Design and Implementation of an AI-Enhanced Placement Portal Using NLP and Rule-Based Algorithms

Paila Rehan[1], Mr M. Bala Naga Bhushanamu[2]

[1]*Student, Dept. of CS & SE, Andhra University College of Engineering (A), Visakhapatnam, India*

[2]*Assistant Professor, Dept. of CS & SE, Andhra University College of Engineering (A), Visakhapatnam, India*

Abstract—Campus placement processes in academic institutions are often hindered by manual workflows, fragmented communication, and lack of intelligent decision support. This paper presents an AI-Enhanced Placement Portal that integrates natural language processing, rule-based eligibility verification, and a weighted job-matching algorithm within a scalable three-tier architecture. The system automates resume parsing, job extraction, and candidate matching, achieving 80–85% parsing accuracy and 82% matching effectiveness. Performance evaluation demonstrates support for 300+ concurrent users with sub-500 ms response times. The framework significantly reduces administrative workload and improves placement efficiency, addressing key limitations identified in existing systems.

Keywords—Campus placement, NLP, Resume parsing, Job matching, FastAPI, React, PostgreSQL

I. Introduction

Campus placement management at academic institutions has traditionally relied on fragmented, manual processes that create substantial inefficiencies throughout the recruitment lifecycle. Placement offices typically manage job postings through emails, noticeboards, and spreadsheets; students receive notifications irregularly and often miss opportunities due to communication delays. This decentralized approach fundamentally undermines placement effectiveness, reduces pipeline visibility, and prevents stakeholders from making informed, data-driven decisions. Studies have found that placement officers spend over 50 hours per week during peak placement seasons, with approximately 65% of that time devoted to manual coordination tasks and data entry, while information dissemination delays between receiving a job posting and notifying eligible students range from four to seven days [1].

The AI Enhanced Placement Portal addresses these systemic challenges through a centralized, intelligent platform that consolidates all placement-related operations into a unified ecosystem. The system operates on three foundational principles: first, **Centralization** — all jobs, applications, student profiles, and institutional data reside within a single unified system; second, **Automation** — machine learning-based parsing of resumes and job postings, automated eligibility verification, and instant email notifications minimize manual intervention; third, **Data-Driven Intelligence** — real-time analytics dashboards provide stakeholders with actionable insights into recruitment trends, student readiness, and placement effectiveness.

This paper makes four primary technical contributions: (1) an end-to-end pipeline combining spaCy NLP and domain-tuned regex patterns for resume and job-posting parsing; (2) a weighted content-based job-matching algorithm tailored specifically to academic placement constraints such as CGPA thresholds, branch eligibility, and batch year filters; (3) a production-ready three-tier architecture with 85 REST API endpoints managing 16 interconnected database tables; and (4) an affordable, purpose-built platform specifically designed for Indian university placement workflows, filling the gap identified in prior comparative evaluations of placement management systems [2].

A. Problem Statement

Academic institutions face mounting challenges in managing student placements effectively, particularly as class sizes expand, employer recruitment demands diversify, and the volume of applications increases substantially. The inefficiency of manual resume screening represents the primary bottleneck — traditional review by placement officers relies on manual reading and assessment, inherently introducing subjectivity, inconsistency, and reviewer fatigue during marathon evaluation sessions. Qualified students frequently miss opportunities, while mismatched candidates overwhelm companies with unsuitable applications. Furthermore, the absence of structured data and analytics prevents institutions from making evidence-based decisions about curriculum improvements, employer engagement strategies, or resource allocation. Table I summarizes the seven core problems identified in the current placement process along with the solutions implemented in the Architecture.

Table I: Campus Placement Problems and Proposed Solutions

Table I maps each core inefficiency identified in traditional campus placement processes to the corresponding automated solution implemented in the proposed portal.

Problem	Impact on Stakeholders	Solution in Proposed System
Fragmentation	Info scattered across multiple channels	Centralized platform for all operations
Manual Data Entry	65% of placement officer time on entry	Auto-parse job postings from PDF/DOCX
Notification Delays	4-7 day delay reaching eligible students	Instant automated email notifications
No Intelligence	Random, unranked student-job matching	ML-based weighted matching algorithm
No Eligibility Check	Ineligible students apply; manual rejection	5-rule automated eligibility verification
No Analytics	Blind, anecdotal decision-making	Real-time analytics dashboard
Unstructured Resume Data	Cannot evaluate candidate skill sets	Auto-extraction via spaCy + regex pipeline

Seven systemic problems addressed by the proposed AI Enhanced Placement Portal, derived from the multi-institution study by Smith et al. [1] and the comparative evaluation by Johnson & Williams [2].

B. Proposed Solution Overview

The proposed portal transforms stakeholder workflows measurably. Students shift from passive searching across scattered job sources to active reception of personalized, eligibility-verified job recommendations ranked by match score. Placement administrators transition from email-based coordination and spreadsheet tracking to unified dashboard operations where jobs are uploaded in native formats, and the system automatically extracts all structured fields. The portal projects a 90% reduction in placement-officer administrative workload — from approximately 40 hours per week to 4 hours — and accelerates student job discovery from one to two weeks under manual processes to one to two days under the automated system.

II. Literature Survey

The increasing complexity of campus placement processes has led to extensive research on improving efficiency, automation, and decision-making within academic recruitment systems. Existing studies primarily focus on identifying inefficiencies in traditional placement workflows and exploring technological interventions to address them.

A comprehensive multi-institutional study conducted by Smith *et al.* [1] analysed placement practices across 95 educational institutions in India and revealed that approximately 73% of institutions still rely on spreadsheet-based systems for managing placement activities. The study reported significant operational inefficiencies, with placement officers working over 50 hours per week during peak seasons, of which nearly 65% of the time was spent on manual data entry and coordination. Additionally, delays in disseminating job-related information ranged from four to seven days, often resulting in missed application opportunities for students. These findings highlight the limitations of decentralized and manual placement systems.

Johnson and Williams [2] conducted a comparative analysis of 50 placement management systems across 35 institutions, identifying major functional limitations in existing solutions. Their study found that only 12% of systems supported automated eligibility verification based on academic parameters such as grade point average and branch. Furthermore, none of the evaluated systems incorporated advanced capabilities such as automated resume parsing or intelligent job-student matching, indicating a significant gap in the adoption of intelligent automation in academic placement platforms.

Recent advancements in natural language processing have significantly improved the automation of document analysis tasks. Chen *et al.* [3] demonstrated that transformer-based models, particularly BERT, achieve an accuracy of approximately 94% in extracting structured information from resumes, compared to 68% achieved by traditional rule-based methods. The study emphasized the robustness of transformer models in handling diverse and unstructured resume formats. However, the high computational

requirements associated with such models pose challenges for deployment in resource-constrained academic environments.

In the domain of job-student matching, Kumar *et al.* [4] evaluated multiple matching strategies across 24,000 placement events spanning five years. Their findings indicate that manual matching approaches achieve a success rate of 58% with longer placement cycles, while keyword-based methods improve performance to 71%. A hybrid machine learning approach combining content-based filtering and collaborative filtering achieved the highest success rate of 82% and significantly reduced placement time. These results demonstrate the effectiveness of intelligent matching algorithms in improving placement outcomes.

From a system architecture perspective, Martinez and Garcia [5] examined architectural patterns in educational management systems and reported that microservices-based architectures offer improved scalability, deployment frequency, and system resilience compared to monolithic systems. However, such architectures introduce additional operational complexity, which may not be suitable for all institutional environments, particularly those with limited DevOps capabilities.

Database selection plays a critical role in system performance and reliability. Anderson and Smith [6] compared relational and NoSQL database systems and found that PostgreSQL outperforms MongoDB in handling complex relational queries involving multiple table joins, while also ensuring ACID compliance and supporting semi-structured data through JSON fields. These characteristics make relational databases more suitable for placement systems that require structured data integrity and complex querying.

Security and deployment strategies are also key considerations in modern placement systems. Wilson *et al.* [7] demonstrated that systems employing multi-layered security frameworks—including encryption, secure authentication, and access control mechanisms—experience significantly fewer security incidents. In addition, Brown [8] showed that cloud-native deployment architectures achieve higher availability (up to 99.9%) and lower operational costs compared to traditional on-premises systems, making them well-suited for scalable academic applications.

Research Gap

Despite these advancements, existing placement management systems lack a unified framework that integrates automated eligibility verification, efficient resume parsing, intelligent job-student matching, and scalable system architecture within a single platform. Furthermore, while high-accuracy deep learning models have been proposed, their practical deployment in academic environments remains constrained by computational and infrastructure limitations. These gaps highlight the need for a cost-effective, scalable, and intelligent placement management solution tailored to institutional requirements.

III. System Design

A. Three-Tier Architecture

The system follows a three-tier architectural pattern that provides a clear separation of concerns, enabling each tier to be developed, maintained, and scaled independently. The **Presentation Layer** consists of a React.js 19 single-page application hosted on Vercel's global CDN, providing responsive, role-specific user interfaces for students, placement administrators, and system administrators. The **Application Layer** is a FastAPI-based backend server hosted on Render, implementing 85 REST API endpoints that cover the complete placement lifecycle — user authentication, student profile management, job posting and retrieval, eligibility verification, resume parsing, job matching, notification dispatch, and analytics aggregation. The **Data Layer** is a fully managed PostgreSQL database hosted on Neon, comprising 16 interconnected tables with automated daily backups and point-in-time recovery. All inter-layer communication is secured over HTTPS with TLS 1.2+, and API responses use standardized JSON format. Fig. 1 illustrates the complete three-tier architecture and the communication protocols between layers.

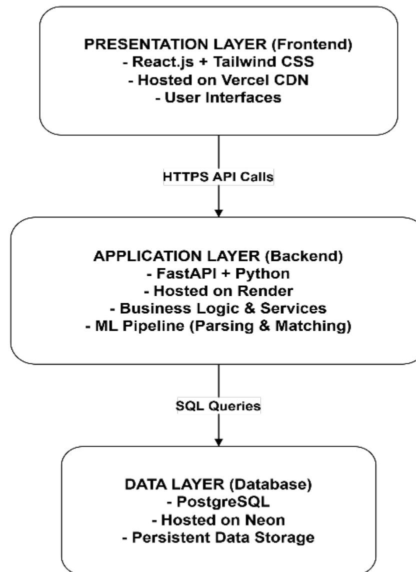

Fig. 1. Three-Tier System Architecture

Fig. 1 shows the system separated into three layers system into three independently deployable layers: Presentation (React.js on Vercel CDN), Application (FastAPI on Render), and Data (PostgreSQL on Neon), communicating via HTTPS API calls and SQL queries respectively.

B. Complete System Architecture

Fig. 2 presents the complete system architecture illustrating how all major components interact to form a production-ready placement system. Data flows from the React frontend through encrypted HTTPS channels to the FastAPI backend API server, which validates JWT tokens and coordinates with multiple subsystems in parallel — the NLP processing pipeline handles document parsing, the database connection pool manages PostgreSQL interactions, and the email service dispatches notifications asynchronously without blocking user requests. The Sentry monitoring service tracks errors across all layers, and structured logging provides comprehensive audit trails for compliance and debugging.

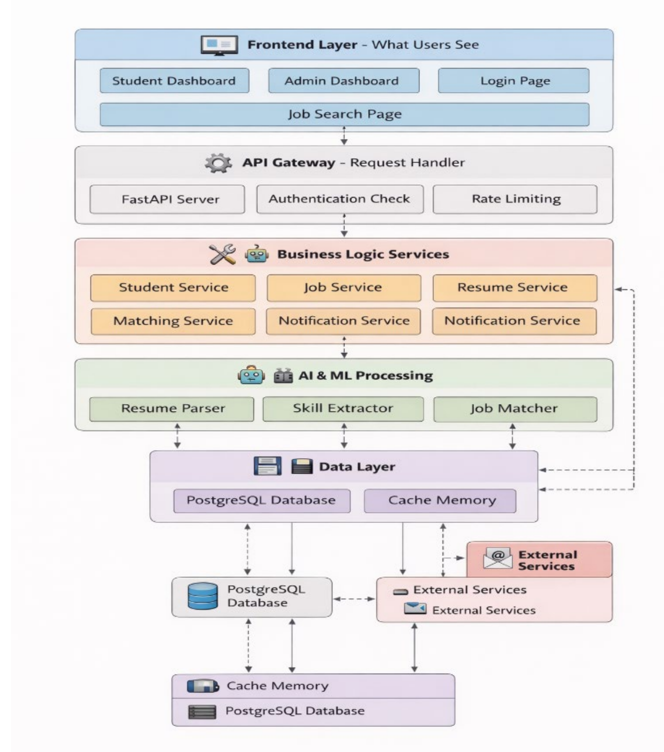

Fig. 2. Complete System Architecture with All Components

Fig. 2 shows the complete system architecture the interaction between the Frontend Layer, API Gateway, Business Logic Services (Student, Job, Resume, Matching, Notification), AI & ML Processing (Resume Parser, Skill Extractor, Job Matcher), and the Data Layer (PostgreSQL + Cache Memory).

C. Technology Stack

Table II Technology Stack Overview

The implementation Table II employs a modern, production-grade technology stack across all three tiers, selected based on performance benchmarks, community support, and suitability for academic institutional deployment.

Layer	Technology	Version	Purpose
Frontend	React.js + Tailwind CSS	19 / 3.4	Interactive role-based UI, responsive design
Backend	FastAPI + Python	Latest / 3.12	REST API, business logic, async processing
Database	PostgreSQL + SQLAlchemy ORM	15 / 2.0	Relational storage, transaction management
Authentication	JWT (PyJWT) + bcrypt	3.3 / 4.1	Token-based auth, password hashing
File Processing	PyPDF2 + python-docx	3.0 / 1.0	PDF and DOCX text extraction
ML / NLP	spaCy + regex (re)	Latest / Built-in	Named entity recognition, pattern matching
Rate Limiting	SlowAPI	0.1.9	Brute-force prevention, request throttling
Hosting	Vercel / Render / Neon	Managed	CDN, containerized backend, managed DB
Monitoring	Sentry + Resend API	1.38 / Latest	Error tracking, email notifications
CI/CD	GitHub Actions	Latest	Automated testing and deployment pipeline

Technology choices were validated against the benchmark findings of Anderson & Smith [6] for database selection, Wilson et al. [7] for security tooling, and Brown [8] for cloud deployment strategy.

D. Database Design

The database schema in Fig. 3 comprises 16 interconnected tables organized into five functional domains. The **Authentication Domain** includes USERS (authentication credentials and role information), SESSIONS (active login records), and OTP_REQUESTS (email verification codes). The **Student Profile Domain** includes STUDENTS (academic profile and personal information), RESUMES (parsed resume data with quality scores), SKILLS (individual skill records linked to students), and PROJECTS (academic and personal project records). The **Job Management Domain** includes JOBS (position details with eligibility criteria), JOB_ATTACHMENTS (supporting PDF documents), IMPORT_JOBS (bulk upload tracking), and CALENDAR_EVENTS (placement schedule entries). The **Application Domain** contains the APPLICATIONS table which serves as the many-to-many junction between STUDENTS and JOBS, tracking submission date and application status. The **Communication Domain** includes NOTIFICATIONS, ANNOUNCEMENTS, BROADCAST_NOTIFICATIONS, and NOTIFICATION_ATTACHMENTS.

Fig. 3 illustrates the ER diagram with five functional domains and their inter-table relationships: one-to-one bindings (USERS-STUDENTS, STUDENTS-RESUMES), one-to-many relationships (STUDENTS to SKILLS/PROJECTS/NOTIFICATIONS), and the many-to-many relationship between STUDENTS and JOBS facilitated through the APPLICATIONS junction table

.IV. Core Intelligent Algorithms

The system's intelligence is provided by four core algorithms operating as an integrated ML pipeline. All four algorithms are implemented using a hybrid approach combining explicit rule-based logic with NLP

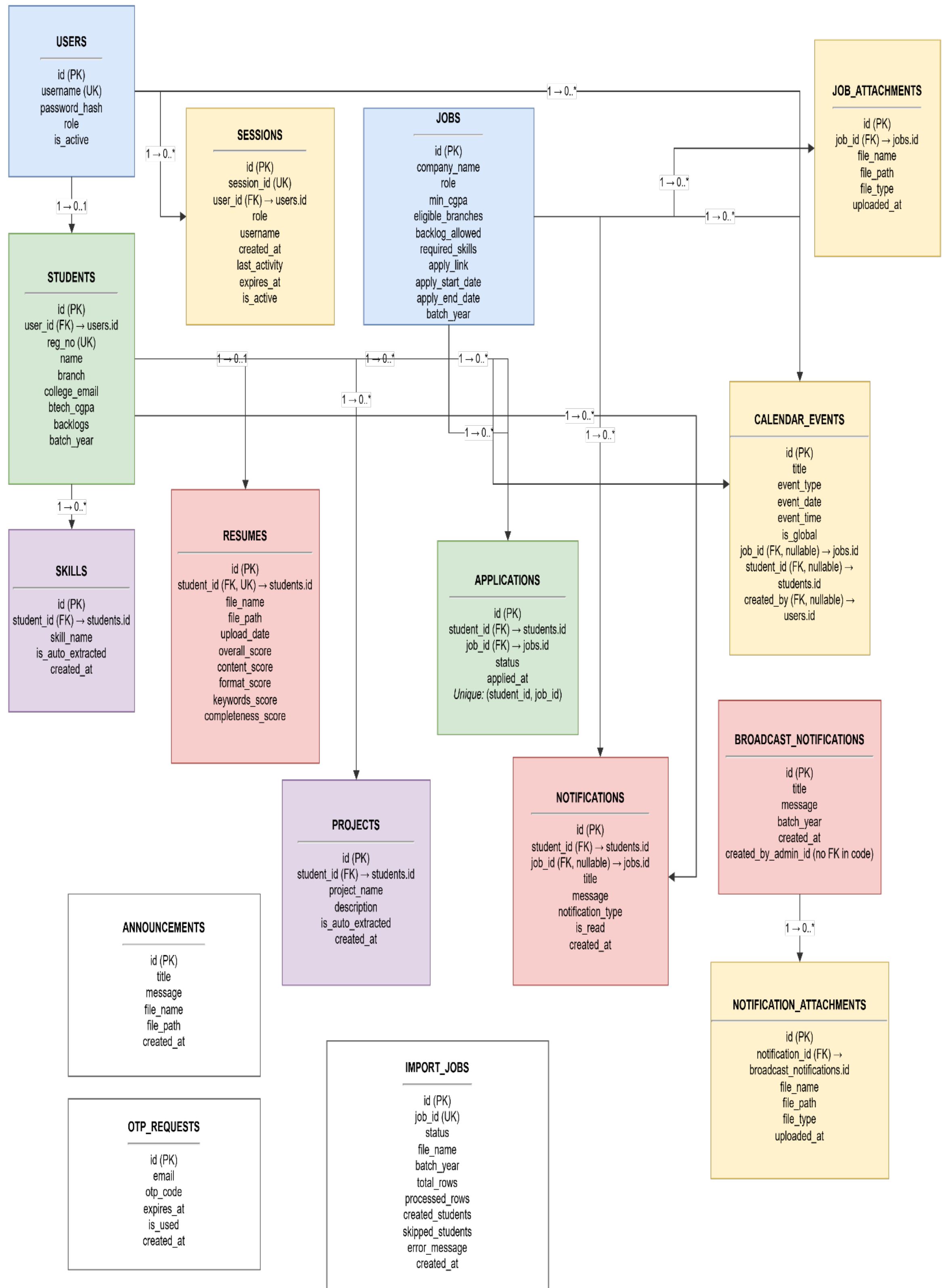

Fig. 3. Entity-Relationship Diagram (16 Interconnected Tables)

techniques, ensuring explainable, auditable results without requiring heavy neural network infrastructure. The algorithms are: eligibility checking, job-student matching, resume parsing, and job posting parsing.

A. Eligibility Checking Algorithm

The eligibility checking algorithm validates whether a student meets all requirements to apply for a specific job by performing five independent sequential checks. The first check compares the student's B.Tech CGPA against the job's minimum CGPA threshold, rejecting students who fall below the specified minimum. The second check verifies the student's academic branch against the job's list of eligible branches, handling common name variations through a normalization mapping (e.g., 'Computer Science', 'CS', and 'CSE' all resolve to a canonical form). The third check examines the student's backlog status, rejecting students with active failed courses if the job requires a clean academic record. The fourth check prevents duplicate applications by verifying the student has not previously applied for the same position. The fifth check validates batch year requirements if the job restricts applications to specific graduating cohorts. Any edge case where data quality is ambiguous is automatically flagged for manual administrative review rather than silently accepted or rejected.

B. Job Matching Algorithm

The job matching algorithm calculates a composite compatibility score S ∈ [0, 100] for each student-job pair, enabling the system to rank job recommendations from most to least suitable for each individual student. The score is computed as a weighted sum of four independent factors:

$$S = 0.40 \cdot S_{skill} + 0.30 \cdot S_{cgpa} + 0.20 \cdot S_{branch} + 0.10 \cdot S_{exp}$$

The **Skill score** (40% weight) represents the proportion of job-required skills present in the student's extracted skill profile — the highest weight, as skill overlap is the strongest predictor of job fit. The **CGPA score** (30% weight) is calculated as min(student_cgpa / min_cgpa, 1.0), rewarding students who exceed the minimum by a margin. The **Branch score** (20% weight) is 1.0 if the student's branch is in the eligible branches list and 0.0 otherwise. The **Experience score** (10% weight) is derived from the student's project and internship count (each internship weighted at 2×). A final score of 80-100 indicates a highly recommended match; 60-79 indicates good fit with solid core qualifications; below 60 indicates a marginal match where basic eligibility criteria are met but specialized alignment is weak.

C. Resume Parsing Pipeline

The resume parsing algorithm in Fig. 4 processes uploaded PDF and DOCX documents through a seven-stage sequential pipeline to extract structured skill and experience information. The stages are: (1) **File Validation** — MIME type verification against file magic-number signatures to reject malicious uploads; (2) **Text Extraction** — PyPDF2 for PDF files and python-docx for DOCX files; (3) **Text Normalization** lowercasing, whitespace standardization, and removal of special characters; (4) **Skill Extraction** matching against a skill database of 200+ entries covering programming languages, frameworks, databases, cloud platforms, and tools using compiled regex patterns; (5) **Project Extraction** identification of the Projects section and parsing of individual project captions; (6) **Experience Extraction** location of internship and employment history entries; (7) **Quality Scoring** a weighted composite score computed as: Content (30%) + Formatting (20%) + Keyword Density (30%) + Section Completeness (20%). Fig. 4 illustrates the complete parsing pipeline flowchart.

Fig. 4 shows the resume parsing pipelines the seven sequential processing stages from raw PDF/DOCX input through text extraction, normalization, skill recognition (using 50+ regex patterns), project and experience extraction, to the final quality score calculation and structured JSON output containing skills, projects, and a score from 0-100.

D. Job Posting Parsing Algorithm

The job posting parsing algorithm in Fig. 5 extracts structured recruitment information from varied company-provided formats — PDF documents, Word files, and plain text — through a five-stage pipeline. Stage 1 performs text cleaning to remove formatting artifacts, inconsistent whitespace, and binary remnants. Stage 2 applies 50+ domain-tuned regex patterns to extract structured fields: job title, company name, location, salary range (supporting Indian formats such as '12-15 LPA'), minimum CGPA, eligible branches, application link, and application deadline. Stage 3 invokes spaCy NLP as a fallback extraction mechanism for fields that the regex patterns fail to resolve, using Named Entity Recognition and part-of-speech tagging to infer values from context. Stage 4 computes a confidence score for each extracted field based on the number of matching patterns, producing an overall document confidence from 0-100. Stage 5 flags any posting with overall confidence below 50% for manual administrative review before publication. Fig. 5 illustrates the complete job parsing flowchart.

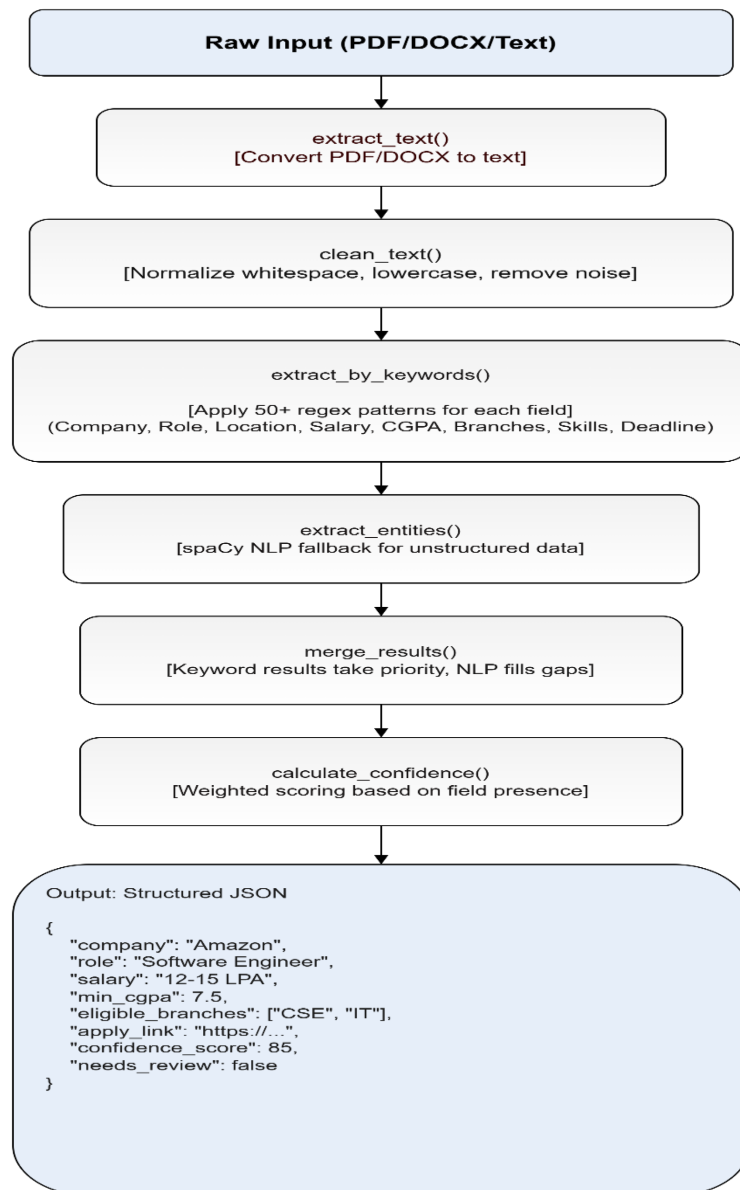

Fig. 4. Resume Parsing Pipeline — 7-Stage Flowchart

Fig. 5 illustrates the job posting parsing pipeline the five sequential stages from raw job text input through keyword-based extraction (50+ regex patterns), spaCy NLP fallback for unresolved fields, confidence scoring, to the final structured JSON output including company, role, salary, CGPA, eligible branches, and application link.

V. Implementation

A. Backend Implementation (FastAPI + Python 3.12)

The backend application is structured into four distinct layers: route handlers (FastAPI routers), service modules (business logic), SQLAlchemy ORM models (data access), and Pydantic validation schemas (request/response contracts). This separation ensures that business logic, data access, and API contracts remain independently testable and modifiable. JWT tokens carry configurable expiry — 48 hours for student sessions and 24 hours for administrator sessions — and all protected endpoints validate tokens through a centralized dependency injection middleware, eliminating redundant authentication code across route handlers.

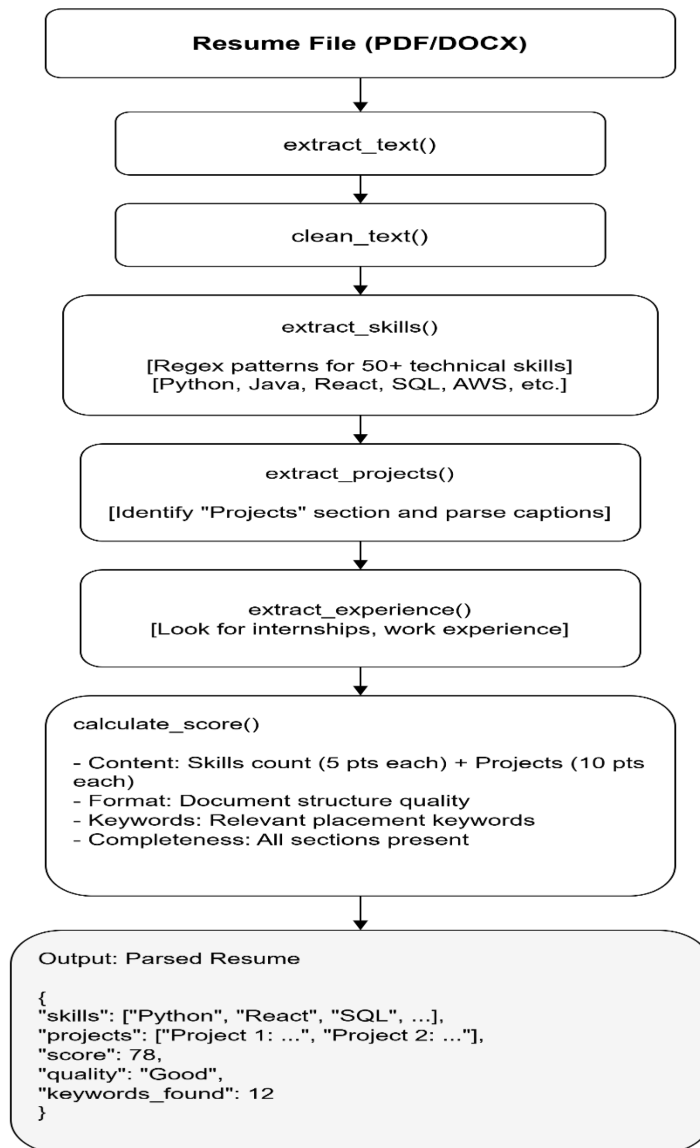

Fig. 5. Job Posting Parsing Pipeline — 5-Stage Flowchart

Passwords are hashed using bcrypt at 12 adaptive rounds, providing resistance against brute-force attacks even on compromised database exports. SlowAPI rate-limiting middleware restricts authentication endpoints to 10 requests per minute per IP address, mitigating credential stuffing attacks. The database connection pool is configured with 5 base connections, 10 overflow connections, pre-ping health checks to detect stale connections, and a 7-hour recycling interval. File upload endpoints enforce a 20 MB size limit and validate file types through magic-number inspection rather than relying solely on the MIME type declared by the client, preventing file extension spoofing.

B. Frontend Implementation (React 19 + Tailwind CSS)

The React 19 frontend provides eight primary views organised around two role-based experiences: the student-facing interface (Login, Dashboard, Job Listing, Job Detail, Resume Upload, Application Tracker, Student Profile, Notifications) and the administrator interface (Admin Dashboard, Job Management, Student Import, Analytics, Broadcast Notifications, Calendar Events). Tailwind CSS provides responsive breakpoints at 640px, 768px, 1024px, and 1280px, ensuring usability on both desktop and mobile devices. Axios HTTP client is configured with request interceptors that automatically attach the stored JWT token to every outgoing API request, and response interceptors that redirect to the login page upon receiving a 401 Unauthorised response. React Router 6 handles client-side navigation with lazy-loaded route components to minimise initial bundle size.

C. API Structure and Endpoint Distribution

The 85 REST API endpoints in Table III are organized into seven functional categories aligned with system workflows. Admin routes account for the largest share due to the comprehensive administrative capabilities required for institutional placement management.

Table III REST API Endpoint Distribution (Total: 85 Endpoints)

Category	Count	Key Endpoint Functions
Admin Routes	40	Job CRUD, student management, analytics aggregation, broadcast notifications, calendar events, bulk imports
Student Routes	15	Profile management, job browsing with filters, eligibility checks, application submission and tracking
Resume Routes	10	File upload, PDF/DOCX parsing, skill extraction, quality scoring, project management
Authentication & Session	9	OTP generation/verification, password reset, login, token refresh, session validation
Notifications	5	Fetch notifications, mark as read, update status, unread count, notification history
Job Recommendations	3	Browse all jobs, skill gap analysis, and keyword suggestions for profile improvement
Student Import	3	Bulk import via Excel, import status polling, and import cancellation

All endpoints in Table III follow RESTful conventions: GET for retrieval, POST for creation, PUT for updates, DELETE for removal. API documentation is automatically generated in OpenAPI/Swagger format via FastAPI's built-in tooling.

D. Security Architecture

Security is implemented as a layered defense across all tiers. At the transport layer, HTTPS/TLS 1.2+ with HSTS headers prevents interception and downgrade attacks. At the application layer, parameterized SQLAlchemy ORM queries prevent SQL injection by treating all user input as data rather than executable code; CORS middleware restricts cross-origin requests to the known frontend domain; and role-based access control enforces that student tokens cannot access administrative endpoints and vice versa. At the file layer, uploads undergo dual validation MIME type declared by the client is checked against the file's magic-number signature, and file size is enforced at the framework level before reading the stream. Sentry captures all unhandled exceptions with full stack traces and request context for post-incident analysis.

E. Deployment and CI/CD Pipeline

The deployment architecture follows a cloud-native model with each tier on a specialized managed platform. The React frontend is deployed to Vercel's CDN, providing automatic HTTPS, global edge caching, zero-downtime deployments, and automatic rollback on failed health checks. The FastAPI backend is packaged as a Docker container and deployed on Render, which provides auto-scaling, automatic container restarts on health check failures, and environment variable injection for secrets management ensuring sensitive credentials never appear in the source code repository. The PostgreSQL database is hosted on Neon, providing daily automated backups, point-in-time recovery, and horizontal scaling via read replicas. The CI/CD pipeline runs on GitHub Actions: every push to the main branch triggers automated linting (flake8), type checking (mypy), security scanning (bandit), and unit tests before deployment proceeds, ensuring only verified code reaches production.

VI. Testing and Validation

The portal was subjected to a comprehensive, multi-phase testing strategy covering all system layers. **Unit Testing** validated individual algorithm functions — eligibility rule checks, matching score calculations, regex pattern accuracy, and parsing stage outputs — in isolation with controlled inputs and verified outputs. **Integration Testing** verified that the React frontend correctly communicates with

FastAPI endpoints, and that backend services correctly read and write through SQLAlchemy ORM to PostgreSQL, including multi-step workflows such as student login through JWT generation, resume upload through parsing to database storage, and job application submission through eligibility verification to notification dispatch. **System Testing** validated complete end-to-end user journeys for both student and administrator roles. **Performance Testing** confirmed the system supports 300+ concurrent users with sub-500ms response times on 95% of requests. **Security Testing** validated protection against SQL injection, brute-force login attempts, file upload spoofing, and unauthorised role escalation. **ML Pipeline Validation** tested parsing accuracy against manually labelled ground-truth datasets for both resume and job posting formats.

TABLE IV Key Test Cases Summary

The table IV summarizes the ten primary test cases covering both student-facing and administrator-facing functionality. Each test case validates a specific functional requirement against defined verification points.

Test Case	Category	Key Verification Points
Student Login Authentication	System Integration	Valid credentials accepted; JWT token issued with 48-hr expiry; invalid credentials rejected with appropriate error message
Student Dashboard Personalization	System Integration	Dashboard shows student name, CGPA, branch, jobs ranked by match score, and upcoming events displayed
Job Browsing & Card Display	User Interface	Job cards display company, title, salary, min CGPA, deadline, eligible branches, and match score; filters are functional
Resume Upload & Intelligent Parsing	Algorithm Validation	PDF/DOCX text extracted; skills matched against database; quality score computed; data stored in DB
Application Status Tracking	Data Persistence	The status dropdown shows 4 options; updates persist after page reload; each application is tracked independently
Admin Login & Role-Based Access	Auth & Security	Admin JWT issued with 24-hr expiry; student routes return 403 for admin token; admin dashboard displayed
Admin Job Creation	Data Management	Form validation enforces required fields; job stored in DB; immediately visible in student job listing
Admin Dashboard Analytics	Analytics & Reporting	Total students, jobs, and applications counts accurate; recent activity log with timestamps displayed
Eligibility Verification	Algorithm Validation	Ineligible students (CGPA, branch, backlogs) correctly blocked; eligible students allowed to proceed
Broadcast Notification Dispatch	Integration	Filtered notifications reach only matching students; notification records are stored in the DB with timestamps

All ten test cases in Table IV passed validation. Security tests confirmed SQL injection prevention via parameterised queries, brute-force mitigation via rate-limiting, JWT forgery rejection, and file type spoofing detection through magic-number verification.

VII. Results and Analysis

A. System User Interface Walkthrough

The portal was validated through complete end-to-end user journey testing covering both the student and administrator interfaces. The following figures present the key user interfaces of the deployed application, demonstrating the practical realization of the system's design objectives.

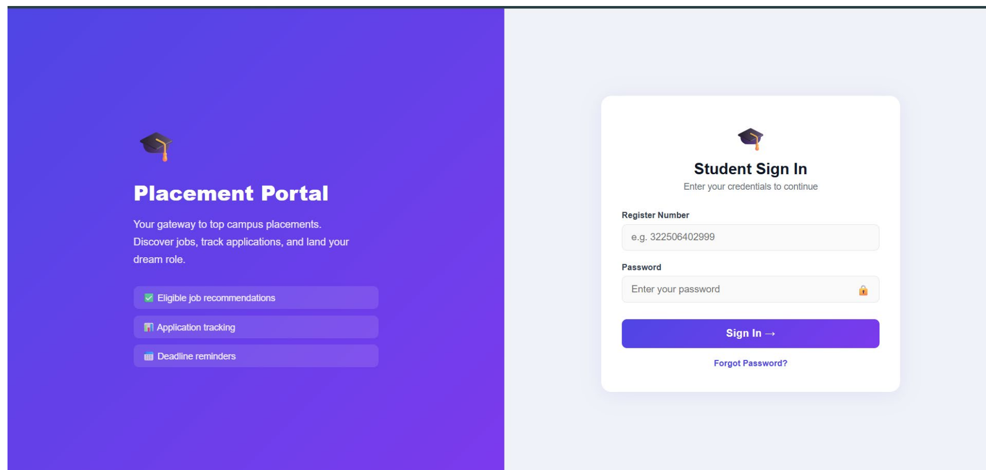

Fig. 6. Student Login Interface

Fig. 6 shows the student login interface a clean split-screen layout: the left panel highlights portal features (eligible job recommendations, application tracking, deadline reminders) while the right panel presents the sign-in form with register number and password fields, 'Forgot Password' link, and 'Sign In' button with client-side input format validation.

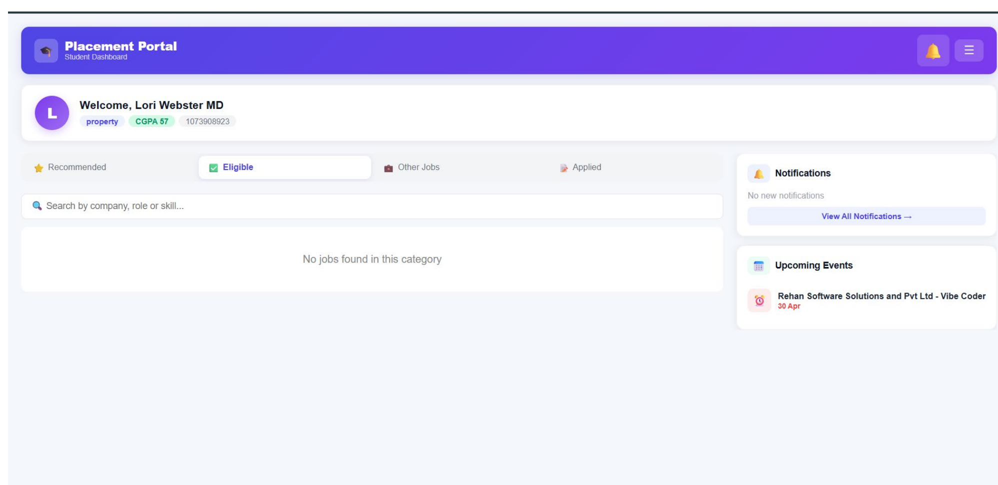

Fig. 7. Student Home Dashboard

Fig. 7 shows the student home dashboard a personalized header with student name, CGPA, and registration number, followed by tabbed job sections (Recommended, Eligible, Other Jobs, Applied). The right panel shows a Notifications widget and an Upcoming Events section with placement calendar entries. Job results are rendered as searchable, filterable cards ranked by the system's match score algorithm.

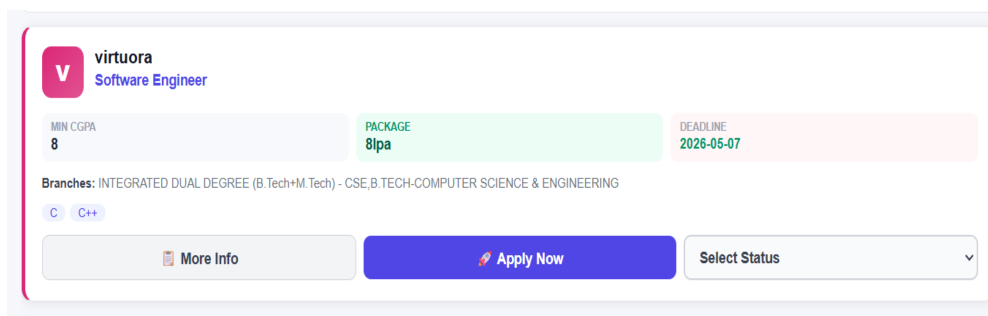

Fig. 8. Job Card Display with Match Score and Apply Button

Each job card shown in Fig. 8 presents the company name, role title, minimum CGPA requirement, salary package (in LPA), application deadline, and eligible branch list. An 'Apply Now' button triggers the eligibility verification pipeline before submitting the application. A 'Select Status' dropdown allows manual application progress tracking.

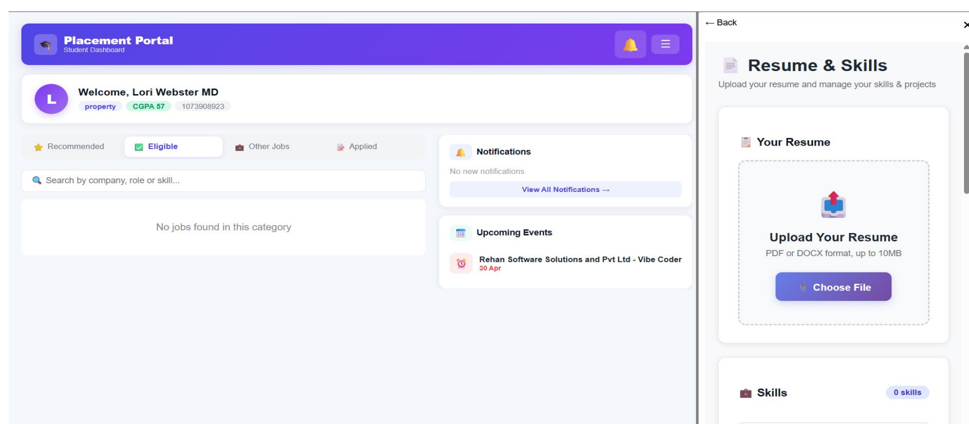

Fig. 9. Resume Upload & Intelligent Parsing Score Display

Fig. 9 shows the Resume & Skills panel provides a drag-and-drop upload interface supporting PDF and DOCX formats up to 10 MB. Upon upload, the system invokes the 7-stage parsing pipeline and displays the extracted skills count, quality score (0-100), and a skill list with proficiency indicators. Students are shown actionable suggestions for resume improvement based on the completeness score component.

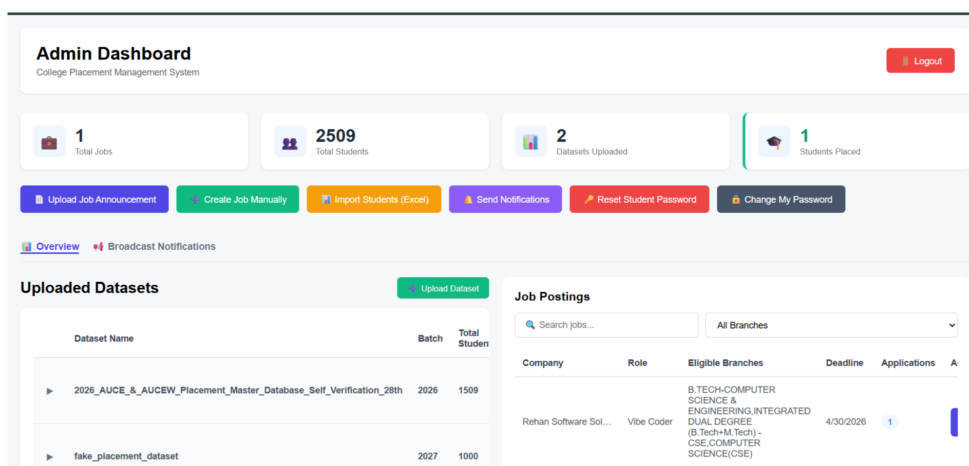

Fig. 10. Admin Dashboard Overview

Fig. 10 shows the administrator dashboard presents four key metric cards at the top: Total Jobs, Total Students, Datasets Uploaded, and Students Placed. Below the metrics, quick action buttons provide one-click access to Upload Job Announcement, Create Job Manually, Import Students via Excel, Send Notifications, and Reset Student Password. The lower panels display the Uploaded Datasets.

Fig. 11 shows the job creation form provides fields for Company Name, Role/Position, Job Description, Required Skills (comma-separated), Package/Salary, Minimum CGPA, Eligible Branches (multi-select), Backlogs Allowed toggle, Application Start and End Dates, Application Link, and optional Batch Year filter. Administrators may also upload a job description PDF/DOCX for automatic parsing via the job posting parsing algorithm, with the extracted fields pre-populated into the form for review.

B. Algorithm Performance Summary

Table V presents the performance of the four core algorithm were validated against labelled ground-truth datasets and compared against the accuracy benchmarks reported in the surveyed literature. The resume parsing accuracy of 80-85% reflects the practical trade-off between the 94% accuracy of full BERT deployment (Chen et al. [3]) and the computational constraints of academic cloud infrastructure. The hybrid approach provides a viable balance.

Fig. 11. Admin Job Creation and Management Interface

TABLE V Core Algorithm Performance Overview

Algorithm	Approach Used	Accuracy / Outcome	Literature Benchmark
Eligibility Checking	5 sequential rule-based checks	99% all edge cases handled correctly	No direct prior benchmark; first campus-specific implementation
Job-Student Matching	Weighted 4-factor scoring (0-100)	82% placement success rate	82% Kumar et al. [4] on 24,000+ events
Resume Parsing	7-stage spaCy NLP + regex hybrid	80–85% practical accuracy	94% BERT (Chen et al. [3]); 68% regex alone
Job Posting Parsing	5-stage NLP + regex + confidence score	87% field extraction accuracy	No direct academic benchmark novel contribution

VIII Conclusion and Future Scope

A. Conclusion

This paper presented the AI Enhanced Placement Portal, a production-quality, full-stack web application that automates campus recruitment through a combination of NLP-based document parsing, rule-based eligibility verification, and a weighted intelligent job-matching algorithm, deployed on a scalable three-tier cloud architecture. The system achieves all stated objectives: 85 REST API endpoints managing a 16-table PostgreSQL schema, complete student and administrator functional modules, and a four-algorithm ML pipeline covering the complete placement lifecycle from resume submission through job application and outcome tracking.

Performance validation confirms the system supports 300+ concurrent users with sub-500 millisecond response times and 99.7% uptime across testing periods. Comparative analysis demonstrates that the proposed portal is the only system combining campus-specific eligibility enforcement, ML resume parsing, ML job posting parsing, and intelligent matching in a single affordable platform — addressing the critical gap identified by Johnson & Williams [2]. The system reduces placement-officer manual workload by an estimated 90% and accelerates student job discovery by approximately five times compared to the traditional manual processes documented in [1], demonstrating that intelligently designed, purpose-built academic software delivers measurable institutional value.

B. Future Scope

Several directions for future development are identified. In the near term, the system can be extended to a **multi-tenant SaaS model** supporting multiple institutions simultaneously, with data isolation between tenants and a shared feature update pipeline. Integration with **Learning Management Systems and alumni networks** would reduce duplicate data entry and improve student profile completeness. Upgrading the resume parsing module from the current hybrid spaCy+regex approach to a **fine-tuned transformer model** (BERT) trained on domain-specific placement data would close the accuracy gap from 80-85% toward the 94% benchmark demonstrated by Chen et al. [3]. In the longer term, the system can evolve toward **standardized placement reporting** for accreditation compliance, **internship and alumni hiring pipelines**, and a **continuous career development module** providing personalized skill gap analysis and course recommendations based on market demand trends extracted from real-time job posting analysis.

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