IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

## IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 5, May 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | A Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 5, May 2024 ||

| DOI: 10.15680/IJIRCCE.2023.1205054 |

# Systematic Approach to Optimal Seating Arrangement for Centralized Exams

S. Anjali[1], P. Navaneethakrishnan[2] , D. Akshaya[3], S. Bharathi[4], R. Noliofernisha[5]

Final year, ECE, Sir Isaac Newton College of Engineering and Technology, Pappakovil, Nagapattinam, India[1,3-5]

Assistant Professor, ECE, Sir Isaac Newton College of Engineering and Technology, Pappakovil, Nagapattinam, India[2]

**ABSTRACT:** Real-world data from various exam scenarios were utilized to implement and validate the algorithm's effectiveness. Results indicate substantial improvements in seating efficiency, decreased administrative burden, and enhanced overall exam experiences for both candidates and administrators. This project provides a practical solution to the complex task of seating configuration in centralized exam centres, offering a valuable resource for educational institutions, testing agencies, and exam administrators. By optimizing resource allocation and streamlining logistics, the algorithm facilitates seamless exam conduct, ultimately enhancing the integrity and effectiveness of centralized assessment processes**.**

**KEYWORDS**: Optimization, Seat Allocation, Algorithm, logistics

## I. INTRODUCTION

In the real time of education, the administration of centralized examinations poses a myriad of logistical challenges, with one of the most critical being the strategic configuration of seating arrangements within examination centres. The efficient allocation of seats not only ensures the smooth conduct of examinations but also plays a vital role in maintaining integrity, security, and fairness throughout the testing process. The "Strategic Seating Configuration Algorithm for Centralized Examination Centres" addresses this challenge by offering a sophisticated solution designed to optimize seating layouts systematically. This algorithmic approach aims to streamline the allocation of seats while considering various factors such as space constraints, candidate preferences, and security protocols. By employing advanced computational techniques, this project seeks to revolutionize the traditional manual methods of seating arrangement, offering educational institutions and examination boards a reliable tool to enhance the overall management and execution of centralized examinations. In this project, we delve into the intricacies of the algorithm, exploring its design, implementation, and potential impact on the efficiency and integrity of centralized examination systems. Through rigorous testing and validation, we aim to demonstrate the efficacy and reliability of our strategic seating configuration algorithm in real-world examination scenarios. This introduction sets the stage for a comprehensive exploration of the algorithm, highlighting its significance in addressing the complex logistical challenges inherent in centralized examination administration.

Centralized examination centres are often faced with significant logistical challenges when it comes to seating arrangements. Traditional manual methods of assigning seats can be time-consuming, error-prone, and may not fully optimize the available space within examination halls. Moreover, ensuring fairness, security, and accessibility for all candidates adds further complexity to the seating allocation process. Key issues associated with current seating configuration practices include:

- Inefficiency: Manual allocation of seats is labour-intensive and time-consuming, often resulting in suboptimal seating layouts that do not fully utilize the available space.
- Error Prone: Human error in seat assignment can lead to discrepancies, such as double-booked seats or candidates assigned to incorrect locations, causing confusion and disruptions during examinations.
- Fairness and Security Concerns: Ensuring fairness and preventing cheating requires careful consideration of factors such as candidate proximity, visibility of examination materials, and adherence to security protocols, which may be challenging to achieve using manual methods.
- Scalability: As the number of candidates and examination centres grows, managing seating arrangements becomes increasingly complex, necessitating a scalable solution capable of handling large volumes of data efficiently.
- Candidate Preferences: Accommodating candidate preferences, such as special accommodations or seating arrangements for candidates with disabilities, adds an additional layer of complexity to the seating allocation process.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | A Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 5, May 2024 ||

| DOI: 10.15680/IJIRCCE.2023.1205054 |

Addressing these challenges requires a strategic approach that leverages computational algorithms to optimize seating configurations, ensuring efficient use of space, fairness, security, and adherence to candidate preferences. The development of a "Strategic Seating Configuration Algorithm for Centralized Examination Centres" aims to tackle these pressing issues by offering a systematic and efficient solution to the complex problem of seating arrangement in centralized examination environments.

## II. SEATING TYPE

There are no fixed rules for exam seating. Different institutions follow the different seat allocation methodology in exam based on the number of students, capacity of seats, environment, and exam type. For all close book written and MCQ exam authority tries to confirm a minimum distance of the students of the same subjects. Mostly two types of seating methodologies are used for exam seating where the room is rectangular or square.

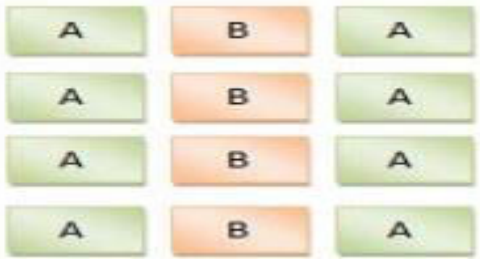


Fig 1: Exam Seating Type

In this seating methodology, students of the same subject are not allowed to nearest column, and they are allowed to the nearest row. At least one column distance is confirmed between two columns having same subject students

## III. SYSTEM DESCRIPTION

The "Strategic Seating Configuration Algorithm for Centralized Examination Centres" is a comprehensive software system designed to automate and optimize the process of seating arrangement within centralized examination centres. This system incorporates advanced computational techniques to strategically allocate seats, taking into account various factors such as space constraints, candidate preferences, fairness, and security considerations.

*Key Components:*

A. Input Module: The system begins by collecting relevant input data, including the number of candidates, examination hall layout, special accommodations requirements, and any security protocols that need to be enforced during the examination.

B. Seating Optimization Algorithm: The core component of the system is the strategic seating optimization algorithm. This algorithm utilizes mathematical optimization techniques, such as linear programming or genetic algorithms, to systematically allocate seats in a manner that maximizes space utilization while adhering to specified constraints and objectives.

C. Fairness and Security Module: To ensure fairness and security, the system incorporates algorithms that consider factors such as candidate proximity, visibility of examination materials, and adherence to security protocols. Additionally, the system can detect and mitigate potential cheating behaviours by strategically positioning invigilators and monitoring candidate activity during the examination.

D. Candidate Preferences Management: The system provides functionality to accommodate candidate preferences, such as special accommodations for candidates with disabilities or specific seating arrangements requested by candidates. These preferences are integrated into the seating optimization process to ensure equitable treatment of all candidates.

E. Output Module: Once the seating arrangement is optimized, the system generates detailed seating plans for examination halls, including seating assignments for each candidate. These plans can be easily accessed and distributed to examination administrators, invigilators, and candidates to facilitate smooth conduct of the examination.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | A Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 5, May 2024 ||

| DOI: 10.15680/IJIRCCE.2023.1205054 |

## IV. PROJECT OVERVIEW

Our project aimed to develop a web application that provides users with [briefly describe the purpose of your application]. The objectives included building a responsive and user-friendly interface, implementing secure authentication, and ensuring seamless interaction with a MongoDB database. The scope of the project covered front-end development using Express.js, back-end logic with Node.js, database management with MongoDB, and deployment on AWS.

**Technologies Used**

- Language: Node.js
- Front-end Framework: Express.js
- Back-end Language: Node.js
- Database: MongoDB
- Cloud Server: AWS (Amazon Web Services)

**System Architecture**

The system architecture follows a client-server model. The client-side is implemented using HTML, CSS, and JavaScript with Express.js for server-side rendering. The server-side logic is developed with Node.js, providing RESTful APIs for client-server communication. MongoDB serves as the database to store and retrieve application data.

1) Front-end Design
   We adopted a Model-View-Controller (MVC) architecture for the front-end design. Express.js handles routing and middleware, while views are rendered using template engines such as EJS or Handlebars. Client-side interactions are managed through JavaScript, providing a seamless user experience. Back-end Design

2) Back end Design
   The back-end design emphasizes modularization and separation of concerns. Express.js routes are organized based on RESTful principles, enabling easy maintenance and scalability. Middleware functions handle authentication, input validation, and error handling, ensuring the security and reliability of the application.

3) Database Design
   MongoDB is used as the NoSQL database for its flexibility and scalability. The database design includes collections for storing user profiles, authentication tokens, and application data. Data relationships are established using references or embedded documents, optimizing query performance and data retrieval.

**Implementation**

1) Development Environment Setup
   To set up the development environment, Node.js and MongoDB were installed locally. Express.js was initialized to scaffold the project structure, and necessary dependencies were added using npm. Development tools such as Visual Studio Code and Postman were utilized for code editing and API testing, respectively.
2) Front-end Implementation
   Front-end features were implemented using Express.js for server-side rendering. HTML templates were created using EJS, and CSS stylesheets were applied to enhance the visual appeal. Client-side interactions were handled using JavaScript, with AJAX requests for asynchronous data retrieval and form submission.
3) Back-end Implementation
   The back-end functionality was implemented with Node.js, leveraging Express.js for routing and middleware. RESTful APIs were designed to handle CRUD operations for different resources, including user authentication, data manipulation, and error handling. Security measures such as encryption and input validation were implemented to protect against common vulnerabilities.
4) Database Implementation
   MongoDB was integrated into the project using Mongoose, a Node.js library for MongoDB. Database schemas were defined to model the application data, including user profiles, sessions, and content. CRUD operations were implemented to interact with the database, ensuring data consistency and integrity.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | A Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 5, May 2024 ||

| DOI: 10.15680/IJIRCCE.2023.1205054 |

**Deployment**

1) AWS Setup
   The application was deployed on AWS using Elastic Beanstalk, a Platform-as-a-Service (PaaS) offering. An EC2 instance running Node.js was provisioned, and MongoDB Atlas was used as the managed database service. AWS services such as Route 53 for DNS management and CloudWatch for monitoring were configured to ensure the reliability and scalability of the deployment.
2) Deployment Pipeline
   A deployment pipeline was set up using AWS CodePipeline for automated testing and deployment. Continuous Integration (CI) and Continuous Deployment (CD) practices were followed to streamline the development workflow. GitHub repositories were integrated with CodePipeline, triggering builds upon code commits and facilitating seamless deployment to the AWS environment.

**Testing**

1) Unit Testing:
   Unit tests were implemented using Jest, a JavaScript testing framework, to validate individual components and functions. Test suites were created to cover critical aspects of the application, including route handlers, middleware, and utility functions. Mocking and stubbing techniques were employed to isolate dependencies and simulate different scenarios.
2) Integration Testing
   Integration tests were conducted to verify the interactions between different modules and components of the application. End-to-end testing was performed using tools like Selenium or Cypress to simulate user interactions and validate the overall functionality. Continuous testing practices were adopted to identify and address issues early in the development lifecycle.
3) User Acceptance Testing
   User acceptance testing (UAT) was conducted with stakeholders and end-users to gather feedback on the application's usability and functionality. Test scenarios were defined based on user stories and requirements, and feedback was collected through surveys, interviews, or usability testing sessions. Iterative improvements were made based on the feedback received to enhance the user experience.

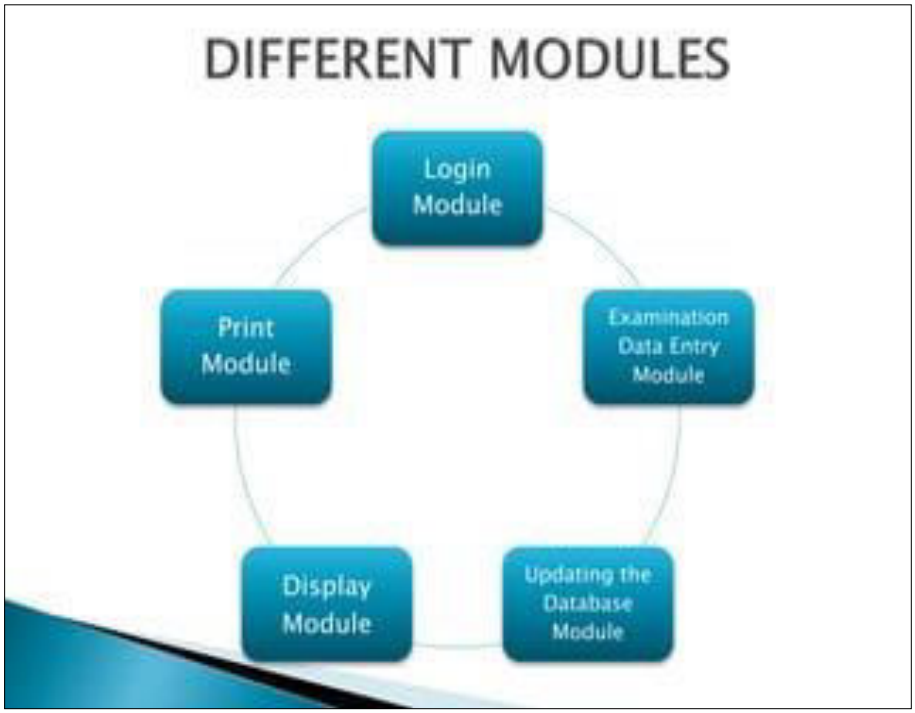


Fig 2: Different Module

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | A Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 5, May 2024 ||

| DOI: 10.15680/IJIRCCE.2023.1205054 |

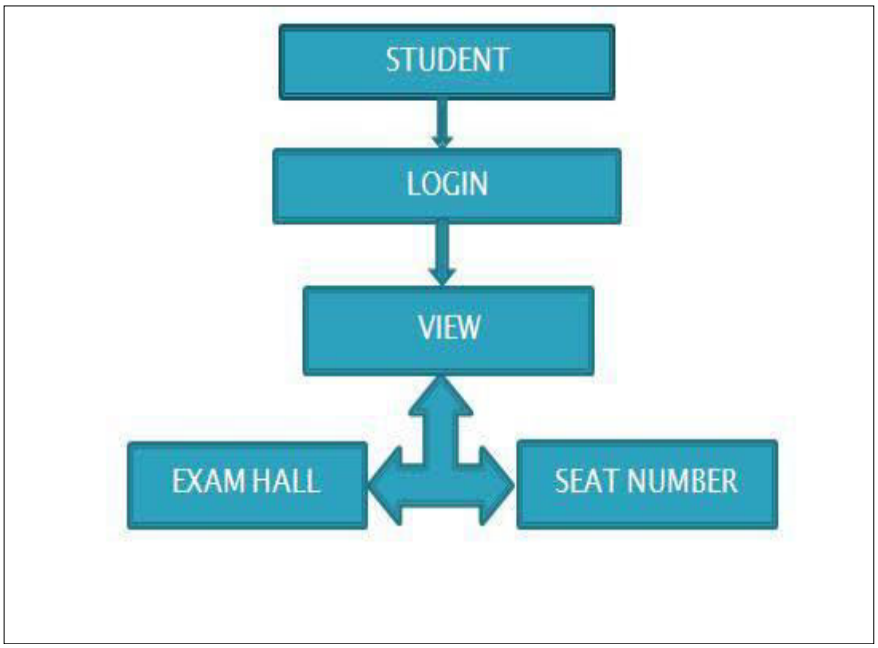


Fig 3: Student Login

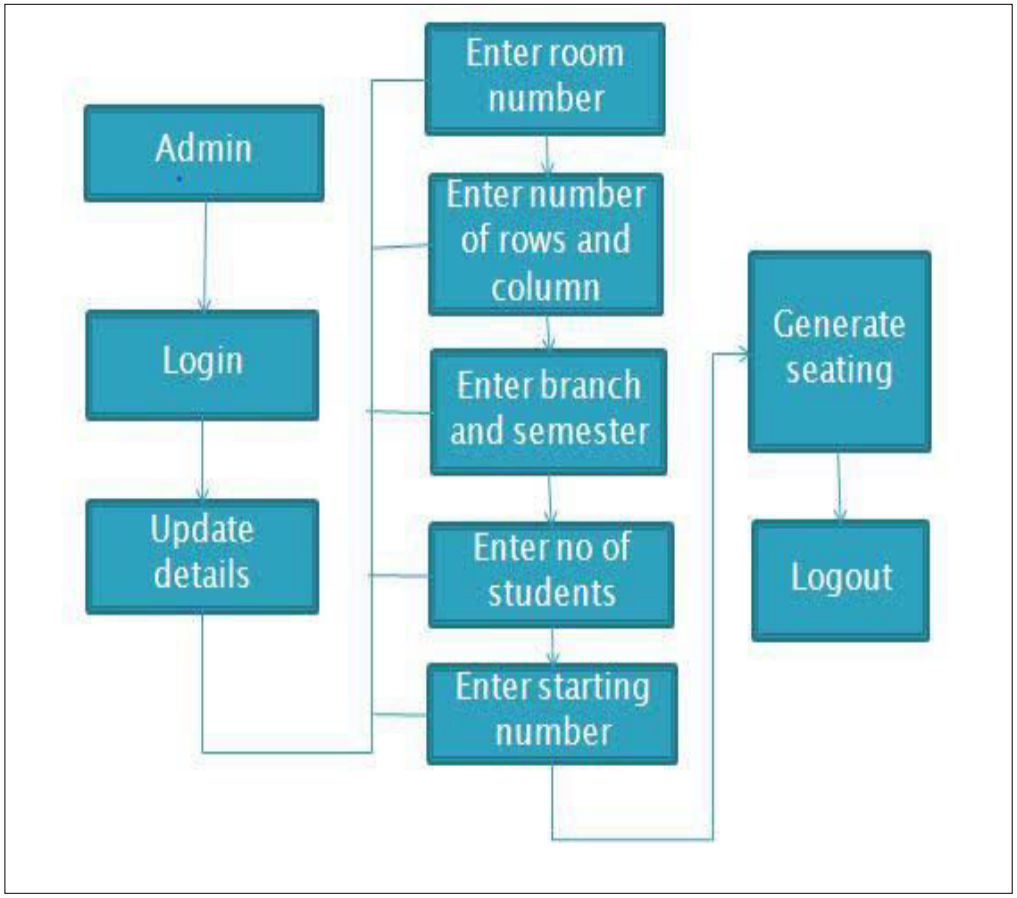


Fig 4: Admin Dashboard

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | A Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 5, May 2024 ||

| DOI: 10.15680/IJIRCCE.2023.1205054 |

## V. RESULT & DISCUSSIONS

The implementation of the exam hall and seating arrangement system has yielded significant improvements in various aspects of exam management, including efficiency, security, and fairness. The system has streamlined administrative processes, facilitated accurate seating assignments, and enhanced the overall exam experience for both administrators and candidates. With the integration of sophisticated hardware components, such as computers, scanners, and networking equipment, coupled with specialized software solutions, institutions have been able to automate tasks, reduce manual errors, and ensure seamless coordination of exam logistics. Real-time monitoring capabilities provided by surveillance cameras have contributed to maintaining exam integrity and deterring potential misconduct, further bolstering confidence in the examination process. Moreover, the adoption of barcode and scanner technology has facilitated efficient identity verification, seating allocation, and exam paper tracking, enhanced security and minimizing the risk of irregularities. The system's versatility has allowed for easy customization to accommodate varying exam formats, seating arrangements, and accessibility requirements, catering to the diverse needs of educational institutions and exam administrators. Overall, the exam hall and seating arrangement system has proven to be a valuable asset in enhancing the efficiency, security, and fairness of exam management processes, leading to a more reliable and transparent assessment environment.

## VI. CONCLUSION AND FUTURE WORK

In conclusion, the implementation of an exam hall and seating arrangement system represents a significant advancement in the realm of educational administration and examination management. By leveraging sophisticated hardware components, including computers, servers, scanners, and networking equipment, coupled with specialized software solutions, institutions can streamline exam logistics, enhance security, and ensure a conducive testing environment for candidates. The integration of barcode and scanner technology facilitates efficient identity verification, seating assignment, and exam paper tracking, reducing administrative burden and minimizing the risk of errors or irregularities. Real-time monitoring capabilities provided by surveillance cameras contribute to maintaining exam integrity and deterring potential misconduct. Moreover, the versatility of modern hardware solutions allows for seamless scalability and adaptability to accommodate varying exam formats, seating arrangements, and accessibility requirements. Whether conducting traditional paper-based exams or transitioning to digital assessments, the system can be tailored to meet the specific needs and preferences of educational institutions and exam administrators. Furthermore, the adoption of such systems underscores a commitment to data security, confidentiality.

Measures such as encryption, access controls, and physical security safeguards protect sensitive exam materials and personal information, instilling confidence in stakeholders and fostering trust in the examination process. Ultimately, the exam hall and seating arrangement system represents a holistic approach to exam management, combining technological innovation with best practices in administration and security. By optimizing processes, enhancing efficiency, and upholding the integrity of examinations institutions can ensure fair and equitable assessment practices while empowering candidates to demonstrate their knowledge and abilities effectively.

## REFERENCES

1. R. D. Danielsen, A. F. Simon, and R. Pavlick, “The Culture of Cheating: From the Classroom to the Exam Room,” Journal of Physician Assistant Education, vol. 17(1), pp. 23-29, 2006.
2. A. Demak, A. Ello Umi, and H. Kemon. "Classroom assignment for exam timetabling," Advances in Engineering Software, pp. 659 -666, 2006.
3. M. Ayub and A. Malik, “A New Model for an Examination-Room Assignment Problem,” IJCSNS International Journal of Computer Science and Network Security, VOL.11 No.10, 2011.
4. E.K. Burke, B. McCollum, and P. McMullan, “Examination Timetabling: A New Formulation,” International Conference on the Practice and Theory of Automated Timetabling (PATAT 2006), Brno, Czech Republic, ISBN 80-210-3726-1, 2007.
5. T. Prabnarong and S. Vasupongayya, "Examination management system: room assignment and seating layout," Proceeding of the Office of Academic Resources International Conference, Phuket, Thailand, pp. 25-27, 2011.
6. S. Vasupongayya, W.Noodam, and P.Kongyong, “Developing Examination Management System: Senior Capstone Project, a Case Study,” World Academy of Science, Entering and Technology, Vol:7 2013.
7. M.N.M. Kahar and G. Kendall, “The examination timetabling problem at University Malaysia Pahang: Comparison of a constructive heuristic with an existing software solution,” MIT Press and McGraw-Hill, ISBN 0-262-03141-8.
8. M. Hegland, J. Garcke, and V. Challis, “The combination technique and some generalisations,” Linear Algebra and its Applications, vol. 420, pp. 249–275, 2007.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | A Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 5, May 2024 ||

| DOI: 10.15680/IJIRCCE.2023.1205054 |

9. S. Mathew and L. Ginsberg, "Dynamic Backtracking," Journal of Artificial Intrelligence Research, vol. 1, pp. 25-46, 1993.
10. Ludger Wobmann, "How Central Exams Affect Educational Achievement: International Evidence from TIMSS and TIMSS-Repeat," Harvard University Program on Education Policy and Governance Working Paper No. PEPG/02-10 y.
**11.** Maria De Paola and V. Scoppa, "A signalling model of school grades: centralized versus ecentralized examinations," JEL Classification: D02, H42, I28.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INNO SPACE SJIF Scientific Journal Impact Factor

doi crossref

निस्केयर NISCAIR

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

## IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details