Implementation of an AI-Driven Job Search Engine for Personalized Career Development

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Abstract- The job market is changing quickly, and people need better ways to find jobs. This paper explains how an AI-powered job search engine can make hiring easier and help people grow their careers. The system includes useful features like: One-Click Apply to apply for jobs quickly, Bluestock Fintech Aptitude Test (BFAT) to test skills, Skill Assessments to check knowledge in different areas. AI helps recommend jobs by using natural language processing (NLP) and machine learning to match job seekers with the right opportunities. To prevent cheating during tests, the platform includes face detection and tab tracking. These features help keep assessments fair. This job search engine not only helps job seekers find the best career options but also makes it easier for employers to find the right candidates. This paper explains how the system is built, how the technology works, and how all the features come together to improve the hiring process.

Keywords – AI-powered job search engine, One-Click Apply, Bluestock Fintech Aptitude Test (BFAT), Skill Assessment, Natural Language Processing (NLP), Machine Learning

I. INTRODUCTION

The job market has changed a lot in recent years. New technologies like artificial intelligence (AI) and automation have made hiring and job searching very different from before. Companies now look for people with very specific skills, and job seekers often struggle to find the right jobs that match their abilities and interests. At the same time, employers find it difficult to go through thousands of applications to select the best candidates.

Most job search websites today allow users to look for jobs and apply, but they do not provide smart recommendations or skill tests. Recruiters also spend a lot of time reading resumes and conducting first-round screenings, which could be made much easier using AI-powered tools.

In our previous research [1], we designed a theoretical model of this job search system. That study explained how AI and natural language processing (NLP) could be used to improve the hiring process. We focused on how AI could help match job seekers with the right jobs, conduct aptitude tests, and analyze resumes automatically. We also introduced features like One-Click Apply, AI-powered job suggestions, and an expert webinar system to help job seekers with career growth.

Now, in this paper, we are discussing the real-world implementation of our job portal. This means we are not just explaining the idea but also showing how we actually built it, the technology we used, and the challenges we faced. Unlike our previous study, which was mostly about planning and designing, this paper talks about how we turned our ideas into a working system.

II. Proposed Algorithm

As shown in Figure 1, the job portal connects two main users: companies that post jobs and job seekers who apply for them. Each user has a separate web interface to manage their profiles.

A central database stores company details, job postings, job seeker profiles, test assessment questions, and a list of skills. The system selects random assessment questions for job seekers based on the test they are giving. After submitting answers, the system automatically checks them and gives scores. To help job seekers find the best jobs, the system analyzes their skills using TF-IDF, a method to check skill importance. Then, it uses the KNN algorithm to match them with the best job listings. The system also collects extra job-related data from external websites to improve job recommendations.

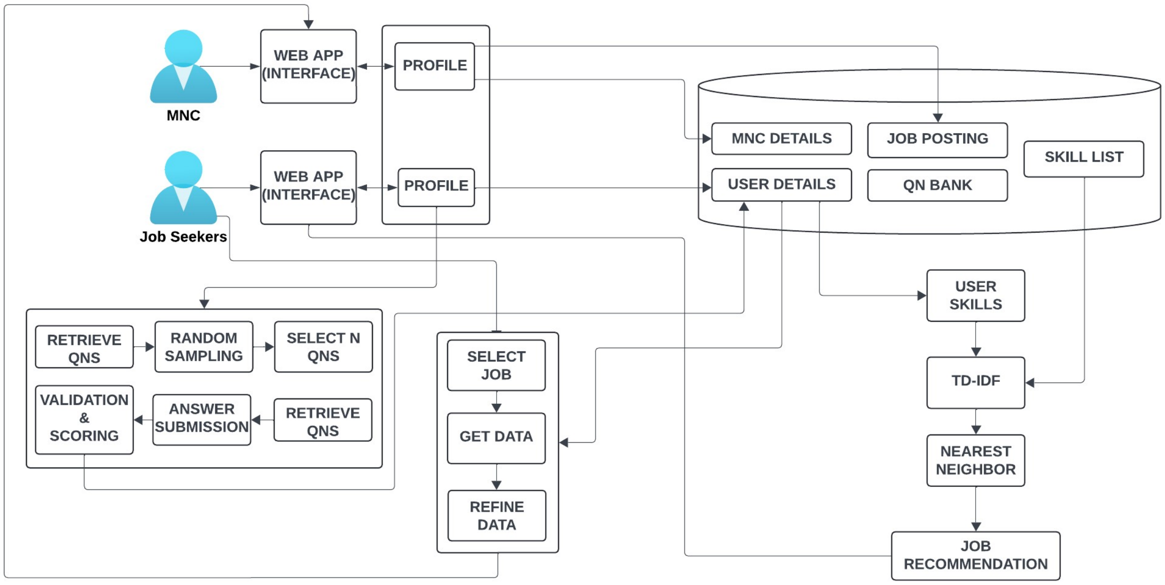


Figure 1. System Architecture

III. System Implementation

The development of the AI-driven job portal required careful planning and execution of various components. Below, we discuss each aspect in detail.

3.1 Technology Stack –

To develop a secure, scalable, and efficient job search engine, we utilized the following technologies:

- Backend Development (PHP): Handles user authentication, job applications, resume parsing, and job recommendations.
- Frontend Development (HTML, CSS, and JavaScript): HTML structures the web pages. CSS (with Bootstrap) ensures a responsive and modern UI. JavaScript (including AJAX) enables real-time dynamic interactions, such as job filtering and form validation.

- Database (MySQL): Stores all user profiles, job listings, applications, skill assessments, and employer records.

- Machine Learning & AI: NLP for resume building and job matching. AI-based Job Recommendations uses TF-IDF and KNN algorithms to suggest jobs based on candidate skills and preferences.

- Online Compiler API (JDoodle): Allows real-time coding assessments within the job portal.
- Cloud Services and Deployment: Docker (for containerization) and Cloudinary Cloud

3.2 Database Structure –

A well-structured database is essential for handling user profiles, job postings, applications, and assessments. The key tables in the database include:

- User Profile Table
- Company Profile Table
- Job Listings Table
- Aptitude Assessment Questions Table
- Skill Assessment Questions Table
- Coding Questions Table

IV. Feature Analysis and Implementation

A. Bluestock Fintech Aptitude Test

Description: The Bluestock Fintech Aptitude Test (BFAT) is designed to assess job seekers' analytical and problem-solving abilities. It evaluates candidates in four key areas: Logical Reasoning, Quantitative Aptitude, Verbal Ability, and Data Interpretation. The test helps recruiters pre-screen candidates based on their aptitude skills before further hiring stages.

Implementation:

1) Frontend
    - The test interface is built using JavaScript, which dynamically loads questions and enables real-time user interactions.
    - The test supports section-based navigation, allowing users to switch between Logical, Quantitative, Verbal, and Interpretation sections.
    - Selected answers are stored in an object and updated dynamically when the user navigates between questions.
2) Backend
    - Fetches random questions from the MySQL database based on the selected section.
    - Collects and processes user responses, calculates scores, and stores results in the database.
    - Retrieves and displays candidates' test results after submission.
3) Security Measures
    - Tab switching detection: If a user attempts to switch tabs, the system records a violation.
    - Full-screen exit warning: If the user exits full-screen mode, a warning is displayed, and repeated violations may end the test.
    - Auto-submission: If the test timer runs out, the system automatically submits the test.

B. Skill Assessment Test

Description: The Skill Assessment feature allows users to evaluate their proficiency in various technical and non-technical domains. The system supports:

- Technical Tests: Includes multiple-choice questions (MCQs) and coding challenges for programming languages.

- Non-Technical Tests: Includes MCQs based on domain-specific knowledge.

Implementation:

1) Test Selection: Users choose a subject or domain for the test.
2) Test Interface:

- MCQs and coding problems are displayed dynamically.
- Timer management for test duration.
- Real-time compilation support for coding problems.

3) Submission & Evaluation:

- MCQs are auto-evaluated.
- Coding problems are executed using JDoodle API.

4) Result Display: Users receive their scores instantly.
5) Code Execution is done using JDoodle API. With respect to our project JDoodle helps in:

- Running user-submitted code: Receives the candidate's code, executes it, and returns the output.
- Supporting Multiple Languages: Executes Python, Java, C++, etc.
- Error Handling: Identifies syntax/runtime errors and sends appropriate feedback.
- Security Measures: Uses sandboxing to prevent malicious code execution.

6) Result Calculation is implemented using the following scoring logic:

i. MCQs Scoring:
   - Each correct answer = +1 marks.
   - Incorrect answers = 0 (or negative marking if applicable).

ii. Coding Evaluation:
   - Runs against test cases.
   - Each passed test case = +X marks.
   - Partial credit for partially correct answers.

C. Job Recommendation

Description: The Job Recommendation feature suggests relevant job opportunities to users based on their skills or job title search. It uses machine learning algorithms to find the best job matches, helping users discover opportunities that align with their expertise.

Implementation:

- The system retrieves job data from a MySQL database, including job titles and descriptions.
- A TF-IDF (Term Frequency-Inverse Document Frequency) vectorizer is used to transform job descriptions into numerical features.
- A k-Nearest Neighbors (k-NN) model is trained on job descriptions to find similar jobs based on a given job title.
- For recommendations by search, users input a job title, and the system returns the top 10 most similar job listings based on text similarity.

- For recommendations by skill, the TF-IDF vectorizer processes the skills and compares them to job descriptions. A k-NN model finds the top 10 job listings that best match the user's skills.
- The trained models (tfidf_vectorizer.pkl and knn_model.pkl) are saved and reused to avoid repeated training.

Several models were trained and tested for the recommendation system. The performance was measured using MAP (Mean Average Precision) and NDCG (Normalized Discounted Cumulative Gain). Metrics like Precision, Recall, and F1 Score are useful for classifying whether a job is relevant or not, but job recommendation is more than just classification—it is about ranking jobs in the right order. MAP and NDCG help measure how well the ranking is done.

The tables below show the results, along with an explanation of why KNN was chosen as the best model for our recommendation system.

Table -1 Model Results

Model	**Recommendation System Evaluation Metrics**		
	MAP (%)	***NDCG (%)***	***Time (sec)***
KNN	100	97.02	0.0047199
FAISS	100	97.02	0.0068964
BM25	100	95.92	0.0032458
SBERT	100	96.77	0.0041944
Siamese Network	89.23	64.40	0.240814

Table 1 presents the results of different models tested for the recommendation system. The points below explain why we chose KNN as the final model for making recommendations in search.

- The Siamese Network was eliminated immediately due to its poor accuracy and the long time required to generate recommendations.
- The FAISS and KNN models performed similarly, providing the same recommendations for different job titles. However, KNN was preferred over FAISS because FAISS is more suitable for larger datasets, which was not the case in our project.
- The SBERT model showed good accuracy but required a significant amount of time to load and run. Additionally, the quality of its recommendations could have been better. The similarity scores it generated for less relevant job titles were higher than those of more relevant job titles.
- The BM25 model had the shortest processing time. However, after manually inspecting the recommendations, it was observed that BM25 performed well for some job titles, but it had a major drawback—when multiple job titles had a similarity score of 0.00, the system randomly displayed any job title, often irrelevant ones.
- Based on these findings, KNN was chosen as the preferred model as it recommended better job titles, and its similarity scores were higher.

The points below explain why we chose KNN as the final model for making recommendations by the user's skills.

- SBERT gives good results, but it takes a long time to load. It also suggests many jobs with the same title instead of showing different job types based on different skills.
- BM25 is the fastest, but it mostly recommends jobs based on how similar the job title is to the skills. It focuses too much on certain skills and does not show results for all skills.
- FAISS and KNN work in a similar way, but KNN was chosen as the final model because it gives faster recommendations based on skills. KNN is also better for smaller datasets, like in our project.

D. Smart Resume Builder

Description: The Smart Resume Builder allows job seekers to easily create professional resumes directly on the job portal. It offers a form-based, drag-and-drop interface for inputting personal, educational, project, and work experience details. Users can preview their resume in real-time and make adjustments interactively. This feature simplifies resume building for users without needing external tools like MS Word or online editors.

Implementation:

1) Frontend

- Loads the form structure and binds input fields for user details such as experiences, projects, and education.
- Manages dynamic section visibility, section movement (up/down), and live updates to the resume preview.
- Implements auto-saving, form validation, and section toggles.
- Loads saved data from local storage so users can resume editing at any time.
- Automatically reflects changes made in the form fields to a resume preview panel.
- Offers an interactive and user-friendly WYSIWYG experience (What You See Is What You Get).

2) Backend

- Converts form entries into a printable PDF or HTML version.
- Handles formatting for display or download.

3) Additional Functionalities

- Bullet-point input formatting for clean resume entries.
- Project links integration**:** Users can attach GitHub/portfolio links to their projects.
- Data persistence via local storage to ensure user input is not lost on page refresh or accidental exit.
- Data Parsing to load data from pre-made resumes.

E. Expert Webinar

Description: The Expert Webinar feature allows job seekers to attend live online sessions hosted by industry professionals. These sessions aim to provide guidance on career planning, industry trends, skill-building, and job interview strategies. Users can join or create meetings, interact through video/audio, and participate in real-time discussions. This feature enhances the platform’s value by offering community learning and mentorship.

Implementation:

1) Frontend

- Built using HTML and Bootstrap 4/5 for layout and responsiveness.
- Offers a pre-join screen where users can configure their camera, microphone, and speaker before entering the session.
- Includes a "Create a Meeting" button that initiates a new session and a Join Meeting input for existing meeting IDs.
- Integrates camera preview and network status indicators to assist users in setting up their devices.
- Uses dark-themed styles for a modern webinar interface.
- Includes network speed monitoring UI with live download/upload rate display

2) Backend

- Uses the VideoSDK JavaScript SDK to handle real-time video communication.
- Core logic includes:

  i. Token generation for secure access.
  ii. Device selection for camera, microphone, and speakers.
  iii. Joining and validating meetings via a generated or user-entered Meeting ID.
  iv. Creating video/audio elements dynamically as users join or leave.
  v. Handling permissions for audio and video devices.
  vi. Screen sharing, recording events, and participant tracking.
  vii. Implements event listeners for meeting lifecycle events such as joining, leaving, and streaming.

3) Key Functional Features

- Admin/Host and Participant based functionalities
- Real-Time Video Conference: Participants can join sessions with video and audio.
- Device Control: Users can toggle webcam/microphone and select preferred devices.
- Network Quality Display: Shows upload/download speed and connection status.
- Recording Support: Meetings can be recorded and saved for later access.
- Participant List and Chat Integration: Basic participant list UI and in-meeting chat (based on pub/sub model).

- Secure Meeting Access: Validates meeting links using unique tokens and room IDs.

F. Technical Interview with Real Person

Description: The Technical Interview with a Real Person feature allows candidates to participate in live one-on-one technical interviews conducted by human interviewers. After a booking is confirmed, the interviewer sends a Google Meet link and relevant interview details directly to the candidate.

G. One-click Apply

Description: The One-Click Apply feature allows users to instantly apply to multiple saved jobs using a single click. It simplifies the job application process by enabling users **to** pre-select resumes and optionally include their BFAT and Skill Assessment scores**.** Users can save job listings they're interested in and apply to all eligible ones at once, enhancing the user experience and saving time.

Implementation:

- When a user views a job's detailed description, they have the option to save the job for later application.
- Clicking the "Save" button triggers a backend request that stores the job in the saved_jobs table, along with: user_id and job_id.
- If the user has uploaded multiple resumes, a dropdown lets them select which one to use for each job.
- Users can choose whether to include their BFAT and Skill Assessment scores as part of their application.
- This information is saved per job in the saved_jobs table to ensure personalized applications.
- The saved jobs are displayed in a separate Saved Jobs Page**,** showing job details and selected options.
- The "Apply to All" button allows the user to apply to all saved jobs in one click.

- If the job has already been applied to by the user (prevents re-application).

V. Challenges Faced & Solutions Implemented

i. Handling real-time code implementation was challenging.

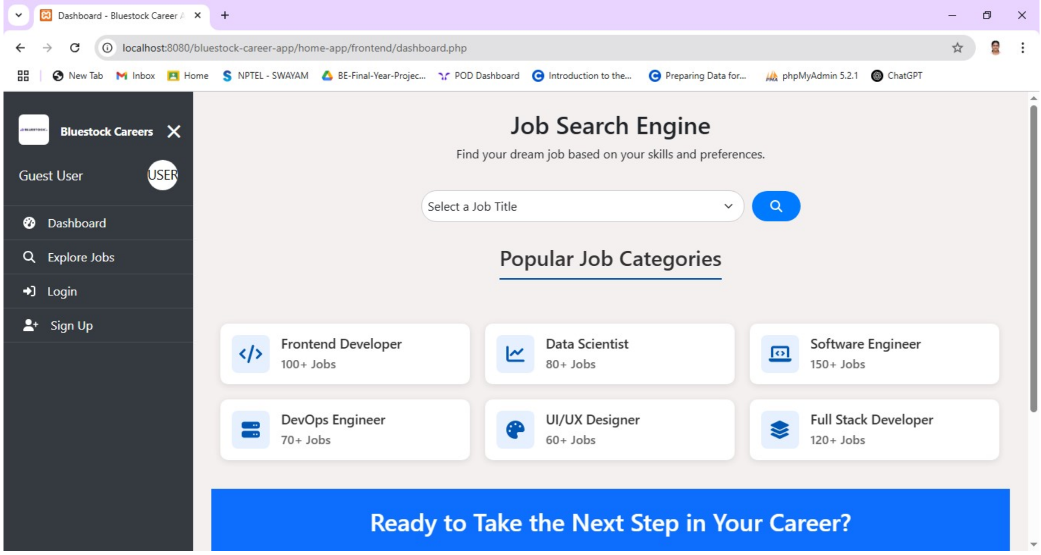
ii. The JDoodle API has a limited number of execution attempts for free accounts. Each test run and submission counted toward this limit, even if the code execution resulted in failure, quickly exhausting the available trials.

iii. Making sure the camera could detect and recognize multiple faces at the same time was difficult. Training the model to do this correctly took a lot of time and effort.

iv. Parsing resumes was also a big challenge because every resume looked different and had a different format. So, we decided on one final format and did the parsing based on that. But even after that, parsing still remained difficult sometimes.

v. Sending emails to individual webinar participants with tailored subjects and message content proved to be challenging.

VI. Outputs



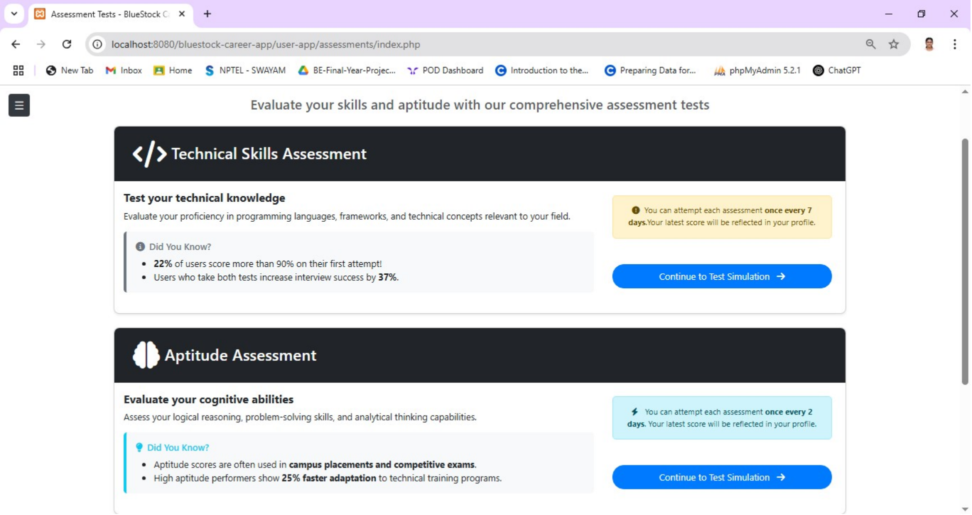
Job Search Engine

Find your dream job based on your skills and preferences.

Popular Job Categories

Ready to Take the Next Step in Your Career?

Figure 2. User Dashboard


Assessment Tests - BlueStock C
localhost:8080/bluestock-career-app/user-app/assessments/index.php
New Tab
Inbox
Home
NPTEL - SWAYAM
BE-Final-Year-Projec...
POD Dashboard
Introduction to the...
Preparing Data for...
phpMyAdmin 5.2.1
ChatGPT
Continue to Test Simulation →
Continue to Test Simulation →

Evaluate your skills and aptitude with our comprehensive assessment tests

Technical Skills Assessment

Test your technical knowledge

Evaluate your proficiency in programming languages, frameworks, and technical concepts relevant to your field.

Did You Know?

- **22%** of users score more than 90% on their first attempt!
- Users who take both tests increase interview success by **37%**.

You can attempt each assessment **once every 7 days.**Your latest score will be reflected in your profile.

Aptitude Assessment

Evaluate your cognitive abilities

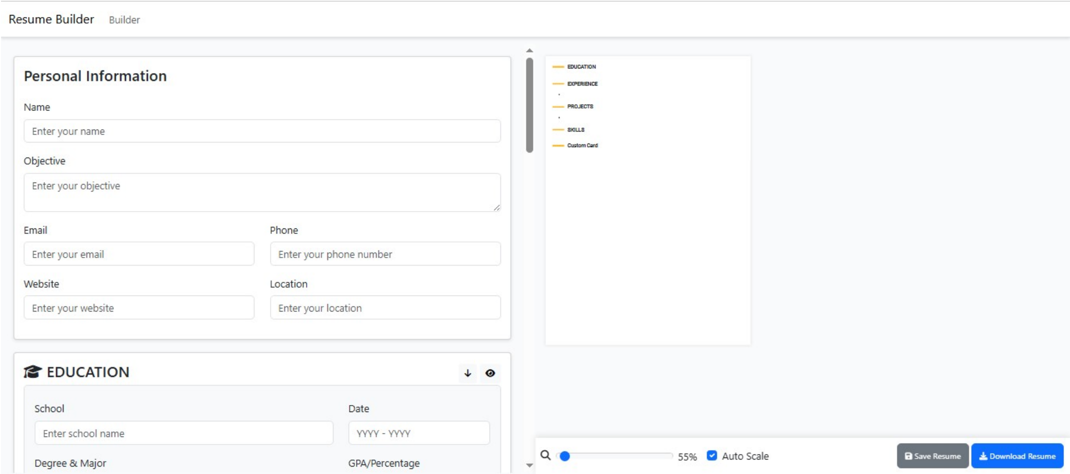
Assess your logical reasoning, problem-solving skills, and analytical thinking capabilities.

Did You Know?

- Aptitude scores are often used in **campus placements and competitive exams**.
- High aptitude performers show **25% faster adaptation** to technical training programs.

You can attempt each assessment **once every 2 days.** Your latest score will be reflected in your profile.

Figure 3. Aptitude and Skill Assessment



Resume Builder Builder

Personal Information

Name

Enter your name

Objective

Enter your objective

Email | Phone

Enter your email | Enter your phone number

Website | Location

Enter your website | Enter your location

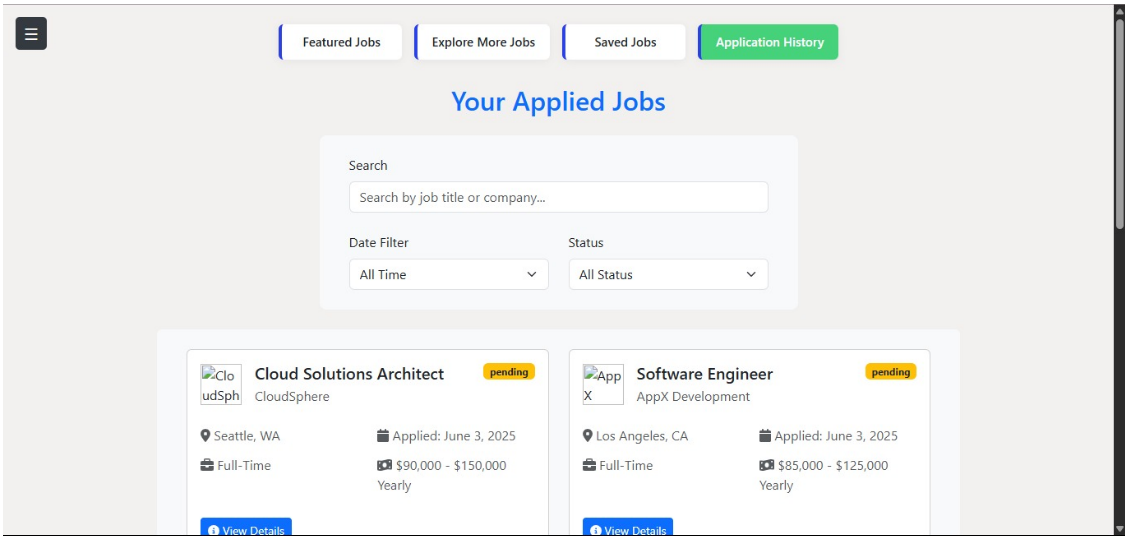
EDUCATION

School | Date

Enter school name | YYYY - YYYY

Degree & Major | GPA/Percentage

Figure 4. Resume Builder



Your Applied Jobs

Search

Search by job title or company...

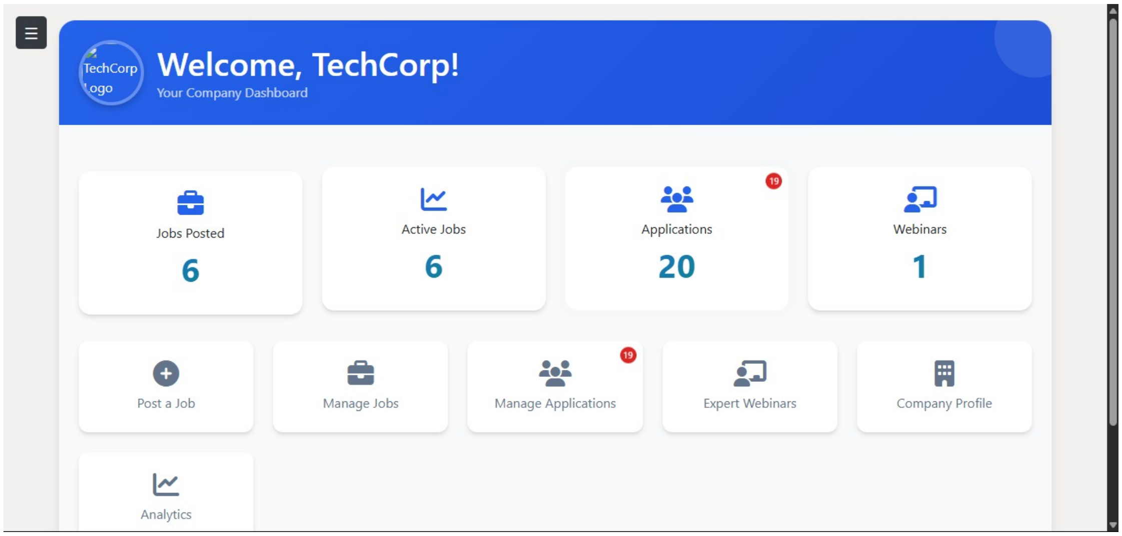
Date Filter: All Time

Status: All Status

Cloud Solutions Architect — pending
CloudSphere
Seattle, WA — Applied: June 3, 2025
Full-Time — $90,000 - $150,000 Yearly
View Details

Software Engineer — pending
AppX Development
Los Angeles, CA — Applied: June 3, 2025
Full-Time — $85,000 - $125,000 Yearly
View Details

Figure 5. One-Click Apply

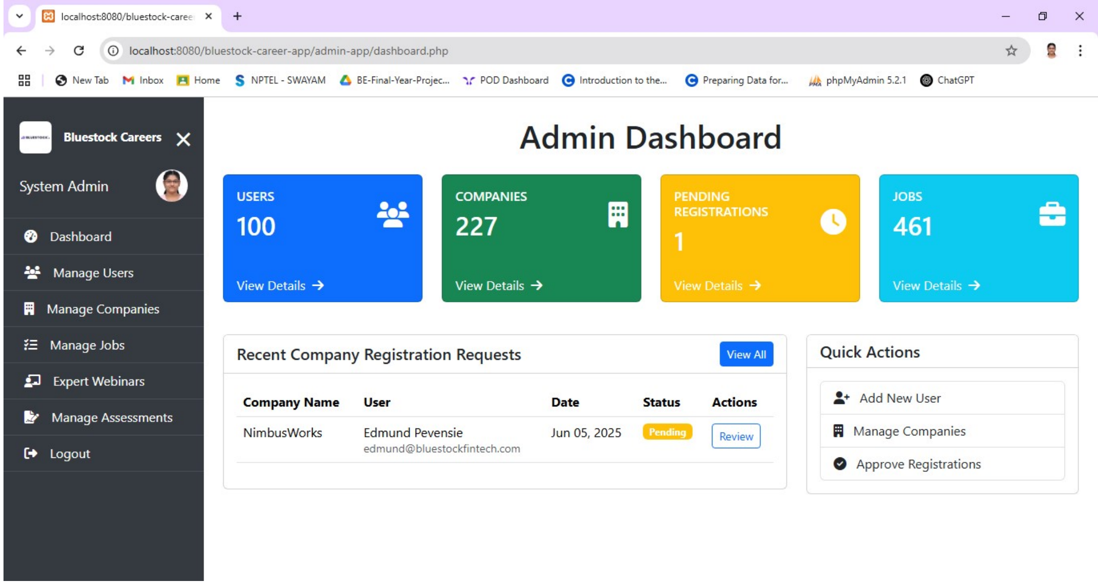


Welcome, TechCorp!

Your Company Dashboard

Jobs Posted	Active Jobs	Applications	Webinars
6	6	20	1

Figure 6. Company Dashboard



Admin Dashboard

USERS 100 View Details →

COMPANIES 227 View Details →

PENDING REGISTRATIONS 1 View Details →

JOBS 461 View Details →

Recent Company Registration Requests View All

Company Name	User	Date	Status	Actions
NimbusWorks	Edmund Pevensie edmund@bluestockfintech.com	Jun 05, 2025	Pending	Review

Quick Actions

- Add New User
- Manage Companies
- Approve Registrations

Figure 7. Admin Dashboard

VII. Future Scope

- Create a dashboard for users to view past BFAT test results, performance trends, and areas of improvement. It could provide feedback on how to improve based on test performance.
- Implement a leader-board to allow users to compare their scores with others, fostering a sense of competition and motivation for improvement.
- The system can be able to track how good a user is at certain skills and show their progress over time.
- Show job recommendations along with a skill gap analysis, suggesting online courses or certifications for the candidate to improve their qualifications for the job.
- Allow users to watch replays of webinars with time-stamped chapters, so they can skip to specific sections of the webinar that interest them.
- Add an ATS compatibility checker that ensures the resume format is suitable for Applicant Tracking Systems, highlighting potential issues that might prevent the resume from being seen by recruiters.
- Introduce a wider variety of professional resume templates to give users more design choices tailored to different industries and job roles.

VIII. CONCLUSION

This project successfully delivers an AI-driven job search and career development platform that bridges the gap between job seekers and employers. By integrating smart features like one-click apply, skill-based job recommendations, technical assessments, and expert webinars, the system provides a seamless and personalized experience. Using machine learning algorithms such as TF-IDF with KNN, along with secure and user-friendly interfaces, the platform enhances both recruitment efficiency and user engagement. Overall, it offers a complete and scalable solution to simplify the hiring process and support career growth in today’s competitive job market

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