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Final Year Exam Seating Arrangement System

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***Abstract*— Examinations are a critical part of any academic institution, and managing the logistics surrounding them especially seating arrangements can be a tedious and error-prone task if done manually. Traditional methods often involve spreadsheets, charts, and manual assignments, which can lead to inefficiencies, human errors, duplication of students, and conflicts in seating or supervisor allocation. This project, titled "Exam Seating Arrangement System", aims to automate and streamline the entire process of seating students and assigning supervisors for exams. The system is developed as a full-stack web application using Spring Boot for the backend and React.js for the frontend, with MySQL serving as the relational database. The backend is structured around RESTful APIs and adheres to a layered architecture, ensuring scalability and maintainability. The frontend is designed to be user-friendly and responsive, providing administrative staff with intuitive control over the entire examination layout process. This project aims to simplify the manual and error-prone process of allocating exam seats and assigning supervisors in educational institutions. Built with Spring Boot for backend and React.js for frontend, it provides an automated, scalable, and user- friendly interface for managing exams. One of the key features is its dynamic seating algorithm that adapts to the number of students, block capacities, and shifts.**

Keywords: Exam Seating Arrangement, Student Allocation, Automated System, MySQL, Invigilation Scheduling, Educational Management, Conflict-Free Scheduling, Academic Integrity

I.INTRODUCTION

In educational institutions, the process of allocating students to examination seats has traditionally been handled manually. This method is often time-consuming, error-prone, and inefficient—especially when dealing with large student populations across multiple departments and examination halls. Manual seating arrangements may lead to issues such as overlapping seat assignments, exam clashes, or supervisors being assigned to invigilate subjects they are teaching, which can raise fairness and transparency concerns **[1].**

To address these problems, automated exam seating arrangement systems are being adopted. These systems streamline the process by ensuring seat allocation is accurate, efficient, and in compliance with defined academic constraints. Automation helps in minimizing human error, reducing administrative workload, and improving transparency in invigilation duties **[1]**.

II. OBJECTIVE OF THE PROJECT

The primary goal of this project is to develop an efficient and intelligent Exam Seating Arrangement System that automates the process of allocating students and supervisors to examination rooms based on specific rules and constraints **[1]**.

Key objectives include:

- Automating the allocation of students to seats and blocks **[1]**.
- Preventing student duplication in the same shift on the same day **[1]**.
- Ensuring supervisors are not assigned to exams of the subjects they teach **[1]**.
- Providing an easy-to-use web interface for admins to manage exams, students, subjects, and seating **[1]**.

III. LITERATURE REVIEW

A literature survey is an essential part of any project development process. It involves the study and analysis of existing systems and research that are relevant to the problem being addressed. In the context of this project, the focus is on understanding how traditional and modern systems manage exam seating arrangements and identifying the gaps that still exist **[2]**.

This chapter highlights several existing approaches used in educational institutions, studies related to automated

systems, and the technologies involved. It also helps justify the need for the newly proposed system **[2]**.

IV. TRADITIONAL MANUAL SEATING SYSTEMS

Most educational institutions traditionally use manual seating arrangement methods, where administrators allocate students to blocks and seats using spreadsheets or paper charts. This approach has several limitations **[2]**:

- High human effort and time consumption
- Error-prone data entry
- Difficulty in maintaining records
- Lack of transparency and traceability
- No conflict validation mechanisms

Due to these limitations, manual systems are unsuitable for institutions with a large number of students and multiple exams scheduled simultaneously **[2]**.

V. EXAM MANAGEMENT SYSTEM – ERP MODULES

Large ERP systems like TCS iON, SAP Education, and Oracle PeopleSoft have exam management modules that automate part of the seating process. However, they are **[3]**:

- Often complex and require extensive training
- Not cost-effective for small and mid-size institutions
- Difficult to customize according to unique institutional rules (e.g., supervisor–subject conflict)

VI. WEB-BASED ACADEMIC EXAM TOOLS

Some educational tools provide simple exam scheduling and seating modules, such as **[3]**:

- *iExam* – A browser-based app for creating exam schedules
- *Smart Campus* – An online suite with exam and seat allocation features

From the survey of existing systems and research, it is evident that while there are several tools available for examination management, most fall short when it comes to customizability, real-time validations, and intelligent conflict checking [1].

This highlights the need for a system that is **[3]**:

- Lightweight yet powerful
- Rule-driven
- Built with modern technologies
- Easily usable by non-technical staff

Our proposed Exam Seating Arrangement System fills this gap by using Spring Boot, React, and MySQL, enabling efficient backend processing and a responsive frontend interface with built-in validation logic **[3]**.

VII. SYSTEM DESIGN

System design is a critical phase in software development that focuses on how the system will fulfill the functional and non-functional requirements. It translates user requirements into technical architecture and detailed diagrams that act as blueprints for the development process **[4]**.

DFD LEVEL 0

- DFD Level 0 (also known as context diagram) shows the system as one single process **[4]**.
- It provides a bird's-eye view of the system's interaction with external entities **[4]**.
- It helps stakeholders understand what data goes in and what comes out, without showing internal processes **[4]**.

This is a Level 0 Data Flow Diagram (DFD) of the Seating Arrangement System, also known as the Context Diagram. It provides a high-level overview of the entire system, showing how external entities interact with the system and how data flows between them **[4]**.

External Entities **(**Rectangles**)**

Admin

- The Admin is the primary controller of the system.
- Responsibilities:
  - Manage Exams – Add or update exam schedules.
  - Manage Blocks – Allocate available classrooms or blocks.
  - Manage Seating – Assign students to specific seats/rooms.
- Sends data to the system like exam schedules, block details, and student allocation information **[5]**.

User

- Represents students, faculty, or any user who wants to view the seating plan.
- Sends a request to view the plan.
- Receives the seating plan from the system as a result **[5]**.

Process **(**Circle**)**

Seating Arrangement System

- Core processing unit of the application.
- Functions:
  - Accepts inputs from Admin (exam, block, seating data)
  - Stores and retrieves data from the database
  - Generates seating arrangements based on availability and rules
  - Responds to users with relevant seating information
- Acts as a middle layer between users/admins and the backend database **[5]**.

Data Store (Open Rectangle)

Database

- Stores all important data:
  - Exam details
  - Block/classroom information
  - Student records
  - Seating plans
- Supports read and write operations from the system **[5]**.

Data Flows (Arrows)

Each arrow shows the direction and type of data flowing between the entities and the system **[5]**.

- Admin → Seating Arrangement System:
  Sends input like exam schedules, seating requests, or room availability.
- System → Database:
  Saves or retrieves seating-related data.
- User → Seating Arrangement System:
  Sends a request to view or download the seating plan.
- System → User:
  Returns the requested seating data to the user.
- Database → System:
  Provides stored seating data to the system when needed.

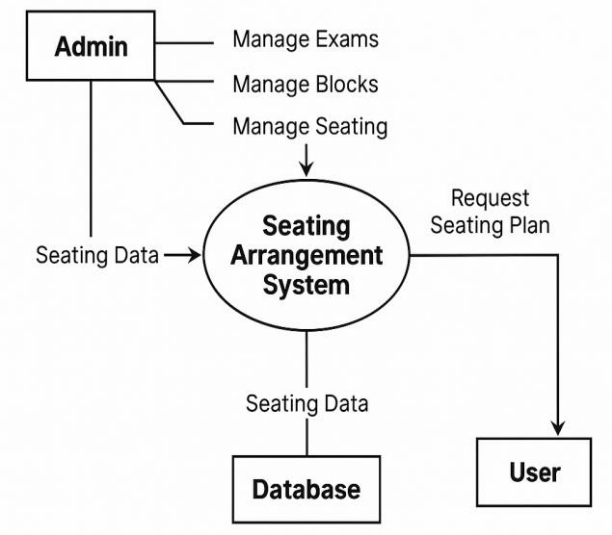


Fig 1:DFD Level 0

DFD LEVEL 1 (with Citations)

Level 1 expands the context-level DFD by showing sub-processes within the main system. It clearly demonstrates how data is processed, stored, and output **[6]**.

This is a Level 1 Data Flow Diagram (DFD) for your Exam Seating Arrangement System. It shows how data flows between the Admin, the main processes (functions), and the database**s** in the system **[6]**.

Entities (External Sources)

Admin

• The only external user interacting with the system at this level **[6]**.

• Responsible for:

- Managing exams
- Managing student data
- Assigning supervisors
- Generating the seating plan

Processes (Circles)

Each circle represents a major system function **[6]**:

- Manage Exams
  - • Admin inputs exam details (subject, date, time, etc.)
  - • These details are saved to the Exam DB
  - • Used later for generating the seating plan
- Manage Students
  - • Admin provides student details (name, roll number, course, etc.)
  - • These are stored in the Student DB
  - • Ensures accurate seat allocation
- Assign Supervisors
  - • Admin provides supervisor details (name, email, etc.)
  - • Stored in the Supervisor DB
  - • Linked during seating plan generation
- Generate Seating Plan
  - • Core process of the system
  - • Admin initiates it by sending a Generate Plan Request
  - • This process:
    - Fetches data from Exam DB, Student DB, and Supervisor DB
    - Generates an optimized seating plan
    - Stores the result in the Seating Plan DB
    - Sends the Seating Plan Report back to the Admin

Data Stores (Open-ended Rectangles)

Each represents a persistent database **[6]**:

1. Exam DB – Stores all exam-related information
2. Student DB – Stores student details required for seat allocation
3. Supervisor DB – Stores details of supervisors assigned for invigilation
4. Seating Plan DB – Stores generated seating plans (mapping students to rooms/seats)

Data Flows (Arrows)

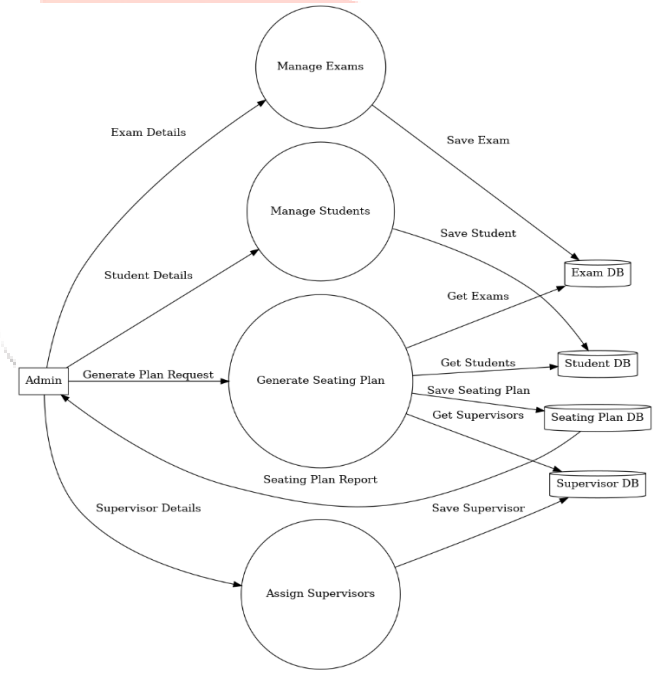
Each arrow represents a flow of data within the system **[6]**:

• From Admin to system (input actions)

• Between processes and databases

• From databases back to processes

• From system back to Admin (final results)



VIII. FUTURE SCOPE

the exam seating arrangement system, though fully functional in its current form, holds significant potential for future enhancements and scalability [7]. one of the primary areas of growth is the integration of biometric authentication for students and supervisors, enabling secure and automated attendance tracking during examinations [8].

Additionally, deploying the system on a cloud platform would support multi-campus institutions, allowing centralized data access and management [9]. A dedicated mobile application could be developed to provide real-time updates, seat location details, and notifications to students and supervisors [6].

Future versions may also include:

Interactive graphical seating maps

Advanced conflict detection algorithms

AI-driven optimization for block utilization and supervisor assignments [7]

Integration with academic ERP systems can automate data synchronization for courses, faculty, and students, reducing manual input errors [9]. Furthermore, implementing role-based access control (RBAC), multilingual support, and accessibility features would improve usability and security [9].

These enhancements would make the system more efficient, scalable, and user-friendly, ultimately serving as a comprehensive digital solution for examination management in educational institutions [7].

IX. CONCLUSION

The Exam Seating Arrangement System developed using Spring Boot (backend), React (frontend), and MySQL (database) has proven to be an efficient and reliable solution for automating the complex process of managing exam seating in educational institutions. By incorporating essential entities such as students, subjects, exams, supervisors, departments, and blocks, the system ensures accuracy, transparency, and fairness in the seating process. Special constraints, like preventing supervisors from overseeing exams of their own subjects and avoiding multiple exam allocations for a student on the same shift and day, enhance the system's practicality and trustworthiness.

The modular design, clear separation of frontend and backend responsibilities, and structured database support seamless performance, while the user interface ensures ease of use for both administrators and supervisors. The inclusion of features to eliminate data duplication and scheduling conflicts further enhances efficiency.

X. ACKNOWLEDGMENT

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