graphs, pie charts, and geographic maps.

Filtering and Exploration: Administrators will have the ability to filter training data based on various parameters such as course, batch, state of origin, student category, and program type (e.g., PGD courses, WBL programs, HPC initiatives, CBP workshops). This filtering functionality allows administrators to tailor their analysis to specific criteria and gain deeper insights into training trends and patterns.

Customizable Views: The CDAC Insights Dashboard will offer customizable views, allowing administrators to personalize their dashboard layout and configure widgets according to their preferences. Administrators can rearrange, resize, and add or remove widgets to create a dashboard layout that best suits their needs and workflow.

Responsive Design: The dashboard will be designed with a responsive layout, ensuring seamless access and optimal viewing experience across various devices and screen sizes. Whether accessed on desktop computers, laptops, tablets, or smartphones, the CDAC Insights Dashboard will adapt its layout and functionality to provide a consistent user experience.

The user interface of the CDAC Insights Dashboard will prioritize usability, interactivity, and flexibility, empowering administrators to effectively explore, analyze, and derive actionable insights from training data across all CDAC branches. Dashboard's UI is intuitively designed to empower administrators with efficient data exploration and analysis capabilities, enabling them to make informed decisions regarding enrollment management and resource allocation.

➢ 2.2 System Interface

The CDAC Dashboard employs a modern and efficient technology stack:

Frontend: Developed using React JS, a widely-used JavaScript library known for its modular and high-performance approach to building dynamic web interfaces.

React libraries like React-Chartjs-2 and Victory are utilized for data visualization components, offering flexibility and ease of integration with React applications.

Backend: Powered by Node.js, a JavaScript runtime known for its speed and scalability in building server-side applications. Express.js, a minimal and flexible Node.js web application framework, is used to handle HTTP requests and responses. For database interaction, Sequelize, an ORM (Object-Relational Mapping) for Node.js, is utilized to interact with the MySQL database.

Database: Utilizes MySQL as the backend data store. MySQL is a popular open-source relational database management system known for its reliability, scalability, and performance. It offers advanced features for data integrity, security, and scalability, making it well-suited for handling complex data structures in the CDAC Dashboard.

Communication between the frontend and backend is facilitated through RESTful APIs, providing a standardized and lightweight communication protocol. Libraries such as Axios or Fetch API in the frontend and Express.js in the backend are used to handle HTTP requests and responses, ensuring efficient data exchange between different components of the system.

This technology stack was carefully selected for its proven reliability, scalability, and widespread industry adoption. By leveraging these technologies, the CDAC Dashboard is poised to deliver a high-performance solution that meets the evolving needs of CDAC administrators effectively and efficiently.

2.3 Software & Hardware Requirements

Software:

- Integrated Development Environment (IDE): The development team will utilize industry-standard IDEs such as Visual Studio Code or WebStorm for efficient coding, debugging, and deployment.
- Frontend Framework: React JS will serve as the frontend framework for building the CDAC Dashboard, offering a component-based architecture for scalable UI development. React libraries like React-Chartjs-2 and Victory will be used for data visualization.

- Backend Framework: Node.js will power the backend logic of the CDAC Dashboard, with Express.js as the web application framework. Sequelize will handle database interaction with MySQL.
- Database Management System (DBMS): MySQL, a robust and scalable relational DBMS, will be employed for storing and managing enrollment data securely.

Hardware:

- Desktop or Laptop Computer: The CDAC Dashboard will be accessible through a web browser, so the end-users (administrators) will need to have access to a desktop or laptop computer with a modern web browser, such as Google Chrome, Mozilla Firefox, or Apple Safari.
- Operating System: Windows 10 or newer, macOS Catalina (10.15) or newer, or a compatible Linux distribution.
- RAM: Minimum 8GB RAM, recommended 16GB or higher for optimal performance.
- Storage: Minimum 256GB SSD, with a recommended size of 500GB or more for storing development files and databases.
- Processor: Intel Core i5 or AMD Ryzen 5 (or equivalent) processors, ensuring smooth execution of development tasks.
- Internet Connectivity: A stable internet connection with a minimum download speed of 10 Mbps is required for accessing and using the CDAC Dashboard efficiently. Higher speeds are recommended for improved responsiveness and data transfer.

- **2.4 Constraints**

Security:

Data Encryption: To protect sensitive student information, the CDAC Dashboard must implement data encryption mechanisms. Encryption ensures that even if unauthorized users gain access to the database, they cannot decipher the stored data without the encryption key. Industry-standard encryption algorithms such as AES (Advanced Encryption Standard) should be used to encrypt data at rest and during transmission. Additionally, encryption keys should be securely managed and stored to prevent unauthorized access.

Secure Communication Protocols: Secure communication protocols such as HTTPS (Hypertext Transfer Protocol Secure) must be employed to encrypt data transmitted between the frontend and backend components of the CDAC Dashboard. HTTPS encrypts data in transit, preventing eavesdropping and man-in-the-middle attacks. SSL/TLS (Secure Sockets Layer/Transport Layer Security) certificates should be properly configured and renewed to ensure the integrity and confidentiality of data exchanged between clients and servers.

Performance:

Efficient Data Processing: Efficient data retrieval and processing algorithms are essential for maintaining responsive performance in the CDAC Dashboard, especially when handling large volumes of enrollment data. Optimized database queries, caching mechanisms, and indexing strategies can improve data retrieval speed and reduce latency. Additionally, asynchronous processing techniques such as background tasks and job queues can offload resource-intensive operations from the main application thread, enhancing overall responsiveness.

Scalable Infrastructure: As the CDAC Dashboard grows in terms of user base and data volume, its infrastructure should be designed to scale seamlessly. Horizontal scaling involves adding more instances of servers or containers to distribute the workload, while vertical scaling involves upgrading hardware resources such as CPU and RAM. Cloud-based infrastructure providers like AWS (Amazon Web Services) or Azure offer scalable solutions such as auto-scaling groups and serverless architectures, enabling the CDAC Dashboard to handle increased traffic and data without performance degradation.

Optimized User Interface: The user interface (UI) of the CDAC Dashboard should be optimized for performance to ensure a smooth user experience. Techniques such as lazy loading, progressive rendering, and client-side caching can reduce initial page load times and improve interactivity. Minimizing the number of HTTP requests, optimizing images and assets, and using efficient CSS and JavaScript frameworks can further enhance UI performance. Continuous monitoring and profiling of UI components can help identify performance bottlenecks and optimize critical paths for improved responsiveness.

By addressing these security and performance considerations, the CDAC Dashboard can maintain the confidentiality of student data while delivering a fast and reliable user experience for administrators and stakeholders.

➢ 2.5 User Characteristics

The CDAC Dashboard primarily caters to administrators tasked with managing PGD courses and enrollment data. These administrators typically possess the following characteristics:

Computer Literacy: Proficiency in basic computer skills and familiarity with web-based applications is expected. Administrators should be comfortable navigating and interacting with the CDAC Dashboard's interface.

Domain Knowledge: Adequate understanding of CDAC's PGD course offerings, enrollment procedures, and overall program operations is essential. This domain expertise enables administrators to contextualize the data and insights provided by the dashboard effectively.

Data Interpretation Skills: Ability to interpret data visualizations and analytics is crucial. Administrators should possess the capability to derive meaningful insights from the data presented in the CDAC Dashboard, facilitating informed decision-making and action planning.

By accommodating these user characteristics, the CDAC Dashboard aims to deliver an accessible, intuitive, and valuable tool for administrators responsible for managing PGD courses and enrollment data. This approach ensures that administrators can leverage the dashboard's capabilities efficiently to support CDAC's operational objectives.

System Features & Requirements

- ### 3.1 Functional Requirements

Enrollment Tracking:

The CDAC Insights Dashboard must provide comprehensive functionality for tracking and monitoring enrollment data across various training programs offered by CDAC. This includes:

- Data Capture: The system should capture and store detailed enrollment information, including the number of students enrolled in each program, batch details, start/end dates, and other relevant metadata.

- Real-time Updates: The dashboard should reflect real-time updates to enrollment data, ensuring that administrators have access to the most current information regarding student enrollments.

- Program-specific Enrollment: Administrators should be able to view enrollment statistics for different training programs, such as PGD courses, workshops, HPC programs, cybersecurity education, and WBL initiatives, allowing for a comprehensive overview of enrollment across all CDAC branches.

Data Visualization:

The CDAC Insights Dashboard must employ effective data visualization techniques to present enrollment data and demographic insights in an intuitive and interactive manner. This includes:

- Dynamic Charts and Graphs: Utilization of dynamic line charts, bar graphs, and pie charts to visualize enrollment trends, demographic breakdowns, and categorical data, enabling administrators to identify patterns and make informed decisions.

- Geographic Representation: Integration of maps with color-coded regions to illustrate the geographic distribution of enrolled students across different states, providing administrators with insights into regional enrollment patterns.

- Customizable Visualization: Administrators should have the flexibility to customize visualization settings, such as adjusting chart types, selecting data parameters, and applying filters, to tailor the display to their specific analytical needs.

Filtering and Exploration:

The CDAC Insights Dashboard should offer robust filtering and exploration capabilities to enable administrators to delve deeper into enrollment data and extract meaningful insights. This includes:

- Flexible Filtering Options: Administrators should be able to filter enrollment data based on various parameters, such as course, batch, state of origin, student category (Scheduled Castes, Scheduled Tribes, OBC, EWS, General), and program type (PGD courses, WBL programs, HPC initiatives, CBP workshops), allowing for targeted analysis.

- Interactive Exploration: The system should support interactive exploration of enrollment data, allowing administrators to dynamically adjust filters, drill down into specific subsets of data, and visualize the impact of filtering criteria on enrollment statistics.

- Saved Filter Configurations: Administrators should have the ability to save and reuse filter configurations for efficient data analysis, streamlining repetitive tasks and facilitating comparative analysis over time.

Historical Data Analysis:

The CDAC Insights Dashboard should enable administrators to analyze historical enrollment data and track trends over time. This includes:

- Access to Historical Data: Administrators should be able to access historical enrollment data for completed training courses, including completion rates, revenue generated, and demographic insights, facilitating longitudinal analysis.

- Trend Identification: The system should support trend identification and analysis, allowing administrators to track changes in enrollment patterns, demographic distributions, and program performance over time and make informed decisions based on historical trends.

- Comparative Analysis: Administrators should have the ability to compare enrollment data between different time periods, courses, branches, and demographic categories, enabling them to identify growth opportunities, areas for improvement, and emerging trends.

By meeting these functional requirements, the CDAC Insights Dashboard will empower administrators to effectively track, analyze, and manage enrollment data across all CDAC branches, facilitating informed decision-making and resource allocation for training initiatives.

➢ 3.2 Use Cases/Sequence Diagrams

Use Case: Analyze Enrollment Data

Primary Actor:Administrator

Stakeholders and Interests:

- Administrator: Wants to analyze enrollment data to make informed decisions.

- Management: Requires accurate insights into enrollment trends to allocate resources effectively.

- CDAC Branch Administrators: Need branch-specific enrollment data for optimizing training initiatives.

Preconditions: The administrator must be logged into the CDAC Insights Dashboard.

Postconditions: The administrator successfully analyzes enrollment data and gains actionable insights.

Main Success Scenario:

1. The administrator selects the option to analyze enrollment data.

2. The system presents various filtering options, including course, batch, state of origin, and student category.

3. The administrator chooses filtering criteria based on their analysis requirements.

4. The system retrieves and displays enrollment data matching the selected criteria.

5. The administrator explores enrollment trends using dynamic visualizations such as line charts and bar graphs.

6. The administrator identifies patterns and fluctuations in enrollment and demographic breakdowns.

7. Based on the insights gained, the administrator formulates strategies to optimize training initiatives and resource allocation.

Extensions:7a. If the administrator encounters difficulties in interpreting the data:

- The system provides tooltips or contextual help to clarify data representations.

- The administrator seeks assistance from the technical support team for further guidance.

Use Case: Generate Enrollment Reports

Primary Actor: Administrator

***Stakeholders and Interests*:**

- Administrator: Needs to generate comprehensive reports on enrollment data for decision-making purposes.

- Management: Requires detailed reports to assess the effectiveness of training programs.

- CDAC Branch Administrators: Need branch-specific reports to evaluate enrollment performance.

Preconditions: The administrator must be logged into the CDAC Insights Dashboard.

Postconditions: The administrator successfully generates and accesses enrollment reports.

Main Success Scenario:

1. The administrator selects the option to generate enrollment reports.

2. The system presents report generation options, including report type, timeframe, and filtering criteria.

3. The administrator chooses the report type (e.g., enrollment trends, demographic breakdowns).

4. The administrator selects the timeframe (e.g., monthly, quarterly, annually) for the report.

5. The administrator applies filtering criteria to customize the report based on specific parameters.

6. The system generates the enrollment report based on the selected options.

7. The administrator accesses and reviews the generated report for insights and analysis.

8. Based on the report findings, the administrator makes informed decisions regarding training program optimization and resource allocation.

Extensions:

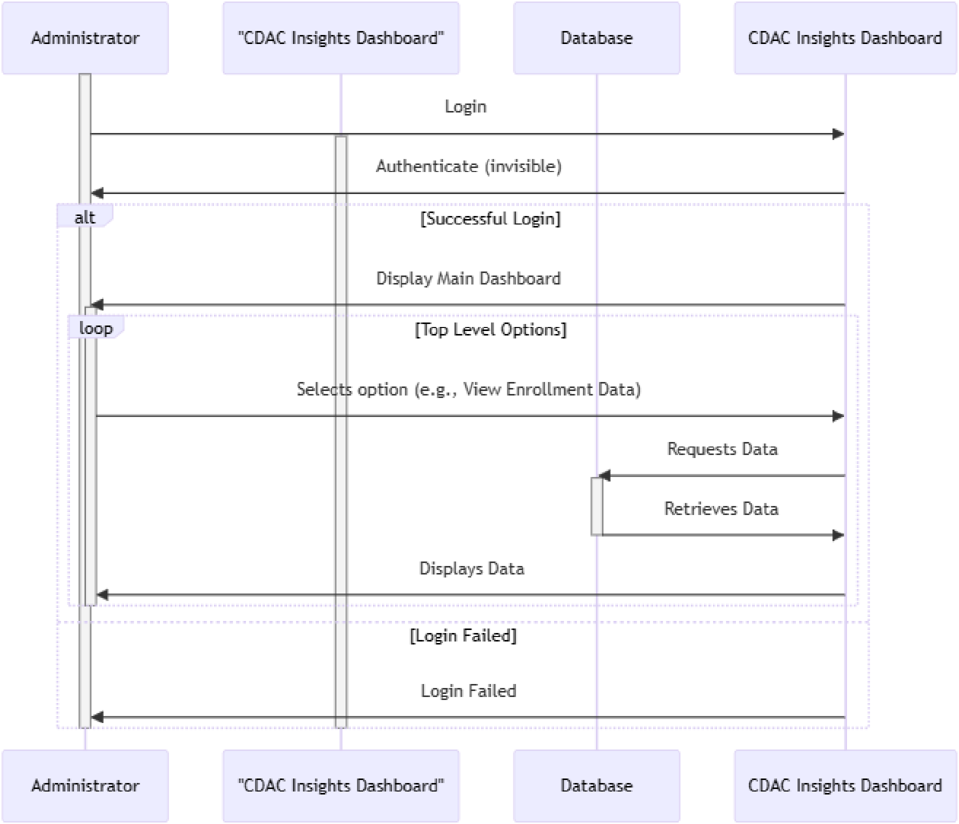
8a. If the generated report contains inaccuracies or inconsistencies:

- The administrator verifies the filtering criteria and parameters used for report generation.

- The administrator contacts the technical support team to address any data discrepancies.

These use cases illustrate how administrators interact with the CDAC Insights Dashboard to analyze enrollment data and generate reports for informed decision-making regarding training initiatives and resource allocation.

Sequence Diagrams :



This sequence diagram provides a clear visualization of the steps involved in the login process, data retrieval, and interaction between the Administrator, CDAC Insights Dashboard, and the Database.

1. Administrator initiates login: The sequence begins with the Administrator initiating the login process by providing their credentials to access the CDAC Insights Dashboard.

2. CDAC Insights Dashboard authenticates: Upon receiving the login request, the CDAC Insights Dashboard authenticates the Administrator's credentials invisibly, ensuring that the login process remains secure.

3. Successful login: If the authentication is successful, the CDAC Insights Dashboard proceeds to display the main dashboard interface to the Administrator

4. Administrator selects option: The Administrator interacts with the main dashboard interface and selects an option, such as "View Enrollment Data," initiating a request for specific data.

5. Dashboard requests data: Upon receiving the Administrator's request, the CDAC Insights Dashboard sends a request to the Database to retrieve the required data.

6. Database retrieves data: The Database processes the request from the CDAC Insights Dashboard and retrieves the requested data, such as enrollment statistics or demographic information.

7. Dashboard displays data: Once the Database returns the requested data, the CDAC Insights Dashboard receives it and proceeds to display the relevant information to the Administrator on the dashboard interface.

8. Login failure: In case the authentication process fails, the CDAC Insights Dashboard notifies the Administrator of the login failure.

3.3 External Interface Requirement

Frontend:

The CDAC Dashboard's user interface will be developed using the React JS library, a widely adopted JavaScript framework known for its efficiency and component-based architecture. React JS facilitates the creation of dynamic and interactive user interfaces, which is essential for presenting training data effectively to administrators.

Key Features:

- UI Components: React JS will be used to build various UI components, including dashboards, charts, graphs, filters, and interactive widgets.

- User Interactions: The frontend will handle user interactions such as clicking, dragging, and filtering data, providing a seamless and intuitive user experience.

- Communication: It will communicate with the backend API to fetch data, perform operations, and update the UI dynamically based on user actions.

Backend:

The backend of the CDAC Dashboard will be developed using Node.js along with the Express.js framework, providing a lightweight and efficient platform for building web applications and RESTful APIs. Node.js's event-driven architecture allows for non-blocking I/O operations, making it suitable for handling concurrent requests and scalable applications.

Key Features:

- **RESTful APIs:** Express.js will facilitate the creation of RESTful APIs to enable seamless communication between the frontend and backend components of the CDAC Dashboard. These APIs will define endpoints for operations such as fetching enrollment data, managing courses, and handling user authentication.
- **Business Logic:** The backend will implement the core business logic of the CDAC Dashboard, including data processing, validation, and authentication. This logic will govern the behavior of the application and ensure the integrity of the data being manipulated.
- **Data Management:** The backend will interact with the MySQL database to retrieve and store data related to student enrollment, course management, and user accounts. Sequelize, an ORM (Object-Relational Mapping) for Node.js, will facilitate database interactions and ensure data consistency.

Database:

The CDAC Dashboard will utilize MySQL as the backend data store due to its reliability, scalability, and comprehensive feature set. MySQL is a popular open-source relational database management system known for its performance and robustness.

Key Features:

- **Data Storage:** MySQL will store various types of data, including student enrollment details, course information, and administrator accounts. Its relational model allows for efficient organization and retrieval of structured data.
- **Data Integrity:** MySQL ensures data integrity through features such as transactions, constraints, and foreign key relationships. These mechanisms enforce data consistency and prevent anomalies in the database.
- **Security:** MySQL offers robust security features, including user authentication, access controls, and data encryption, to safeguard sensitive information stored within the CDAC Dashboard. By implementing these security measures, the dashboard can protect against unauthorized access and maintain the confidentiality of student and administrative data.

➢ 3.4 Database Requirement

The CDAC Insights Dashboard requires a robust database system to store and manage various entities such as administrators, courses, students, enrollments, and programs. Here's a breakdown of the database requirements based on the provided schema:

1. Administrator Table (admin_users):

- This table stores information about the administrators who have access to the CDAC Insights Dashboard.
- Fields:
  - adminId (Primary Key): Unique identifier for each administrator.
  - name: Name of the administrator.
  - email: Email address of the administrator.
  - password: Encrypted password for authentication.

2. Course Table (courses):

- Contains details of the courses offered by CDAC.
- Fields:

- courseId (Primary Key): Unique identifier for each course.
- courseName: Name of the course.
- courseType: Type of the course.
- duration: Duration of the course in months.
- startDate: Start date of the course.
- endDate: End date of the course.
- revenue: Revenue generated by the course.

3. Course-Program Mapping Table (course_program_map):

- Establishes a many-to-many relationship between courses and programs.
- Fields:
  - mapId (Primary Key): Unique identifier for each mapping.
  - courseId (Foreign Key): References the courseId in the courses table.
  - programId (Foreign Key): References the programId in the programs table.

4. Enrollment Table (enrollments):

- Stores information about student enrollments in courses.
- Fields:
  - enrollmentId (Primary Key): Unique identifier for each enrollment.
  - studentId (Foreign Key): References the studentId in the students table.

- courseId (Foreign Key): References the courseId in the courses table.

- enrollmentDate: Date when the student enrolled in the course.

- completionStatus: Status indicating whether the student has completed the course.

5. Student Table (students):

- Contains details of the students enrolled in CDAC courses.

- Fields:

  - studentId (Primary Key): Unique identifier for each student.

  - name: Name of the student.

  - email: Email address of the student.

  - caste: Caste of the student.

  - category: Category of the student (Scheduled Castes, Scheduled Tribes, OBC, EWS, General).

  - state: State of origin of the student.

6. Program Table (programs):

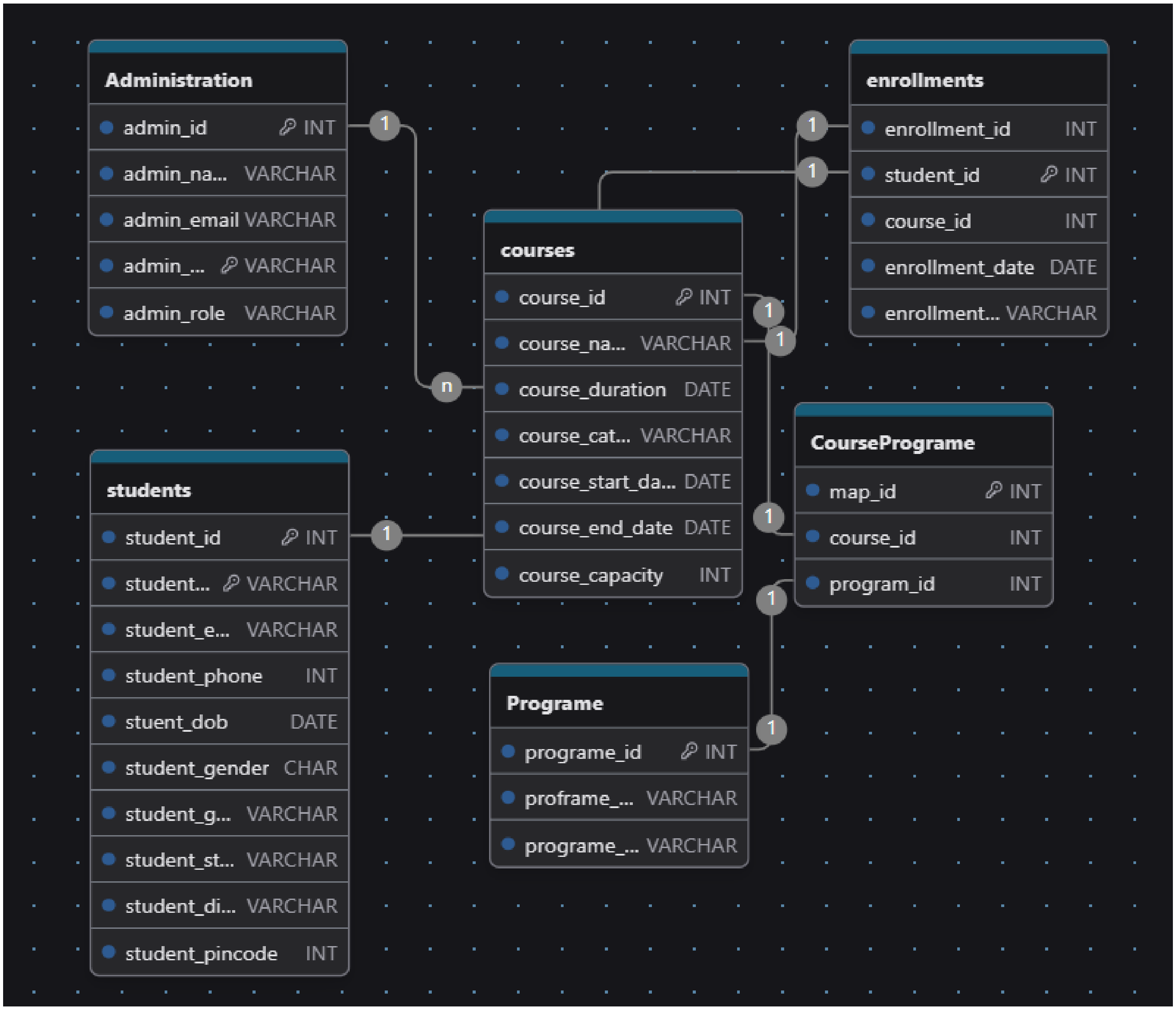
- Stores information about the programs offered by CDAC.

- Fields:

  - programId (Primary Key): Unique identifier for each program.

  - programName: Name of the program.

- programType: Type of the program.



Administration		
admin_id	🔑	INT
admin_na...		VARCHAR
admin_email		VARCHAR
admin_...	🔑	VARCHAR
admin_role		VARCHAR

enrollments		
enrollment_id		INT
student_id	🔑	INT
course_id		INT
enrollment_date		DATE
enrollment...		VARCHAR

courses		
course_id	🔑	INT
course_na...		VARCHAR
course_duration		DATE
course_cat...		VARCHAR
course_start_da...		DATE
course_end_date		DATE
course_capacity		INT

CoursePrograme		
map_id	🔑	INT
course_id		INT
program_id		INT

students		
student_id	🔑	INT
student...	🔑	VARCHAR
student_e...		VARCHAR
student_phone		INT
stuent_dob		DATE
student_gender		CHAR
student_g...		VARCHAR
student_st...		VARCHAR
student_di...		VARCHAR
student_pincode		INT

Programe		
programe_id	🔑	INT
proframe_...		VARCHAR
programe_...		VARCHAR

Explanation of ER Diagram

The ER diagram represents the entities and relationships in the CDAC Insights Dashboard database:

- Administrator: Represents the administrators who manage the dashboard. They have access to course management and enrollment tracking functionalities.

- Course: Represents the courses offered by CDAC. Each course has details such as name, type, duration, start date, end date, and revenue.

- Course-Program Mapping: Establishes a many-to-many relationship between courses and programs. It allows courses to belong to multiple programs and vice versa.

- Enrollment: Represents the enrollment of students in courses. It tracks details such as enrollment date and completion status.

- Student: Represents the students enrolled in CDAC courses. It includes information such as name, email, caste, category, and state.

- Program: Represents the programs offered by CDAC, such as Post-Graduation Diploma (PGD) courses, Work-Based Learning (WBL), High-Performance Computing (HPC), etc.

The relationships depicted in the diagram illustrate how these entities are connected:

- Administrator-Manages-Course: An administrator manages multiple courses.

- Course-Has Enrollment-Student: A course can have multiple student enrollments, and each enrollment is associated with a student.

- Course-Belongs To-Course-Program Mapping: A course can belong to multiple programs through the course-program mapping.

- Program-Offers-Course: A program offers multiple courses, establishing a one-to-many relationship.

- Student-Enrolls In-Enrollment: A student can enroll in multiple courses, and each enrollment is associated with a student.

These relationships ensure that the database maintains integrity and accurately represents the interactions between administrators, students, courses, and programs within the CDAC Insights Dashboard system.

Key Point

1. Admin Users Table:

- Purpose: The Admin Users Table serves as a central repository for storing login credentials that grant access to the CDAC Dashboard. It typically includes fields such as username and password.

- Explanation: Storing login credentials in a dedicated table allows the system to authenticate users securely when they attempt to access the dashboard. Each administrator is assigned a unique username and password combination, which is verified during the login process. By centralizing user authentication data, the system can enforce access controls and track user activity effectively.

- Importance: Proper management of admin user credentials is crucial for ensuring the security of the CDAC Dashboard. By storing credentials securely and implementing robust authentication mechanisms, the system can prevent unauthorized access and protect sensitive student information from unauthorized users.

2. Students Table:

- Purpose: The Students Table stores comprehensive information about students enrolled in PGD courses offered by CDAC. It includes details such as personal information, enrollment dates, course registrations, and demographic data.

- Explanation: Storing student enrollment information in a structured table allows administrators to track and manage student data efficiently. Each student record typically includes unique identifiers, such as student ID, along with relevant enrollment details. Additionally, demographic data, such as caste and category, may be included to provide insights into the diversity of the student population.

- Importance: The Students Table serves as a critical resource for monitoring student enrollment trends, analyzing demographic data, and generating reports. By maintaining accurate and up-to-date student records, the system can support informed decision-making and optimize training initiatives to meet the needs of diverse student groups.

3. Courses Table:

- Purpose: The Courses Table stores information about PGD courses offered by CDAC, including course names, descriptions, durations, start/end dates, and enrollment capacities.

- Explanation: Centralizing course data in a dedicated table allows administrators to manage course offerings efficiently. Each course record typically includes essential details such as course ID, name, and description, along with logistical information such as duration and capacity. By maintaining a comprehensive repository of course information, the system can facilitate course management, enrollment tracking, and scheduling.

- Importance: The Courses Table enables administrators to add, edit, and remove courses dynamically, ensuring that the CDAC Dashboard reflects the latest training initiatives. By maintaining accurate course data, the system can provide students with up-to-date information about available courses and support effective resource allocation and scheduling.

4. Relationships:

- Purpose: Relationships between tables, such as those between the Students Table and Courses Table, establish connections and dependencies between data entities.

- Explanation: In relational database design, relationships define how data in different tables are related to each other. For example, a one-to-many relationship between the Students Table and Courses Table links student enrollments to the corresponding courses. By defining and enforcing these relationships through foreign key constraints, the system ensures data integrity and consistency.

- Importance: Establishing relationships between tables enables the system to maintain referential integrity and prevent orphaned records. For example, when a student enrolls in a course, the system can enforce constraints to ensure that the corresponding course record exists in the Courses Table. This helps maintain the accuracy and reliability of the database, supporting efficient data retrieval and analysis.

5. Security Measures:

- Purpose: Security measures such as access controls and data encryption protect sensitive student information from unauthorized access and ensure the integrity and confidentiality of data stored in the CDAC Dashboard.

- Explanation: Access controls regulate user permissions and restrict access to authorized personnel. Role-based access controls (RBAC) allow administrators to define roles and assign access rights based on job responsibilities. Data encryption techniques, such as hashing passwords and encrypting sensitive data at rest, protect information from unauthorized disclosure.

- Importance: Implementing robust security measures is essential for safeguarding student privacy and maintaining compliance with data protection regulations. By enforcing access controls and encrypting sensitive data, the system can mitigate the risk of unauthorized access, data breaches, and malicious activities, instilling trust and confidence in users and stakeholders.

3.5 Non-Functional Requirements

Performance:

- Data Handling Efficiency: The CDAC Dashboard must efficiently handle large volumes of enrollment data, ensuring fast retrieval, processing, and storage of data for responsive data visualization and reporting. Algorithms for data handling should be optimized to maintain performance even with substantial datasets.

- Scalability: The system architecture should be designed for scalability, allowing the CDAC Dashboard to accommodate increasing amounts of data and user traffic as enrollment numbers grow over time. Scalability measures should include horizontal and vertical scaling capabilities to support future expansion.

- Optimized User Experience: The user interface and network communication between frontend and backend components must be optimized to deliver a seamless user experience. Minimal latency and smooth transitions should be ensured, especially during complex data analysis and filtering operations.

Security:

- Authentication: The CDAC Dashboard must implement a secure authentication mechanism, such as username and password-based login, to ensure that only authorized administrators can access the system.

- Authorization: Role-based access controls (RBAC) should be enforced, allowing administrators to be assigned different levels of permissions based on their roles and responsibilities within CDAC.

- Data Encryption: Sensitive data, including student information and administrator credentials, must be encrypted both at rest and in transit. Industry-standard encryption algorithms should be employed to prevent unauthorized access and maintain data confidentiality.

Usability:- Intuitive Interface: The dashboard layout, navigation, and user interface elements should be intuitive and easy to understand, reducing the learning curve for administrators. Clear labeling and consistent design patterns should enhance usability.

- Accessibility: The CDAC Dashboard should be accessible and responsive across various devices and screen sizes, including desktops, laptops, tablets, and smartphones. Responsive design principles should be followed to ensure a consistent user experience.

- Contextual Help: To assist administrators in navigating the dashboard and interpreting data, contextual help features such as tooltips, hover effects, and clear labeling should be provided. These features enhance usability and facilitate user engagement with the dashboard.

By meeting these non-functional requirements, the CDAC Dashboard will offer a high-performance, secure, and user-friendly platform for administrators to effectively manage and analyze enrollment data for CDAC's PGD programs.

4 Deliver for Approval