ISSN 2277-2685
IJESR/April-June. 2026/ Vol-16/Issue-2/389-394
N.Kavya *et. al.*, /International Journal of Engineering & Science Research
Full Length Article

A Role -Based Placement Communication And Opportunity Tracking System For College Students Using AI And MERN

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Accepted 18-04-2026

ABSTRACT

The College Placement process often suffers from communication gaps, missed opportunities and lack of centralized information management. Traditional methods such as whatsapp groups and emails lead to message clutter, missed deadlines and inefficient coordination between students and placement officers. This paper proposes a Role-Based Placement Communication and Opportunity tracking system developed using MERN Stack (Mongdb, Expressjs React,Node,js). The system provides a centralized platform where placement officers can post opportunities and students can view ,track and apply efficiently .The system includes secure Authentication with role-based access, real-time opportunity updates and AI-based skill gap analysis using cosine similarity. This helps students understand missing skills and receive personalized recommendations. The platform improves communication efficiency, reduces information overload, and enhances placement success rates. The system also incorporates structured dashboards, real-time updates and efficient data management using Mongodb, ensuring scalability and fast retrieval of information. Experimental evaluation demonstrates that the platform significantly reduces communication gaps, improves transparency in placement processes, and enhances student management. Role-based authentication using secure login mechanisms ensures controlled access for administrators and students, thereby improving data security and system reliability. Overall, the proposed solution provides a scalable, efficient, and intelligent platform that simplifies placement management while empowering students with actionable insights to improve their careers readiness.

Keywords:
Placement Portal, MERN stack, Role-based Access, Dashboard, Artificial Intelligence, Cosine Similarity, Skill gap Analysis System.

I. INTRODUCTION

Campus Placements are a vital component of higher education, providing students with opportunities to secure employment. However, existing placement communication systems are unstructured and rely heavily on informal channels such as messaging groups and emails. The methods lead to missed deadlines, information overload and lack of transparency. With the rapid advancement of web technologies and artificial intelligence, there is a need for an intelligent, centralized system that can streamline placement opportunities.

Modern Web frameworks enable the development of scalable and interactive platforms, while AI techniques can be used to

enhance decision-making and personalization.
The proposed system introduces a Role-based placement communication and opportunity tracking system that centralizes all the placement-related activities into a single platform. It provides secure login and role-based access for students and placement administrators, ensuring that data is managed efficiently and securely. The system allows administrators to post and manage opportunities, while students can easily browse, filter, and track them through a structured dashboard.

II. LITERATURE SURVEY

In recent years, significant research has been conducted to improve communication systems and enhance student employability using web technologies and artificial intelligence.
The study conducted by Sharma and Gupta [1] presents a comparative analysis of campus placement automation systems. Their research highlights the inefficiencies associated with traditional manual placement processes, such as data redundancy, lack of coordination, and increased administrative workload. The authors emphasize the importance of adopting centralized web-based platforms to streamline placement activities. Their proposed solutions demonstrate improvements in data organization, accessibility, and overall process efficiency. However, the system lacks intelligent features that can provide personalized guidance to

students based on their individual skills and career goals.

Another study by Lee and Chen [2] focuses on improving student employability through centralized placement portals. The authors examine how unified systems influence student engagement and participation in placement activities. Their findings indicate that centralized platforms significantly increase application rates and ensure equal access to opportunities for all students. Despite these advantages, the system does not incorporate advanced analytical mechanisms or AI-based recommendation models, which are crucial for enhancing decision-making and providing tailored career suggestions.

In addition, Patel and Singh [3] explored the use of MERN stack technologies (MongoDB, Express.js, React, and Node.js) for developing scalable university applications. Their study highlights key advantages such as high performance, flexibility, and efficient handling of large volumes of data. The MERN stack enables seamless integration between frontend and backend components, making it suitable for dynamic web applications. However, their work primarily focuses on system architecture and scalability, without integrating intelligent modules capable of analyzing user behavior or providing personalized recommendations.

Recent advancements in artificial intelligence have introduced recommendation systems that can analyze user profiles and match them with relevant opportunities. Studies on AI-based systems demonstrate that similarity-based algorithms, such as cosine similarity, are effective in comparing skill sets and identifying gaps in knowledge. These systems assist users in improving their profiles and enhancing employability. However, such AI models are often developed as standalone solutions and are not fully integrated into placement management platforms.

Overall, existing systems have contributed significantly to improving communication, data management, and accessibility in placement processes. Nevertheless, they lack intelligent decision-making capabilities and integrated AI features that can provide personalized guidance to students.

To address these limitations, the proposed system combines the strengths of previous approaches by integrating the following features:

1. A centralized placement communication platform
2. Role-based authentication for secure and controlled access
3. A scalable architecture based on the MERN stack

This integrated approach aims to deliver a comprehensive and intelligent solution that enhances both placement management efficiency and student preparedness for employment opportunities.

III. SYSTEM OVERVIEW

The proposed Role-Based Placement Communication System is designed as a centralized web-based platform that streamlines all placement-related activities within an academic institution. The system integrates multiple functional modules, including the user interface, backend server, database management system, and an AI-based analytical module, to ensure efficient communication, data handling, and opportunity tracking.

The overall architecture follows a three-layer model consisting of the frontend, backend, and database layers, which work collaboratively to deliver a seamless and responsive user experience.

A. User Interface (Frontend)

The frontend of the system is developed using React and Tailwind CSS, enabling the creation of a modern, responsive, and user-friendly interface. This layer acts as the interaction point between users and the system. Students can easily browse available job opportunities, view detailed descriptions, and apply for positions. Administrators, on the other hand, can efficiently manage job postings, monitor applications, and communicate with users. The use of component-based architecture ensures scalability and maintainability of the interface.

B. Backend Server

The backend is implemented using Node.js and Express.js, which handle server-side operations, API request processing, and application logic. This layer acts as a bridge between the frontend and the database. It manages user authentication, authorization, and role-based access control using JSON Web Tokens (JWT). The backend ensures secure data transmission, efficient request handling, and smooth communication between different system components.

C. Database

MongoDB is used as the primary database for storing and managing system data. It maintains records of user profiles, job opportunities, applications, and role-specific information. As a NoSQL database, MongoDB provides flexibility in handling unstructured data and ensures high scalability and fast data retrieval. This enables the system to efficiently manage large volumes of placement-related data.

D. AI Module

An Artificial Intelligence module is integrated into the system to enhance its intelligence and decision-making capabilities. This module performs skill-gap analysis by comparing student skill profiles with job requirements. Instead of relying on traditional datasets, the system dynamically extracts structured skill data from user inputs or resumes.

The cosine similarity algorithm is applied to measure the similarity between student skill sets and job requirements. Based on this comparison, the system identifies missing skills and provides personalized recommendations to help students improve their employability.

All data is continuously updated in the MongoDB database as users interact with the platform. This dynamic data management enables real-time tracking of job opportunities, applications, and user progress. The integration of AI with the placement system ensures not only efficient communication but also intelligent guidance for students, making the platform more effective and future-ready.

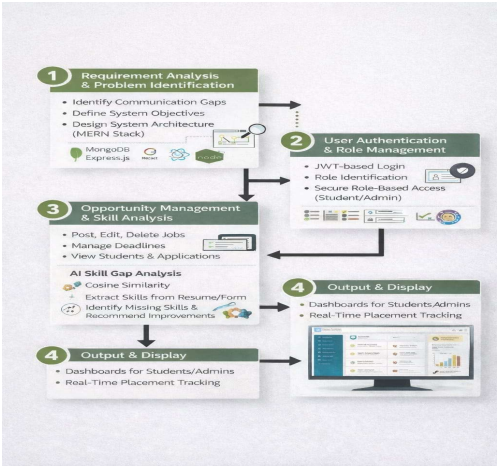


Figure-1

System Workflow

The system operates as follows:

1.Users register and log in based on their roles.
2.Admin posts placement opportunities.
3.Student browse and apply for opportunities.
4.Data is processed and stored in a database.
5.AI module analyzes skills and provides Recommendations.
6.Results are displayed through the dashboard.

IV. DATA DESCRIPTION

The proposed placement tracking system does not rely on a pre-trained dataset as used in traditional machine learning projects.Instead,it operates on real-time user -generated data collected dynamically, students and administrators.The system manages different types of data ,including student profiles,job and internship postings .

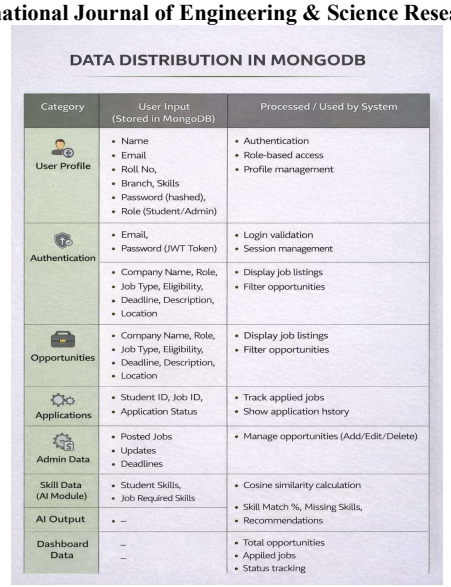


Figure-2

Thus, the system uses live operational data rather than a static dataset, making it more practical and suitable for real-world deployment. The dynamic data management enables real-time tracking of opportunities and applications.

V.MATERIALSAND METHODS

This section describes the materials (technologies used) and the methods (approach followed) in the system design and implementation.

A. MATERIALS

The system is implemented using the MERN stack along with additional tools and technologies

Frontend: Java Script, React.js, Tailwindcss are used to build a responsive and interactive user interface.

Backend: Node.js and Express.js are used to handle server-side logic, API development, and request processing

Database: Mongodb is used as a NoSQL database to store user data, job opportunities, and application records.

AI Technique: Cosine similarity is used to compare student skills with job requirements and identify skills gaps.

B.METHODS

The system follows a structured methodology For development and execution

1.Requirement Analysis: The limitations of existing placement communication methods are identified, and system objectives are defined

2.User Authentication and Role Management: Users register and log in securely. Role-based access control ensures that only administrators can manage opportunities, while students can view and apply.

3.Opportunity Management: Administrators can add, update, and delete job postings. These

opportunities are stored in Mongodb and displayed dynamically on frontend.

4.Application Tracking: Students can apply for jobs and their application status is stored within the system.

VI.IMPLEMENTATION AND SYSTEM WORKFLOW

The proposed system is implemented as a full-stack web application using MERN Stack to ensure efficient handling of placement related activities. After successful login, administrators can post, update job and internship opportunities which are stored in the database. Students can view these opportunities, apply for suitable roles and track their application status.

VII.EXPERIMENTAL RESULTS

The proposed Role-Based Placement Communication and Opportunity Tracking System was implemented and evaluated using real-time user interactions to assess its performance. This system successfully handled core functionalities such as user registration, secure login, and role-based access control.The system was tested under multiple scenarios, including job posting by administrators and application submission by students. The results indicate that job opportunities are displayed in a well-structured manner, allowing students to easily browse, filter and apply for relevant roles.

The AI-based skill analysis module was evaluated by comparing student skills with job requirements using cosine similarity. The system successfully generated similarity scores, identified missing skills, and provided useful recommendations for improvement. Overall, the experimental results demonstrate the system efficiency.

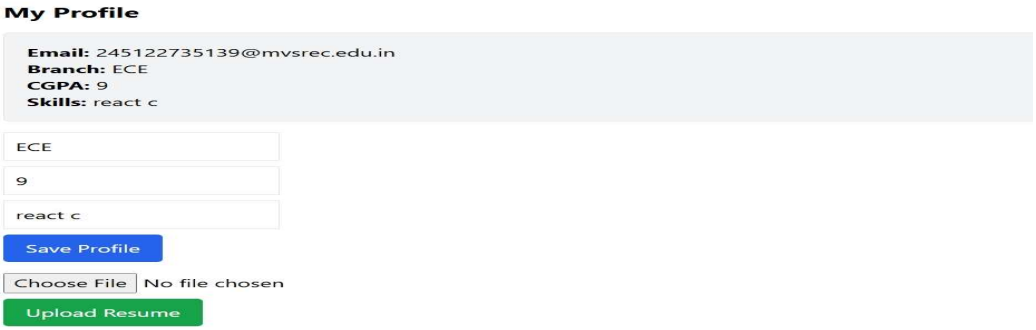
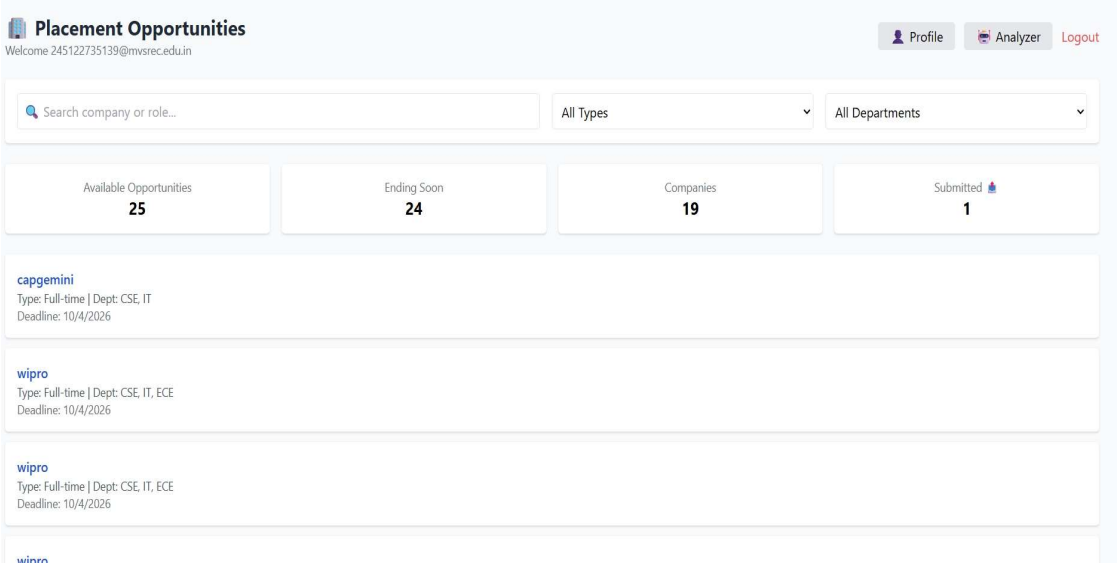
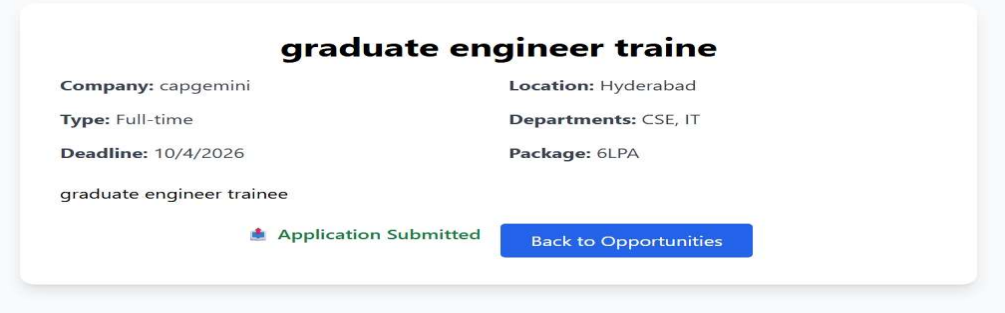


Figure 2: User Interface and Figure 3: Output

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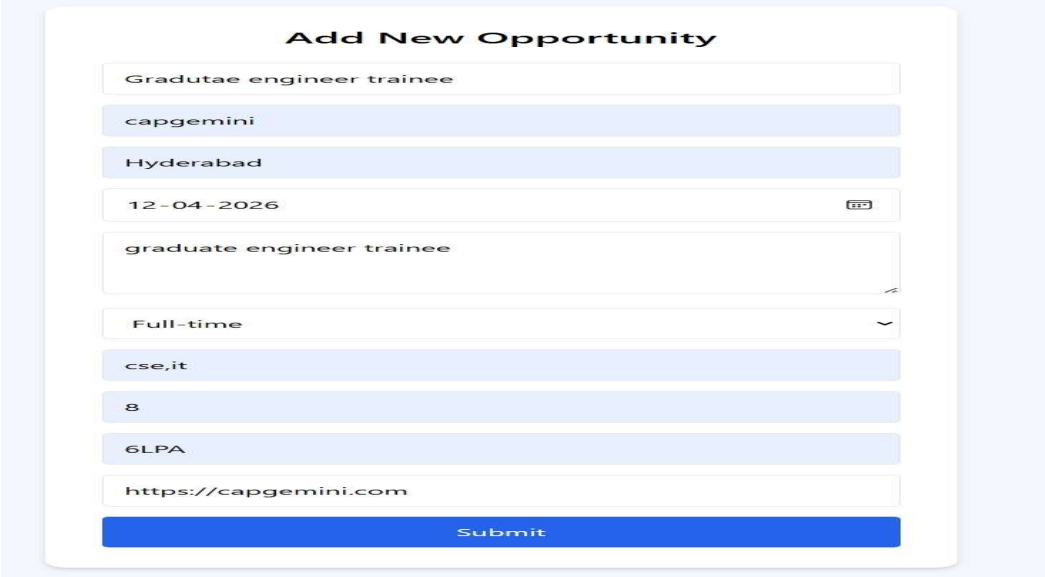
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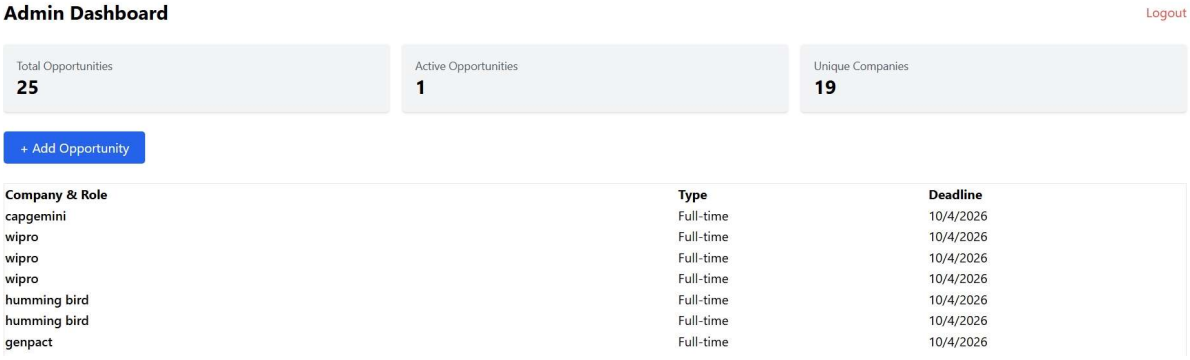
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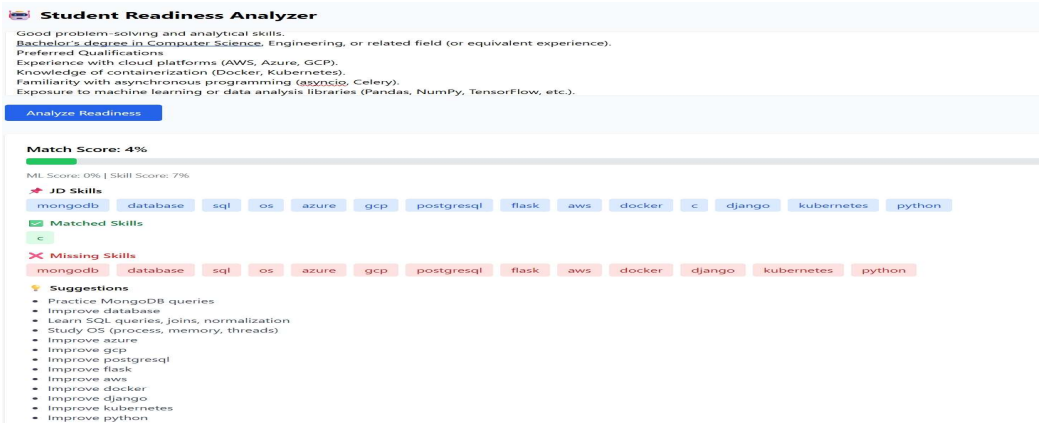

VIII. CONCLUSION AND FUTURE SCOPE

The proposed Role-Based Placement Communication and Opportunity Tracking System provides an effective solution to the challenges faced in traditional placement-related information and implementing role-based access control, the system ensures better communication between students and administrators, the integration of modern web technologies through the MERN Stack enables efficient data management, Scalability and real time updates. Additionally,

The AI-based skill analysis module enhances the system by providing personalized recommendations, helping students to identify skill gaps and improve their employability. Overall, the system improves transparency, reduces missed opportunities and streamlines the placement process.

In the future, the system can be enhanced by incorporating advanced features such as mobile application, support for better accessibility and real time notifications, integration with Natural Language Processing with techniques that can enable automatic resume parsing and more accurate skill extraction, reducing manual effort and improving data quality. Furthermore, advanced machine learning models can be implemented to provide more precise recommendations and predictive analysis. Integration with college ERP systems and company recruitment platforms can further improve efficiency and automation, making the system more robust and widely applicable. Additionally, features such as interview scheduling, and analytics dashboard can be introduced to improve efficiency, monitoring and overall user experience. These improvements would help transform the system into a more advanced platform for personalised placement management.

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