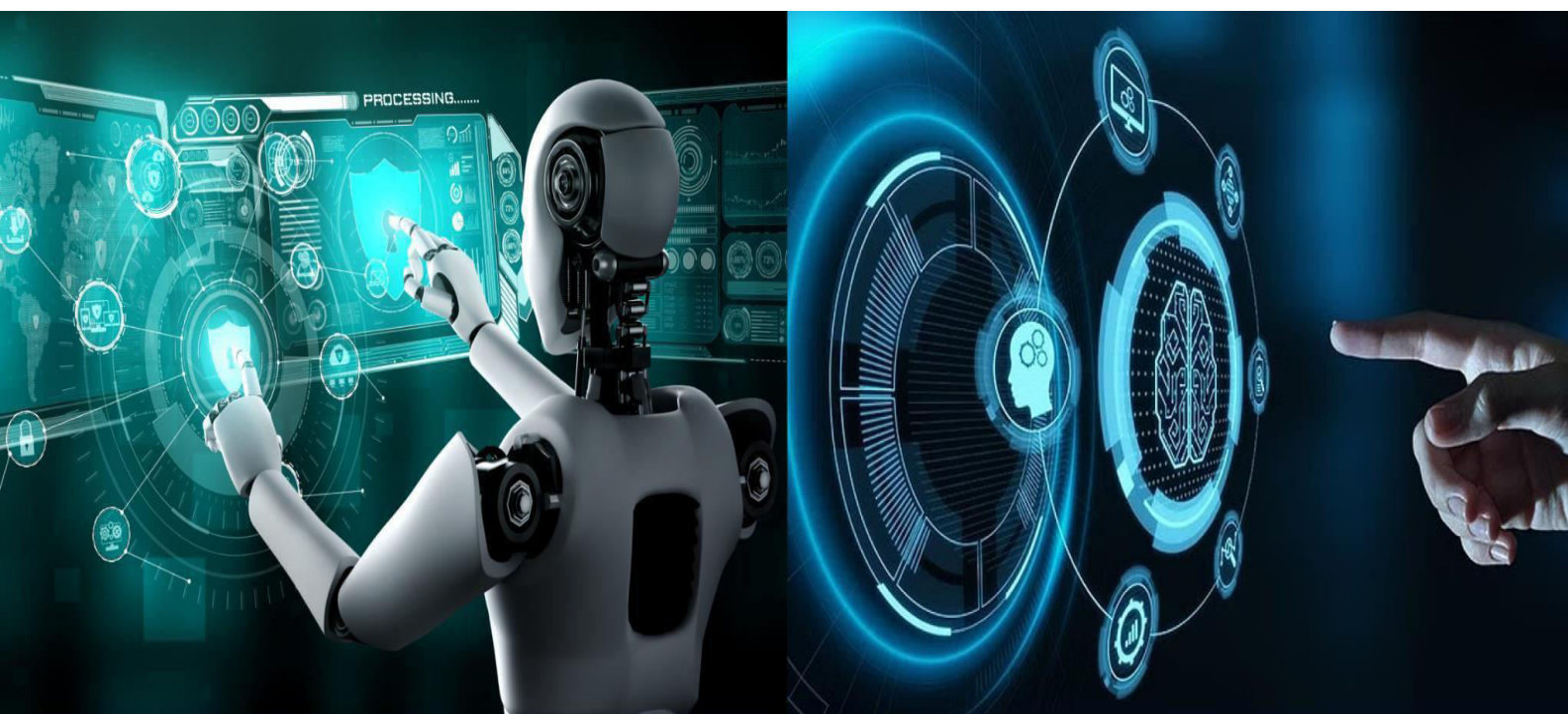


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International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCCE)

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Intelligent Exam Hall Navigation System using Roll Number and Digital Twin

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ABSTRACT: Efficient examination seating management is essential for academic institutions, as traditional manual practices often result in confusion, administrative delays, and allocation errors. This paper presents a Digital Twin-based Exam Hall Seating System designed to create a virtual representation of examination halls and dynamically allocate seats to students. By querying their roll number, students can immediately identify their assigned seat within the digital layout, thereby improving clarity and minimizing human error. The proposed system integrates seat allocation algorithms, hall capacity mapping, and an interactive visualization that highlights the exact seat location. Additional functionalities include exam hall identification, automated seat arrangement, and mark entry, with provisions for handling blocked or defective seats and generating printable seating layouts for invigilators. The digital twin framework ensures real-time synchronization between physical seating arrangements and their virtual counterpart, enabling transparent and adaptable management. This work demonstrates the applicability of digital twin technology beyond industrial domains, extending its utility to educational administration.

The system contributes to operational efficiency, fairness in seat allocation, and improved student experience. Furthermore, the approach offers scalability across institutions and examination types, highlighting the potential of digital twins as a transformative tool for smart academic management.

KEYWORDS: Digital Twin, Examination Seating System, Exam Hall Navigation, Seat Allocation Algorithm, Roll Number Mapping, Academic Administration, Smart Campus Systems

I. INTRODUCTION

Efficient management of examination seating is a critical task for academic institutions. Manual methods of seat allocation and hall arrangement often result in confusion, misallocation, and administrative inefficiencies. Furthermore, students frequently encounter ambiguity regarding their assigned seating, while invigilators face challenges in monitoring hall capacities and handling seat related issues. Recent advances in Digital Twin technology provide opportunities to address these challenges by creating a virtual counterpart of physical environments. This paper introduces a Digital Twin based Exam Hall Seating System that replicates examination halls, dynamically allocates seats, and enables real-time seat visualization. The system improves operational efficiency, reduces human error, and enhances transparency in academic administration.

The main contributions of this paper are:

1. A digital twin framework for representing examination halls and seating layouts.
2. Seat allocation algorithms integrated with hall capacity mapping.



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3. Functional extensions including hall identification, automated seat arrangement, and mark entry.
4. A synchronized digital–physical seating management approach for educational institutions.

II. LITERATURE SURVEY

2.1 TITLE: The Effectiveness of a Digital Twin Learning System in Assisting Engineering Education Courses: A Case of Landscape Architecture

AUTHOR: J. Zhang, J. Zhu, W. Tu

YEAR: 2024

DESCRIPTION:

To mitigate those issues, a whole lot of computer aided examination seating structures have emerged, many harnessing internet technologies to enhance automation and consumer accessibility. Earlier implementations had been in large part desktop primarily based totally gear targeted on static seat assignment.

2.2 TITLE: Algorithm for Efficient Seating Plan for Centralized Exam System.

AUTHOR: P. K. Chaki and S. Anirban YEAR: 2016

DESCRIPTION:

Examination seating control has traditionally relied on manual methods such as printed lists and spreadsheets, which are inefficient, error-prone, and difficult to scale for large student populations. Studies consistently report issues including seat duplication, last-minute conflicts, and reduced transparency for both students and administrators.

2.3 TITLE: Digital Twin: Benefits, use cases, challenges, and opportunities.

AUTHOR: M. Attaran and B. G. Celik YEAR: 2023

DESCRIPTION:

Latest answers make use of full-stack internet frameworks—consisting of React, Node.js, and MongoDB—to allow real-time seat allocation updates and interactive consumer interfaces.

EXISTING SYSTEM:

Manual seating systems rely on paper-based charts or spreadsheets, which are prone to errors during seat allocation and updating. Although computerized allocation using legacy tools improved digitization by generating seat lists, these systems lack hall-level visualization and do not support dynamic updates for blocked or unavailable seats. Additionally, they offer limited functional support for invigilators, reducing their effectiveness in managing examinations efficiently.

Disadvantages:

- High administrative workload, as significant manual intervention is required for seat allocation, updates, and conflict resolution.
- The absence of transparency prevents students from easily accessing clear and timely information about their seating arrangements, often leading to confusion and repeated inquiries.
- The systems lack scalability, making them ineffective for managing examinations conducted simultaneously across multiple halls or large student populations.

III. PROPOSED SYSTEM

The system creates a virtual replica of examination halls that remains synchronized with real-time conditions. A seat allocation algorithm is used to assign students in a fair and efficient manner. The web-based user interface, developed using React, allows students to easily query their seating details. In addition, the system includes functional modules for seat arrangement, mark entry, and printing, supporting comprehensive examination management.

Advantages

- Seat Allocation Accuracy stays fundamental in both, however the proposed gadget is higher located for destiny enhancements.
- Real-time Updates and Hall Visualization are absent with inside.
- Blocked/Defective Seats can now be controlled automatically, in contrast to the guide managing with inside the present gadget.
- Invigilator Support is more advantageous with automatic plans and clean instructions.
- Student Transparency is substantially stepped forward via stay seat maps and on-line access. Administrative Effort is

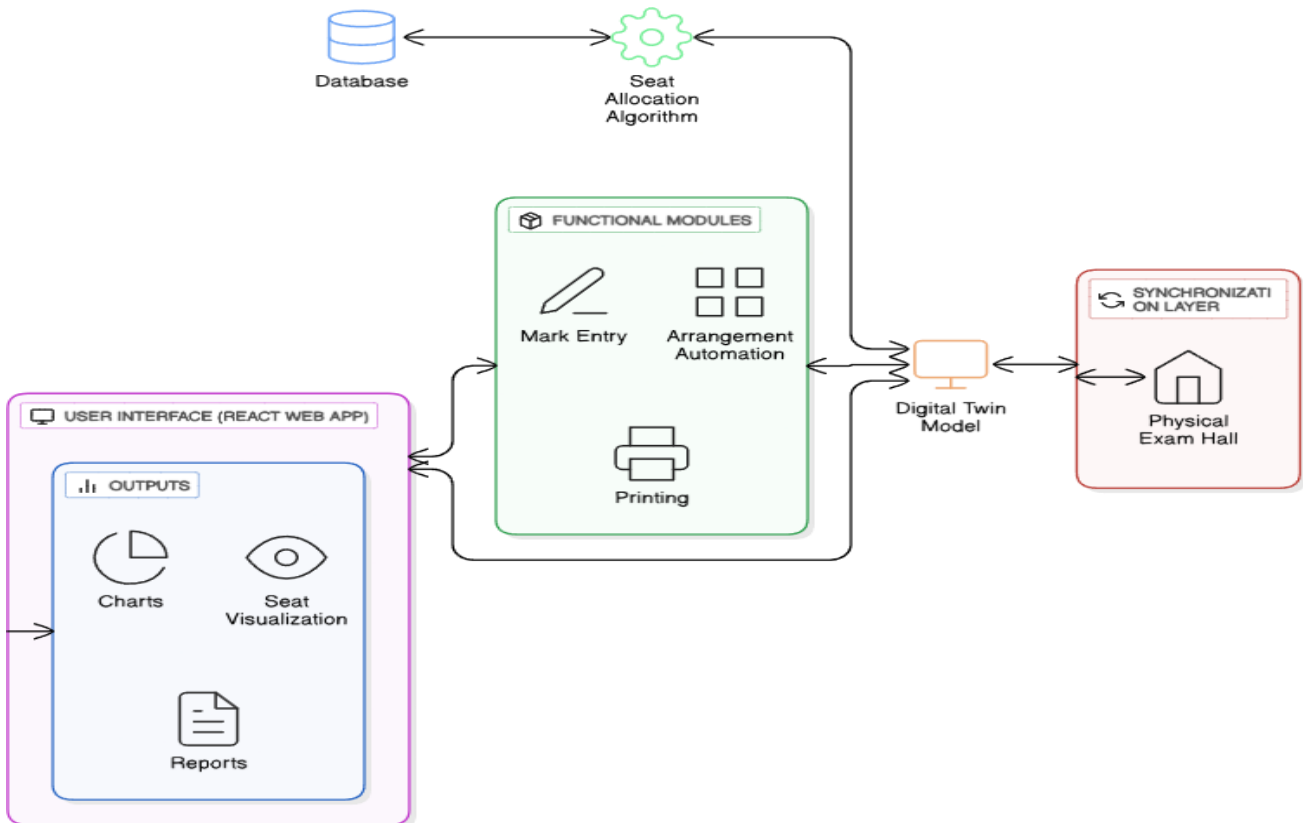


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significantly decreased because of automation and intuitive interfaces.

- Scalability throughout a couple of halls is absolutely supported with inside the proposed gadget, in contrast to the confined potential of cutting-edge method.



IV. CONCLUSION

This paper offered a Digital Twin—primarily based totally Exam Hall Seating System that complements transparency, fairness, and operational performance in educational exam control. The device integrates a virtual reproduction of exam halls, a seat allocation algorithm, and a web-primarily based totally consumer interface to dynamically map scholar roll numbers to seats. By permitting real time seat visualization and synchronization with bodily corridor conditions, the proposed answer minimizes confusion, reduces administrative workload, and guarantees equitable seat distribution. Functional modules consisting of computerized seat arrangement, portal entry, and invigilator printing similarly enlarge the devices sensible utility. Future paintings will cognizance on numerous directions. First, the combination of biometric authentication can beef up protection and save you impersonation at some stage in examinations. Second, the improvement of a cellular utility interface will enhance accessibility and value for each college students and administrators. Finally, the incorporation of predictive analytics for corridor potential optimization can help establishments in proactively handling sources and enhancing scheduling performance. Collectively, those extensions will allow the device to adapt right into a complete clever exam control platform, demonstrating the broader applicability of virtual dual generation with inside the training sector. Furthermore, to enhance scholar orientation and decrease delays or confusion at the day of the examination, we advocate the mixing of a navigation map gadget in the platform. This function will permit college students and invigilators to visually find the assigned examination corridor in the campus via an interactive campus map interface.

V. FUTURE ENHANCEMENT

Future work will focus on several directions. First, the integration of biometric authentication can strengthen security and prevent impersonation during examinations. Second, the development of a mobile application interface will



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improve accessibility and usability for both students and administrators. Finally, the incorporation of predictive analytics for hall capacity optimization can assist institutions in proactively managing resources and improving scheduling efficiency. Collectively, these extensions will enable the system to evolve into a comprehensive smart examination management platform, demonstrating the wider applicability of digital twin technology in the education sector.

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Android Malware Detection using Machine Learning

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Fake News Detection System Using Machine Learning

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Smart Fall Alert System for Seniors

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Control Robotic Car by Mind Wave in IOT Network Using Solar Energy Harvesting Method

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Effectiveness of Computer Technology in Education System for Social Science

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Hospital Management System

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Fraud Detection on Bank Payment

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Generative AI for Code Repair & Optimization

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Hybrid Recommendation System for Spotify using Content-Based Filtering and Collaborative-Based Filtering

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Bias Checker AI Web Application: A Framework for Identifying Bias in AI Models

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Weather Data Analysis and Temperature Prediction using Machine Learning

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AI Assistant for Groundwater Insights

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Intelligent Behavioral Cyber Lock – Securing Apps through user Behavior

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AI Based Solar Powered Agricultured E Vehicle

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Solar Powered Energy Harvesting Equipment

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21

**IOT Based Electric Vehicle Energy Consumption Predicting
Device**

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Smart AI and IOT Based Grass Maintenance System

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UPI Fraud Detection using Machine Learning

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AI-Powered Travel Itinerary Generator

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**Smart Air Quality Analytics and Visualization System using API
Integration**

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Neurophage Sentinel – Adaptive AI Honeypot System

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**Artificial Intelligence Based Traffic Control for Edge Computing
Assisted Vehicle Networks**

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Quantum-Resistant Cyber Security Apparatus

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**Intelligent System for Digital Image Forgery Detection using
ML and AI**

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**Novel Quantum Computing Architectures for Enhanced
Computational Efficiency: A Hybrid Classical-Quantum
Approach**

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**Lung Sound Classification for Respiratory Disease by using
CNN-LSTM**

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