

EduPath

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ABSTRACT

The *Telangana Entrance Exam Portal* is a full-stack web application developed to serve as a centralized and user-friendly platform for students seeking information on entrance examinations in Telangana, especially for Intermediate and Polytechnic streams. The main objective of this system is to simplify access to accurate and up-to-date exam-related information, reducing the need to browse multiple websites.

The platform allows users to explore various entrance examinations, view eligible colleges, check important academic dates such as application deadlines and exam schedules, and access direct application links along with syllabus resources. It also provides real-time updates on exam results and includes a notification system that delivers alerts through website notifications, email, and SMS, ensuring that students remain informed about critical updates.

The system is developed using modern web technologies, with a frontend built using React, Tailwind CSS, HTML, and JavaScript, and a backend powered by Node.js and Express.js. MySQL is used as the database to efficiently manage structured data. The application follows a well-defined relational schema to ensure data consistency and integrity, while secure user authentication is implemented using JSON Web Tokens (JWT). A notable feature of the portal is its multi-language support, offering content in both English and Telugu to enhance accessibility and inclusiveness.

The application is designed with a responsive and intuitive user interface to provide a seamless experience across various devices. Overall, the *Telangana Entrance Exam Portal* integrates exam information, college details, and notification services into a single unified system, making it an efficient digital solution for students.

Keywords: Telangana Entrance Exam Portal, Full-Stack Web Application, React, Node.js, Express.js, MySQL, JWT Authentication, Entrance Exams, College Information System, Notification System, Multi-language Support, Student Portal, Polytechnic Exams, Intermediate Exams.

Introduction of the Project

Students from Intermediate streams such as MPC, BiPC, MEC, and CEC often encounter challenges when planning their higher education due to the lack of a unified source of information. Details regarding entrance examinations and colleges are typically dispersed across multiple platforms, which makes the search process time-consuming and confusing. To address this issue, the proposed system introduces a centralized digital platform that consolidates entrance exam and college-related information in one place. This platform assists students in identifying appropriate entrance examinations, exploring suitable colleges, and receiving timely notifications regarding important academic events. By providing structured and reliable information, the system supports students in making informed academic decisions and effectively planning their future educational pathways.

Requirement Analysis

The requirement analysis phase focuses on identifying both functional and non-functional needs of the system to ensure proper design and development.

Functional Requirements

The system provides secure user registration and authentication, allowing students to create accounts and log in safely to access personalized features. It includes an organized navigation system that enables users to browse through different educational streams, levels, and entrance examinations efficiently. The portal offers comprehensive exam-related information such as important dates, application deadlines, syllabi, and direct application links. It also provides a mapping feature that helps users identify colleges accepting specific entrance exams and vice versa. Additionally, the system incorporates a notification mechanism that delivers timely alerts regarding deadlines, results, and announcements through web notifications, email, and SMS services. To enhance accessibility, the platform supports multilingual functionality, allowing users to switch between English and Telugu based on their preference.

Non-Functional Requirements

A Sanjana *et. al.*, /International Journal of Engineering & Science Research

The system is designed to ensure high performance by providing quick response times during data retrieval and search operations. It emphasizes usability through an intuitive and student-friendly interface. Reliability is maintained by ensuring continuous system operation with accurate and consistent information. The platform is scalable, allowing it to support an increasing number of users without affecting performance. Security mechanisms are implemented to protect user data and prevent unauthorized access. The system is also designed for high availability, ensuring accessibility through standard web browsers at any time. Cross-browser compatibility is maintained to support different user environments, and the system architecture is structured to allow easy maintenance and updates by administrators.

Computational Resource Requirements

The hardware requirements for the system include a minimum Intel i3 processor or equivalent configuration, at least 8 GB of RAM, and a minimum of 100 GB hard disk storage to ensure smooth development and execution. On the software side, the system operates on Windows 11 as the primary operating system. The frontend is developed using HTML, CSS, JavaScript, and React, while the backend is implemented using Node.js. MySQL is used as the database management system to handle structured data efficiently. Visual Studio Code serves as the integrated development environment (IDE) for development activities.

Life Cycle Model

The Waterfall model has been selected for the development of the Telangana Entrance Exam Portal due to its structured and sequential nature, which aligns well with the clearly defined system requirements. This model ensures that each phase is completed thoroughly before progressing to the next stage, making it suitable for projects with stable and well-understood requirements. The development process begins with requirement analysis, where all system functionalities such as exam details, college information, notifications, authentication, and multilingual support are collected and documented in a structured format. This is followed by system design, where the overall architecture of the application is planned. The frontend is designed using React and Tailwind CSS, while the backend is developed using Node.js and Express.js, with MySQL serving as the database. The API structure and user interface components are also defined during this phase. In the implementation phase, the actual coding of the system is carried out. Frontend components for displaying exams, streams, and colleges are developed, while backend APIs are created to manage data flow and business logic. Database integration is performed using SQL queries, and features such as JWT-based authentication and notification services through web, email, and SMS are implemented. The testing phase ensures that all system functionalities operate correctly. Features such as exam filtering, user authentication, and notification delivery are verified, while API responses and database interactions are tested for accuracy and reliability. Any identified issues are resolved during this stage. In the deployment phase, the complete application is launched in a live environment, where the frontend, backend, and database are configured to work together seamlessly. Once deployed, the system becomes accessible to users with all functionalities fully operational.

Design

Architecture of the System

The architecture of the proposed system represents the overall structure of the Telangana Entrance Exam Portal and describes how different components interact with each other during request processing. It defines the flow of data between users, application layers, and the database, thereby providing a clear understanding of system organization. The architecture can broadly be categorized into two major types: software architecture and technical architecture.

Software Architecture

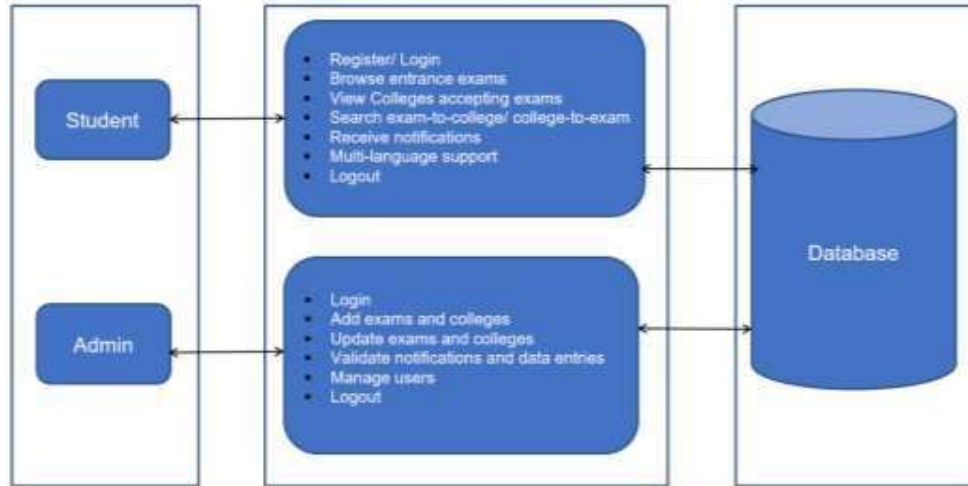


Fig 1 Software Architecture

The software architecture of the system illustrates the interaction between two primary user roles—Student and Admin—through a centralized database. Both roles access the system via a web-based application, but each performs distinct operations based on their responsibilities. The Student acts as the primary user of the platform, utilizing the system to explore entrance examinations and related academic information. Students can register and securely log in to the system, browse available entrance exams categorized by stream and level, and view colleges associated with specific examinations. They are also able to access important academic details such as application deadlines, syllabus information, application links, and result updates. In addition, students receive notifications through multiple channels, including web alerts, email, and SMS. The platform further enhances usability by supporting bilingual access in English and Telugu. All student activities are processed through and stored in the centralized database.

The Admin is responsible for managing the overall system content and ensuring data accuracy. Admin users can log in securely to add, update, or delete information related to entrance exams, colleges, and their relationships. They also manage user accounts and oversee notification dissemination. The admin plays a critical role in maintaining data integrity and ensuring that all information presented to students remains current and reliable. All administrative operations are recorded in the centralized database.

The Database serves as the core storage component of the system. It stores structured data related to users, exams, streams, levels, colleges, and notifications. It also maintains relational mappings between entities, enabling efficient retrieval and consistency of information across the platform. Every interaction from both student and admin interfaces is ultimately reflected in the database.

Technical Architecture

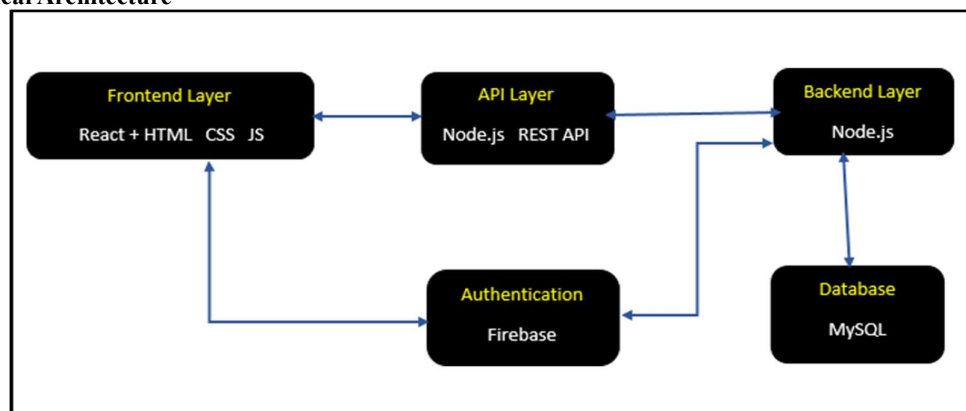


Fig 2 Technical Architecture

The technical architecture of the system defines how the application is implemented across multiple layers, including frontend, API, backend, authentication, and database layers.

The Frontend Layer is developed using React along with HTML, CSS, JavaScript, and Tailwind CSS. It provides a responsive and interactive interface for students to access exam-related information. The frontend allows users to browse exams, filter results based on streams and levels, view deadlines, and access syllabus and result

information. It also integrates multilingual support using react-i18next and manages authentication tokens using localStorage. Notifications are displayed through a dedicated interface component.

The API Layer is built using Node.js and follows RESTful principles. It acts as an intermediary between the frontend and backend systems. This layer receives client requests, forwards them to appropriate services, and returns structured JSON responses. It ensures consistent communication between different parts of the system.

The Backend Layer is developed using Node.js with Express.js framework. It handles core business logic, processes HTTP requests, and performs database operations. The backend manages CRUD operations for exams, colleges, and users, and executes SQL queries, including JOIN operations for relational data retrieval. It also secures routes using JWT-based authentication and supports notification services through email and SMS integration. The Authentication Layer ensures secure access to the system using JSON Web Tokens (JWT). After successful login, a token is generated and stored on the client side, which is then used to validate future requests to protected routes. The Database Layer is implemented using MySQL, which stores all structured data in relational tables. Key tables include users, levels, streams, exams, colleges, exam_colleges, and notifications. Relationships between these tables ensure efficient querying and maintain data consistency across the system.

Implementation

Technologies Used

The Telangana Entrance Exam Portal is implemented using a modern full-stack technology stack comprising HTML, CSS, JavaScript, React.js, Tailwind CSS, Node.js, Express.js, and MySQL. This combination enables the development of a scalable, responsive, and efficient web-based system that provides students with comprehensive academic information, including entrance exams, colleges, deadlines, and notifications.

The frontend is responsible for presenting data in an interactive and user-friendly format, while the backend manages application logic, authentication, and API communication. MySQL is used for structured data storage and ensures consistency and relational integrity across different modules.

HTML is used to structure web content, including exam listings, college details, and user interface components. CSS enhances the visual appearance of the system by providing layout styling, spacing, and responsiveness across devices. JavaScript introduces interactivity, enabling dynamic updates, form validation, and asynchronous API communication.

React.js is used to build a component-based frontend architecture, ensuring reusability and efficient rendering of UI components. Tailwind CSS is utilized for utility-first styling, allowing rapid development of responsive and modern interfaces.

On the server side, Node.js handles runtime execution and backend processing, while Express.js provides a lightweight framework for building RESTful APIs. MySQL serves as the relational database system that stores all application data, including users, exams, streams, colleges, and notifications.

Overall, this technology stack ensures high performance, scalability, maintainability, and an enhanced user experience.

Testing

Testing is a vital phase in the software development life cycle that ensures the correctness, reliability, and efficiency of the Telangana Entrance Exam Portal. It involves evaluating the system to identify defects, performance issues, and inconsistencies before deployment.

Since the application handles critical academic information such as entrance exams, colleges, deadlines, and notifications, accurate functioning is essential to prevent misinformation. The testing process verifies that all modules, including authentication, exam search, college mapping, and notification delivery, operate correctly. It also ensures accurate data retrieval from the database, proper API response formatting, and stable system performance under various user interactions.

Dimensions of Testing

Testing dimensions refer to different perspectives used to evaluate the quality and effectiveness of the software system. These dimensions ensure that the application is not only functionally correct but also efficient, reliable, and user-friendly.

Functional testing verifies whether all system features operate according to requirements, including user authentication, exam browsing, and college mapping. Performance testing evaluates system responsiveness, ensuring quick API responses and minimal loading delays. Usability testing focuses on user experience, ensuring that the interface is simple, intuitive, and easy to navigate.

Reliability testing ensures that the system operates consistently without failures over time. Accuracy testing verifies the correctness of displayed data such as exam dates, syllabus links, and college mappings. Compatibility testing ensures that the application functions properly across different browsers and devices.

Security testing ensures safe access to the system using JWT authentication and password encryption mechanisms, preventing unauthorized access. Maintainability testing ensures that the system can be easily updated, modified, and scaled with minimal effort.

Stages of Testing

The testing process is carried out in multiple stages. Unit testing focuses on individual components such as login APIs and database queries. Integration testing verifies the interaction between frontend, backend, and database systems. System testing evaluates the entire application workflow, including user navigation from login to exam and college selection. User Acceptance Testing (UAT) is conducted to ensure that the system meets user expectations and requirements.

Types of Testing

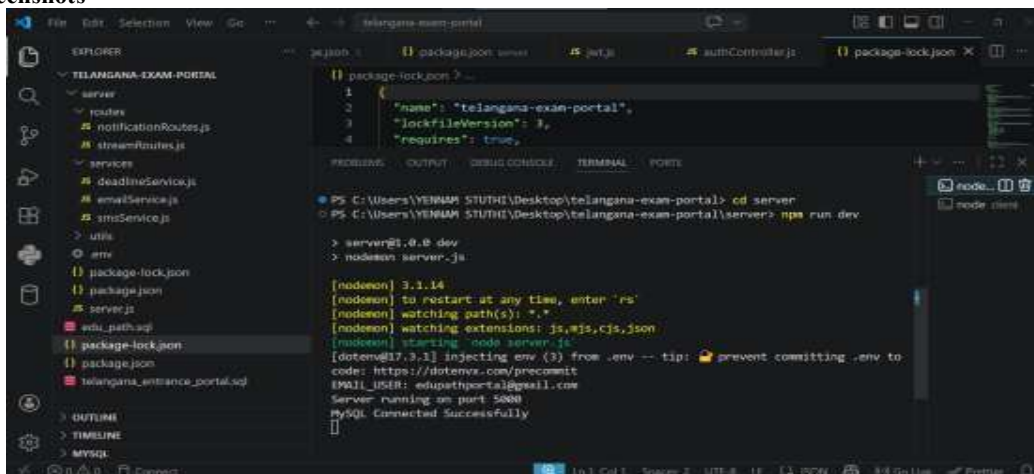
Various types of testing are applied to ensure system quality. Functional testing verifies core features such as login, registration, and data retrieval. Unit testing focuses on individual modules, while integration testing ensures proper communication between system components. System testing evaluates the complete workflow, and User Acceptance Testing ensures usability from the end-user perspective. Performance testing measures response time and system efficiency, while usability testing evaluates interface simplicity and user experience. Regression testing ensures that new updates do not affect existing functionality, and compatibility testing verifies cross-browser support.

Test Cases

The system was validated using multiple test cases covering authentication, data retrieval, navigation, and system functionality. User registration and login functionalities were tested with valid credentials, ensuring successful account creation and authentication. Admin login was verified to confirm secure access to administrative features. Navigation features were tested by checking the retrieval of levels, streams, exams, and colleges based on user selections. Multi-language switching between English and Telugu was validated to ensure dynamic UI updates. Notification functionality was tested to confirm proper display in the user interface.

API response format was verified to ensure consistent structured output, while database relationships were tested using JOIN operations to confirm correct data mapping. Finally, logout functionality was tested to ensure proper session termination and secure redirection to the login page.

Screenshots



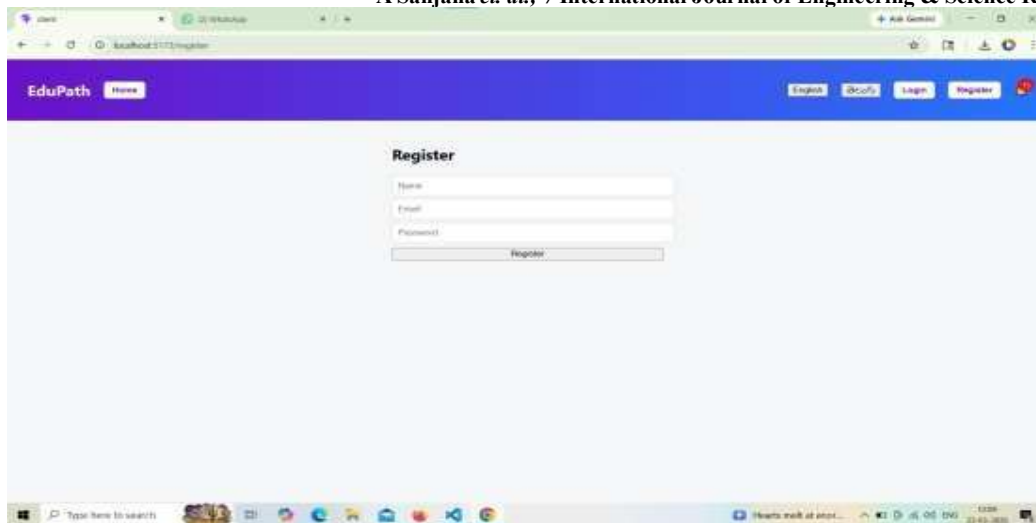
```

C:\Users\YENNAM STUTHI\Desktop\telangana-exam-portal> cd server
C:\Users\YENNAM STUTHI\Desktop\telangana-exam-portal\server> npm run dev

> server@1.0.0 dev
> nodemon server.js

[nodemon] 3.1.14
[nodemon] to restart at any time, enter `rs`
[nodemon] watching path(s): *.*
[nodemon] watching extensions: js,mjs,cjs,json
[nodemon] starting node server.js
[dotenv@17.3.1] injecting env (3) from .env -- tip: 🛑 prevent committing .env to code: https://dotenv.com/precommit
EMAIL_USER: edupathportal@gmail.com
Server running on port 5000
MySQL Connected Successfully
  
```

Fig 6.1: Run server terminal



The screenshot shows the 'Register' page of the EduPath website. The page has a blue header with the 'EduPath' logo and navigation links for 'Home', 'English', 'About Us', 'Login', and 'Register'. The main content area is white and contains a 'Register' form with fields for 'Name', 'Email', and 'Password', followed by a 'Register' button. The browser's address bar shows 'localhost:5173/register'.

Fig 6.3: Register Page



The screenshot shows the 'Login' page of the EduPath website. The page has a blue header with the 'EduPath' logo and navigation links for 'Home', 'English', 'About Us', 'Login', and 'Register'. The main content area is white and contains a 'Login' form with fields for 'Email' and 'Password', followed by a 'Login' button. The browser's address bar shows 'localhost:5173/login'.

Fig 6.4: Login Page



The screenshot shows the 'Apply Now' page for the Joint Entrance Examination (Main) on the website of the National Testing Agency (NTA). The page features a header with the NTA logo, the text 'Joint Entrance Examination (Main)', and the NTA logo. Below the header is a navigation bar with links for 'Home', 'About Us', 'Information', 'FAQ', 'Candidates' Corner', 'Archive', and 'Contact Us'. The main content area is divided into two columns. The left column, titled 'LATEST NEWS', contains a list of recent updates. The right column, titled 'INTRODUCTION', provides information about the NTA and the examination. The browser's address bar shows 'https://www.nta.ac.in/applynow'.

Fig 6.13: Apply Now Page



Fig 6.14: Multi Language Page

Conclusion

The Telangana Entrance Exam Portal has been developed to streamline the access to entrance examination details and college-related information by integrating all essential data into a single unified platform. The system effectively supports students in making well-informed and timely academic decisions by offering features such as exam-wise and college-wise search functionality, direct application links, important deadlines, syllabus access, and real-time result updates. In addition, the inclusion of multilingual support enhances accessibility for users with different language preferences, while the notification system ensures that students remain consistently updated with the latest information. Overall, the proposed system significantly improves the efficiency, convenience, and usability of the entrance exam information retrieval process, making it more organized and student-centric.

Future Scope

The future development of the Telangana Entrance Exam Portal can further enhance its functionality by introducing advanced and personalized features. One key improvement includes the implementation of user-specific dashboards that provide customized recommendations based on a student's academic stream, interests, and eligibility criteria. The system can also be extended with intelligent notification mechanisms that deliver real-time updates more efficiently. In addition, mobile application integration would increase accessibility and allow users to access information on the go. The incorporation of AI-based recommendation systems can further assist students in selecting suitable entrance exams and colleges. Moreover, the platform can be expanded beyond Telangana to include state-level and national-level entrance examinations, thereby transforming it into a more comprehensive educational information system with wider applicability.

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