# Automatic Seating Arrangement and Supervision System for University Examinations

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**Abstract -** *Managing examinations in large institutions can be a challenging and time-consuming task. Supervisors must be assigned to ensure no conflicts, such as instructors overseeing students from their department. Manual methods are often inefficient and error-prone, requiring substantial administrative effort. To address these issues, we propose an Automated Seating Arrangement and Supervision System for University Examinations. This system utilizes a graph coloring algorithm to automate the allocation of supervisors, ensuring no teacher supervises their branch students, and assigns students to their respective exam slots. By streamlining reporting and automating notifications, the system improves operational efficiency, reduces paperwork, lowers manual effort, enhances accuracy, and simplifies the process while minimizing potential conflicts.*

***Key Words***: Seating Arrangement, Automated System, Graph Coloring.

## 1.INTRODUCTION

Efficient management of exam halls and seating arrangements is crucial for a smooth examination process in educational institutions. Manual methods for allocating seats and assigning supervisors are often time-consuming and prone to errors. Automating these tasks has become essential to enhance accuracy and streamline the process. Recent studies have explored various approaches and algorithms to develop systems that simplify and optimize exam management.

Pathari et al. developed a web-based system that generates comprehensive exam hall details, including class, exam time, date, and subject, enabling students to easily locate their examination halls. Nandhu Kishore et al. introduced an AI-powered authentication and automated seating system incorporating classifiers and AES (Advanced Encryption System), significantly improving the efficiency of exam management. Similarly, Adetona et al. addressed seating arrangement challenges using transparent programming techniques with PHP and JavaScript, integrating a graph-based seating generation module. Their approach aimed to optimize seating arrangements and reduce the potential for cheating during exams.

Anirban explored the complexities of exam seat allocation, emphasizing challenges arising from large student populations and diverse constraints related to subjects, rooms, and departments. To address these, three sequential algorithms were proposed to create an optimized seating plan. Inamdar and colleagues presented a model advocating for automation in seating allocation, considering factors like room layout and class size to maintain order during examinations. Similarly, Dhotre et al. developed an automated seating arrangement system to assign exam halls efficiently while managing supervisory duties, reducing reliance on manual effort and expediting exam preparation processes.

Proposed Work In this paper, we propose The Automatic Seating Arrangement and Supervision System for University Exams integrating both these approaches by automatizing the process of allotting center-seating arrangement and invigilator allocation with a Graph coloring technique. It caters to problems such as teacher-student relations and ineffective manual processes, ensuring that both students are allocated seats according to their exams, while supervisors follow suit.

## 2. LITERATURE REVIEW

Extensive research has been conducted on optimizing seat allocation in examination halls, reflecting the importance of this process in ensuring fairness and efficiency. Pathari et al. developed an online system for exam hall seating, which allowed students to access their seating details, including locations and answer script information, ahead of time. This system also included real-time updates, reducing the administrative workload and ensuring smooth operations during large-scale examinations.

Nandhu Kishore et al. proposed a model combining a classifier algorithm and AES for secure and efficient seat allocation. The AES ensured secure login and user authentication, while the classifier facilitated accurate seat assignment. This method enhanced both operational efficiency and security, addressing common challenges in manual seating processes.

Adetona et al. tackled the issue of cheating, particularly via observable seating arrangements, by employing a Harmony Search Algorithm (HSA). Their system, built using PHP and JavaScript, strategically assigned seats to prevent students from sitting near peers taking the same course. This web-based approach improved exam integrity and addressed challenges related to proximity-based collusion.

Anirban focused on automating seating arrangements for large student populations with complex requirements. By utilizing three sequential algorithms, the system efficiently generated seating plans that adhered to spatial and scheduling constraints. This approach reduced unused space, improved time efficiency, and demonstrated the effectiveness of automation for large-scale examination setups.

The authors proposed an automated seating system that takes into account factors such as room layout, number of students, and seating capacity to create a structured and organized examination environment. By utilizing parameters like class size, room orientation, and bench availability, the system ensures optimal space utilization and minimizes the preparation time required for large institutions.

Dhotre et al. introduced a two-module system comprising Student Seating Arrangement and Supervision Duties Allocation. This system automates the assignment of examination halls and invigilators, significantly reducing the manual effort involved in exam preparation. The solution is scalable and can be adapted to meet the needs of various institutions, enhancing both efficiency and accuracy in the process.

## 3. PROPOSED SYSTEM

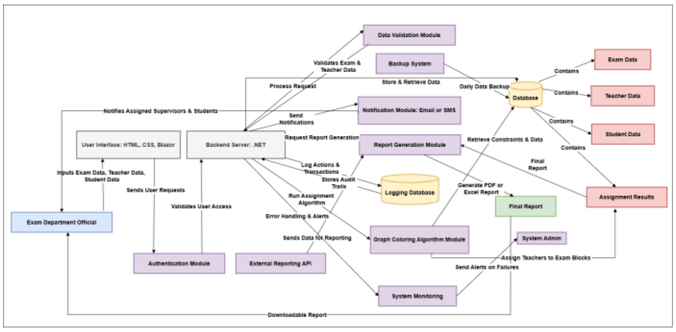


**Fig -1**: Proposed System Architecture

The Automatic Seating Arrangement and Supervision System for University Exams aims to streamline the complex processes associated with exam management in academic institutions. It addresses challenges such as scheduling conflicts, manual data entry errors, and the extensive administrative workload involved in organizing exams.

The system's architecture integrates several components: data input, validation, processing, storage, and report generation. These elements work together to provide a unified interface for exam officials and students. The user interface, designed with HTML, CSS, and Blazor, offers a simple and secure platform for entering exam schedules, teacher availability, and student details, ensuring access is restricted to authorized users.

The backend server, built on ASP.NET, functions as the system's core, facilitating communication between components, validating inputs, running assignment algorithms, and managing data storage and retrieval.

A key feature of the system is the Graph Coloring Algorithm Module, which optimizes supervisor assignments by modeling exam blocks and teacher allocations as graph vertices and edges. This ensures that no teacher supervises their students, minimizing conflicts and maximizing efficiency.

All data, including exam schedules, teacher and student details, and supervisor assignments, is stored in a relational database (e.g., MySQL or Excel-based), providing a reliable and easily accessible record for future reference.

The system incorporates a Data Validation Module to ensure all input criteria are met and to prevent conflicts related to student assignments. Once the assignments are finalized, the Report Generation Module creates detailed reports on seating arrangements and supervisor allocations, available for download in PDF or Excel formats. Following report generation, the Notification Module automatically informs students and supervisors of their assigned exam room, date, and time.

To enhance reliability, a Monitoring and Error Handling Module alerts administrators to any system errors, allowing for prompt resolution. For added data security and integrity, the system supports optional external connections to backup systems and reporting APIs. Daily backups safeguard data, while the reporting API enables integration with external platforms.

This modular, secure, and scalable architecture effectively automates the allocation of exam supervisors and seating arrangements. It minimizes manual labor and human error, providing an organized and efficient examination process that benefits all stakeholders involved.

## 4. METHODOLOGY

The development of the Automated Seating and Supervision System for University Exams follows a structured methodology that includes requirements analysis, system design, algorithm implementation, and comprehensive testing. This process aims to address the issues related to manual scheduling, supervisor allocation, and seating arrangements in educational institutions.

During the Requirements Analysis phase, input is gathered from key stakeholders, such as exam department officials and IT staff, to determine the system's essential features. These include automated supervisor assignments, secure data handling, real-time report generation, and notifications for both students and supervisors. Constraints are identified, including the requirement that teachers cannot supervise students from their department, and students must be properly seated within their assigned exam blocks.

The system design follows a modular approach to ensure scalability and flexibility. Key components include a User Interface (UI) for data entry, a Background Server for data processing, a Database for storing important information, a Graph Coloring Algorithm Module for optimizing supervisor assignments, and Report Generation and Notification Modules for real-time updates. An Authentication Module controls access to the system, ensuring security while logging mechanisms track all system actions for accountability. This modular architecture ensures seamless communication between components to meet all system requirements.

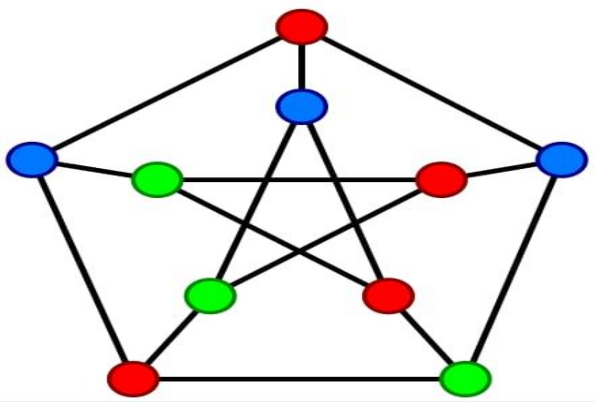

**Fig -2**: Graph Coloring Universal Diagram

The Graph Coloring Algorithm is crucial for assigning supervisors. It models exam blocks and teachers as vertices in a graph, where edges represent constraints, such as avoiding teachers supervising their department. This algorithm ensures that each supervisor is assigned to an exam block without conflicts in timing, optimizing resource allocation and meeting all specified requirements.

Algorithm:-

Step 1: [Initialize] Set i = 0.

Step 2: [Next vertex] Increment i. If i = n + 1, terminate with f as the result.

Step: 3: [Find the colors N(vi)] Compute the set C = j<i f(vj) of colors already assigned to the neighbors of vi.

Step 4: [Assign the smallest available color to vi] For increasing c = 1,2,..., check whether c ∈ C. If not, set f(vi) = c and return to Step G2.

The entire system is integrated, ensuring that components interact smoothly with the database. Input data, including exam schedules, teacher details, and student information, are efficiently managed and linked to the algorithm module, validated, and processed to generate the final assignments. The Report Generation Module compiles seating and supervisor assignments into structured formats like PDF or Excel, while the Notification Module sends automatic SMS or email notifications to inform students and supervisors of their assignments.

In the final Testing and Evaluation phase, the system undergoes rigorous testing to ensure it meets both functional and non-functional requirements. Functional testing checks that all components work as intended, from data entry to supervisor assignment and report generation. Performance testing evaluates the system's responsiveness and ability to handle multiple users simultaneously, while security testing ensures the integrity of the authentication module and data protection. The system is then compared to manual methods to demonstrate its improvements in efficiency, accuracy and reduced administrative workload.

## 5. CONCLUSIONS

In this paper, the Automated Seating and Supervision System for University Exams offers a constructive approach to addressing key shortcomings in the existing literature on exam hall management and supervisor allocation. Studies by Pathari et al. and Nandhu Kishore et al. highlight the need for web-based systems to streamline seating arrangements and supervisor allocation, reducing manual intervention and improving security. However, challenges persist, including the need for scalable algorithms for seating arrangements, resolving conflicts in supervisor assignments, and ensuring data security.

While Adetona et al. and Anirban explored algorithms such as graph coloring and Harmony Search to address exam hall issues like "giraffing" and seating conflicts, these solutions often lack integration with real-time notifications and automated reporting features.

Building on these findings, our system integrates a graph coloring algorithm for conflict-free supervisor assignments and reduces errors from previous methods. It employs a modular architecture that ensures secure data management, real-time notifications, and automated report generation. This solution aims to provide a comprehensive approach to seating and supervisor management, reducing administrative burdens and improving the overall examination process. The system's effectiveness will be further validated through future implementation and testing, demonstrating its potential as a scalable solution for larger educational institutions.

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