



*Green University of Bangladesh*

*Department of Computer Science and Engineering (CSE)  
Semester: (Spring, Year: 2025), B.Sc. in CSE (Day)*

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# **AI-Powered Next-Gen Job Recommendation System Using NLP and Machine Learning**

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*Lab Report: 06  
Course Title: Integrated Design Project II  
Course Code: CSE - 406  
Section: 213 - D6*

## Students Details

<b>Name</b>	<b>ID</b>	<b>Role</b>
Irteja Mahmud	213902016	Leader
Pankaj Mahanta	213902002	Member-1
Nazmul Hasan	213902003	Member-2

*Submission Date: 03 - 05 - 25  
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[For teachers use only: **Don't write anything inside this box**]

<u><b>Lab Project Status</b></u>	
<b>Marks:</b>	<b>Signature:</b>
<b>Comments:</b>	<b>Date:</b>

# 1 Introduction

The AI-Powered Next-Gen Job Recommendation System (NGJRS) leverages Natural Language Processing (NLP) and Machine Learning (ML) to enhance job matching. It provides personalized job recommendations by analyzing user profiles, resumes, and job listings. The system offers real-time job search, automated CV parsing, employer-candidate matching, and a user-friendly interface. By integrating external job boards and continuously learning from user interactions, NGJRS ensures accurate and efficient job recommendations, making the hiring process faster and more effective for both job seekers and employers.

## 2 Objectives

The major objectives of this project are:

- **Develop an AI-Based Job Recommendation System:** Implement an intelligent recommendation engine that utilizes NLP and machine learning to enhance job matching accuracy.
- **Improve Candidate-Job Suitability:** Use BERT embeddings and semantic similarity techniques to ensure that job recommendations align with candidate skills and preferences.
- **Optimize the Recruitment Process:** Provide recruiters with a ranked list of potential candidates based on job requirements, reducing manual filtering efforts.
- **Enhance User Experience:** Design an intuitive user interface for job seekers and employers, ensuring ease of use and seamless navigation.
- **Integrate External Job Data Sources:** Aggregate job listings from various external job boards to provide users with up-to-date employment opportunities.

## 3 Test Case Implementation

Table 1: Self Evaluation

Serial No:	Name	ID	Role	Activity	Ratio	Mark
1	Irteja Mahamud	213902016	Leader	Testing & Report	40%	10
2	Pankaj Mahanta	213902002	Member-1	Testing & Report	30%	10
3	Nazmul Hasan	213902003	Member-2	Testing & Report	30%	10

### b. Test Case Documentation

To ensure systematic validation, each module of the system was tested against predefined inputs, actions, and expected outcomes. Test cases were compiled in a tabular Excel format under the file name: **NextWorkX\_TestCases.xlsx**.

The test cases cover the following modules:

- Registration (TC-001)
- Login (TC-002)
- Job Recommendation (TC-003)
- Job Application (TC-004)
- Resume Upload (TC-005)
- Admin Login (TC-006)
- Job Posting (TC-007)
- Company Profile Setup (TC-008)
- Bookmark Jobs (TC-009)
- Search Filter (TC-010)

Each entry documents:

- Test Case Number
- Criteria
- Description and Steps
- Action Performed
- Input and Expected Output
- Actual Output and Final Result

This documentation served as the foundation for validating both frontend and back-end logic. It helped the team identify potential edge cases and verify consistent system behavior. The organized format ensured clarity, traceability, and ease of peer review during development and testing phases.

### **c. UI Components and Execution Screenshots**

Below are the screenshots of test execution or UI snapshots corresponding to each of the 10 major test cases:

Each screenshot captures the real-time behavior of the system, including form submissions, validation messages, and page redirections. These visual proofs validate that the system responds accurately to various user interactions and functional inputs during testing.

Test Case Number	Criteria	Test Case Description	Test Case Steps	Action	Input(Test Case)	Expected Output	Actual output	Test Result
TC-001	Valid Registration	User registers with valid details	1. Go to Sign Up page 2. Enter all required fields 3. Click 'Sign Up'	1) User submits valid registration form	Full Name: John Doe Email: john@example.com Password: abc123	"Account created successfully" message Redirect to login page	Account created and redirected	Pass
				2) User enters an invalid email format	Email: john@.example.com	Email format valid	Invalid email detected	Pass
				3) Password is encrypted	Password: abc123	Password encrypted	Password stored in encrypted format	Pass
				4) Data saved to database	All valid data	Account created in database	Account saved successfully	Pass
				5) Redirect to login page after registration	N/A	Redirected to login page	Login page loaded	Pass

Figure 1: TC-001: Registration Form Validation and Redirection

Test Case Number	Criteria	Test Case Description	Test Case Steps	Action	Input(Test Case)	Expected Output	Actual output	Test Result
TC-002	Valid Login	User logs in with valid details	1. Go to Login page 2. Enter credentials 3. Click 'Login'	1) User submits login form	Email: john@example.com Password: abc123	Credentials submitted	Credentials accepted	Pass
				2) Credentials are validated	Email: john@example.com Password: abc123	Credentials matched	User authenticated	Pass
				3) Session token is generated	User ID: 102	Session token generated	Token created	Pass
				4) User is redirected to dashboard	N/A	User redirected to dashboard	Dashboard page loaded	Pass

Figure 2: TC-002: Login Verification and Dashboard Redirect

Test Case Number	Criteria	Test Case Description	Test Case Steps	Action	Input(Test Case)	Expected Output	Actual output	Test Result
TC-003	Job Recommendation	System recommends jobs based on user skills	1. Log in as job seeker 2. Click on 'Show My Matches'	1) User clicks on 'Show My Matches'	User ID: 1005 Skills: [Python, ML]	Top 5 matched jobs are fetched	Top 5 job IDs displayed	Pass
				2) Profile data is loaded	User ID: 1005	Profile data loaded	Profile fetched from DB	Pass
				3) Matching scores are calculated	TF-IDF vectors from profile and jobs	Similarity scores generated	Scores: [0.92, 0.87, ...]	Pass

Figure 3: TC-003: Job Recommendation Based on User Skills

Test Case Number	Criteria	Test Case Description	Test Case Steps	Action	Input(Test Case)	Expected Output	Actual output	Test Result
TC-004	Job Application	User applies to a selected job	1. View job details 2. Click 'Apply Now'	1) User clicks 'Apply Now'	User ID: 1005 Job ID: 203	Application is submitted	Application submitted	Pass
				2) Application is recorded	user_id, job_id, applied_at	Saved to applications table	Application stored successfully	Pass
TC-005	Resume Upload	User uploads a valid resume file	1. Go to resume upload section 2. Choose and upload a resume file	1) User uploads a valid PDF resume	File: resume.pdf Size: 3MB	Resume uploaded successfully	Resume saved and displayed	Pass
				2) File type and size are validated	File: resume.docx or size > 5MB	Invalid file or size error shown	Error message displayed	Pass

Figure 4: TC-004 & TC-005: Job Application and Resume Upload

Test Case Number	Criteria	Test Case Description	Test Case Steps	Action	Input(Test Case)	Expected Output	Actual output	Test Result
TC-006	Admin Login	Admin logs in using correct credentials	1. Go to Admin Login page 2. Enter credentials 3. Click 'Login'	1) Admin submits login form	Email: admin@networkx.com Password: admin123	Admin redirected to dashboard	Admin dashboard loaded	Pass
				2) Invalid login credentials entered	Email: admin@wrong.com Password: wrongpass	Error message displayed	Invalid credentials alert	Pass
TC-007	Job Posting	Recruiter posts a new job	1. Login as recruiter 2. Fill job post form 3. Submit	1) Submit new job post form	Title: Web Developer Location: Dhaka Salary: 25,000-35,000 BDT	Job posted successfully	Job entry added to database	Pass
				2) Leave required fields empty	Title: [Blank] Location: Dhaka	Form validation error	Warning: Required fields missing	Pass

Figure 5: TC-006 & TC-007: Admin Login and Job Posting

Test Case Number	Criteria	Test Case Description	Test Case Steps	Action	Input(Test Case)	Expected Output	Actual output	Test Result
TC-008	Company Profile Setup	Recruiter completes company profile steps	1. Login as recruiter 2. Go to Settings > Company Profile 3. Fill each step and submit	1) Fill out 'Company Info' step	Company Name: DevTech Ltd. Founded: 2018	Company info saved	Info saved in company_profiles table	Pass
				2) Skip a step and try to continue	Step: Social Media InfoFields	Validation error message	Step cannot proceed without data	Pass
TC-009	Bookmark Job	User bookmarks a job for later viewing	1. Login as job seeker 2. Click on bookmark icon for a job 3. Click 'Search'	1) User bookmarks a job	User ID: 1005 Job ID: 203	Job added to saved list	Job saved in bookmarks table	Pass
				2) User views saved jobs	User ID: 1005	List of bookmarked jobs displayed	Saved job list shown	Pass
				3) User removes a saved job	User ID: 1005 Job ID: 203	Job removed from saved list	Job deleted from bookmarks table	Pass

Figure 6: TC-008 & TC-009: Company Profile Setup and Job Bookmarking

Test Case Number	Criteria	Test Case Description	Test Case Steps	Action	Input(Test Case)	Expected Output	Actual output	Test Result
TC-010	Search Filter	User searches for jobs using keyword filter	1. Go to job search page 2. Enter keyword in search box 3. Click 'Search'	1) User searches by keyword	Keyword: Python Developer	Jobs with title or description containing keyword are shown	Relevant jobs displayed	Pass
				2) Filter by city	City: Dhaka	Jobs located in Dhaka are displayed	City-filtered jobs shown	Pass
				3) Filter by salary range	Min: 20000, Max: 50000	Jobs within salary range are shown	Salary-filtered jobs shown	Pass
				4) Apply multiple filters together	Keyword: Developer City: Dhaka Salary: 20000-50000	Jobs matching all filters are shown	Filtered job list displayed	Pass
				5) Clear all filters	Click on 'Reset/Clear Filters'	All filters cleared and default job list shown	Filters reset and full list reloaded	Pass

Figure 7: TC-010: Search Filter Functionality

## 4 Conclusion & Discussion

The AI-Powered Next-Gen Job Recommendation System (NGJRS) was successfully designed, implemented, and tested to enhance the job search and recruitment experience using Natural Language Processing and Machine Learning. Through a structured and modular approach, we were able to integrate core functionalities including job recommendation, job posting, resume upload, search filters, bookmarking, and admin-level control.

The test case implementation provided a robust framework to validate each module of the system. A total of 10 core modules were tested thoroughly, and all test cases passed successfully, indicating the system's reliability and readiness for deployment. Screenshots of each module and their corresponding output confirmed the alignment between expected and actual behavior.

Throughout the development cycle, each team member contributed significantly across various roles such as system architecture, frontend and backend development, machine learning integration, and quality assurance. The collaborative effort ensured a well-rounded and functional system.

This project not only fulfilled its initial objectives but also opened up opportunities for further enhancement. Potential future improvements include integrating real-time job market APIs, adding deep learning-based personalization, and implementing analytics dashboards for recruiters.

In conclusion, NGJRS demonstrates the effective application of AI techniques in real-world systems and holds strong potential to transform the job-seeking process for users and streamline hiring for employers.

# References

- [1] Towards Data Science. Understanding tf-idf: A powerful technique for text mining, 2023. Accessed: 2024-10-18.
- [2] KDnuggets. How recommendation systems work: Techniques and applications, 2023. Accessed: 2024-10-18.

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