

CSE Verse

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Abstract

Many CSE students find it difficult to choose the right courses, prepare for interviews, find internships, or understand what skills they need for their future career. To solve this problem, we built an AI-powered educational and career guidance platform specially designed for Computer Science and Engineering students. This platform is a desktop application created using Electron, where students and Training & Placement Officers (TPO) can log in through separate panels. Students can chat with an AI assistant that recommends courses, provides learning paths, and generates mock tests based on the student's skills and interests. TPOs can upload internships, courses, and view student data easily. The system helps students get personalized guidance and helps colleges manage training-related information more smoothly. This project shows how AI can make education and career planning easier and more effective for engineering students.

Keywords: AI Assistant, Career Guidance, Electron Desktop App, Course Recommendation, Student Dashboard.

1. Introduction

Choosing the right career path and identifying the most relevant skills has become one of the major challenges for engineering students in today's rapidly evolving technological world. The IT industry is changing faster than ever—new programming languages, tools, frameworks, platforms, and job roles emerge every year. Because of this, students often feel lost about where to begin, what to learn next, and how to plan their long-term career. Many lack clarity about industry expectations, trending technologies, and the step-by-step path required to build a successful professional profile. Instead of receiving structured and personalized guidance, a large number of students depend on random online sources such as YouTube videos, social media influencers, or informal advice from friends and seniors. While these sources may provide some information, they lack personalization, accuracy, and proper direction. This often leads to confusion, misinformation, and poor decision-making. As a result, students find it difficult to understand the exact skills required for specific job roles like software developer, data analyst, AI engineer, or cybersecurity specialist. They also struggle to identify the right courses to study, the best sequence of learning, and

how to create a clear roadmap that matches their abilities and goals. At the same time, Training and Placement Officers (TPOs) face significant challenges as well. TPOs are responsible for coordinating internships, campus placements, training programs, company interactions, skill development sessions, and maintaining student records. Managing all these tasks manually—especially for large batches of students—becomes extremely time-consuming and inefficient. Traditional methods such as Excel sheets, handwritten notes, or scattered data storage make it difficult for TPOs to track progress, identify student strengths and weaknesses, or recommend the right opportunities to the right students. They also need a more intelligent way to analyze student performance trends and skill gaps so that training activities can be planned effectively. To solve these problems for both students and TPOs, we developed an AI-powered Educational and Career Guidance Platform. This system functions like a personal digital mentor for every CSE student. By analyzing the student's academic background, interests, technical skills, learning speed, and career goals, the platform generates customized recommendations for courses,

certifications, projects, and internships. It also provides AI-generated mock tests that help students assess their knowledge and prepare for exams, coding tests, and interviews. Instead of providing general suggestions, the system offers guidance that is tailored to each individual student, ensuring that every learner receives support aligned with their unique profile and aspirations. For TPOs, the platform provides a centralized and user-friendly dashboard where they can manage all placement-related activities efficiently. They can upload internships, add recommended courses, monitor student progress, and view complete student data in a structured format. This reduces manual work, improves coordination, and ensures transparency in the training and placement process. TPOs can quickly identify which students are ready for company recruitment, which skills are lacking in the batch, and what type of training should be organized next. Overall, this AI-powered platform aims to eliminate confusion, reduce manual workload, and create a much smoother guidance experience. By combining artificial intelligence with well-organized student data, the system ensures that every student receives the right guidance at the right time. It brings clarity to their academic journey, supports career decision-making, and prepares them more effectively for future job opportunities. practical solution that bridges the communication gap, promoting inclusivity and understanding. This document outlines the design, implementation, and testing of the Digital Vocalizer system, detailing the hardware and software components involved. Our goal is to contribute to the development of assistive technologies that empower differently-abled individuals and foster a more inclusive society [1].

2. Literature Survey

- **“Leveraging AI in E-Learning: Personalized Learning and Adaptive Assessment through Cognitive Neuropsychology — A Systematic Analysis.”** *Electronics (MDPI)*, 2024.

This paper presents an extensive analysis of how AI and cognitive neuropsychology contribute to personalized e-learning systems. It examines adaptive assessment models, learner profiling, and how cognitive data can fine-tune learning pathways.

The study emphasizes AI’s capability to analyze behavioral patterns, predict performance, and recommend individualized content in real time. It further highlights how intelligent tutoring systems can improve student engagement, retention, and academic outcomes.

- **“Adaptive Learning Using Artificial Intelligence in e-Learning — A Literature Review.”** *MDPI, Education Journal*, 2023.

This review surveys multiple artificial intelligence and machine-learning techniques applied to adaptive learning systems, including recommender algorithms, student modeling, predictive analytics, and automated content sequencing. The paper highlights how AI can analyze learning patterns, detect knowledge gaps, and generate dynamic learning paths for individual students [2].

- **“The Effects of Artificial Intelligence Applications in Education.”** *ScienceDirect*, 2024.

This study provides a broad analysis of AI applications across various educational domains. It discusses benefits such as personalized instruction, automated assessment, intelligent tutoring, and administrative efficiency. Additionally, the paper highlights challenges including ethical considerations, data privacy, transparency, and accuracy of AI-based decision-making.

- **“Artificial Intelligence and Digital Ecosystems in Education.”** *Springer*, 2024.

This publication explores the architecture of AI-enabled digital learning ecosystems. It explains integration frameworks, multimodal data flows, and how multiple AI services can be combined into a unified educational platform. The study also emphasizes usability, cross-platform deployment, and real-time analytics within modern educational systems.

- **“AI-Enabled Smart Education System.”** *IJSRSET / Preprints*, 2025.

This paper provides implementation-level discussion of smart education systems using chatbots, attendance automation, academic support modules, and real-time analytics. It focuses on practical deployment challenges and solutions for building AI-assisted applications for institutes.

- “Artificial Intelligence in Computer Programming Education.” ScienceDirect, 2025.

This study specifically examines the use of AI in programming education, including automated code evaluation, intelligent hints, error detection, and personalized coding exercises. It explores how AI tools can support skill-building for computer science students [3].

3. System Overview

The proposed AI-Powered Educational Guidance Platform functions as an integrated desktop-based ecosystem designed to support both Computer Science and Engineering (CSE) students and Training & Placement Officers (TPOs). The system operates through two major interfaces—Student Panel and TPO Panel, supported by a centralized AI Assistant Module and a scalable data management layer. The overall workflow integrates user data collection, AI-driven analysis, course/internship management, and personalized recommendations.

3.1. Student Panel

The Student Panel serves as a personalized learning and career development environment where each student can manage their academic details and receive tailored guidance. The student-side functionalities include:

- **Profile Management:** Students can enter and update their technical skills, academic year, projects, certifications, and career goals.
- **AI-Based Course Recommendations:** The system analyzes the student profile and suggests the most relevant courses aligned with emerging technologies and industry needs.
- **Personalized Learning Roadmap:** Students receive a step-by-step roadmap for domains such as Artificial Intelligence, Web Development, Data Science, Cybersecurity, and Cloud Computing.
- **AI-Generated Mock Tests:** The platform dynamically generates domain-specific mock tests based on the student’s skill level, allowing them to evaluate their knowledge and track progress.
- **Performance Analysis:** After test

submission, the AI provides detailed explanations, evaluates incorrect responses, and suggests areas of improvement.

- **AI Chat Assistance:** Students can interact with an AI chatbot to clarify doubts, ask for guidance, request project ideas, or explore career pathways.

3.2. TPO Panel

The TPO Panel is designed to simplify and automate training and placement operations within engineering institutions. The major functionalities include:

- **Internship Management:** TPOs can upload internships, specify eligibility criteria, and manage student applications.
- **Course and Training Uploads:** New technical courses, training programs, and workshops can be added to the system for student access [4].
- **Student Database Access:** TPOs can view complete student profiles including skills, interests, performance scores, and career preferences in a structured manner.
- **Skill & Readiness Analysis:** Dashboards allow TPOs to identify skill gaps, track batch-level progress, and determine student readiness for placement drives.
- **Centralized Training Administration:** All training activities, student registrations, and learning updates are stored in a unified system for efficient tracking.

3.3. AI Assistant Module

The AI module forms the core intelligence of the platform. It processes student inputs, generates personalized guidance, and automates educational support tasks. Key capabilities include:

- **Student Profiling and Analysis:** The AI identifies strengths, weaknesses, interests, and performance trends.
- **Dynamic Recommendation Engine:** Based on goals and skill levels, the AI suggests courses, certifications, projects, and internships.
- **Mock Test Generator:** The system creates domain-specific quizzes using NLP and prompt-based logic.
- **Performance Feedback:** AI evaluates

answers, generates explanations, and provides actionable suggestions for improvement.

- **Career Mentoring:** The AI assists students in exploring job roles, skill requirements, and learning sequences [5].

3.4. Technology Stack

The platform is built using a robust and scalable technology stack suitable for cross-platform desktop deployment:

- **Electron.js** – Framework for developing cross-platform desktop applications.
- **HTML5 and CSS3** – Structure and styling of the user interface.
- **JavaScript (ES6+)** – Frontend logic, validation, and event handling.
- **Node.js** – Backend processing, API handling, and AI request management.
- **SQLite** – Database for storing student profiles, course data, and TPO entries.
- **Gemini API** – For personalized recommendations, mock test generation, and chatbot interactions.
- **bcrypt.js** – Password hashing and secure authentication.
- **Chart.js** – Visualization of analytics and skill dashboards.

4. Methodology and Implementation

The methodology adopted for developing the AI-Powered Educational Guidance Platform involves a structured set of stages, including data collection, preprocessing, AI model integration, and system development using Electron and Node.js. The overall implementation focuses on delivering personalized learning experiences for students and efficient management features for Training and Placement Officers (TPOs).

4.1. Methodology

4.1.1. Data Collection

The system begins by collecting essential student information required for generating personalized guidance. Students provide details such as:

- Technical skills (e.g., C, Java, Python, SQL)
- Areas of interest (AI, Web Development, Cloud Computing, etc.) [6]
- Academic year and educational background

- Projects completed and previous experience
- Short-term and long-term career goals

This dataset serves as the primary input for the AI assistant to evaluate student readiness and recommend suitable learning resources.

4.1.2. Data Preprocessing

Before generating recommendations, the collected data is preprocessed to ensure accuracy and usability.

- Incomplete entries are filtered to maintain data integrity.
- Skills and interests are normalized into predefined categories for consistent AI interpretation.
- Redundant or irrelevant data is removed to reduce noise [7].
- Student strengths, weaknesses, and interest patterns are identified to support personalized suggestions.

This preprocessing step ensures that the AI model receives clean, structured, and meaningful data, enhancing the quality of its output.

4.1.3. AI Model Integration

The platform integrates a cloud-based AI engine such as Gemini or GPT, which enables dynamic interaction and real-time guidance. The AI assistant performs:

- Prompt-based course recommendations based on skills, trends, and interest areas.
- NLP-driven query understanding to interact naturally with students.
- Automatic mock-test generation, including MCQs and coding questions tailored to the student's domain.
- Evaluation of test responses, with detailed explanations and performance analytics.

This integration allows the system to function as a personalized virtual mentor for CSE students.

4.1.4. System Architecture

The system follows a layered architecture consisting of UI, backend, AI, and database components:

- **Electron Frontend:** Delivers a smooth desktop application experience with HTML, CSS, and JavaScript.
- **Node.js Backend Server:** Handles routing, authentication, business logic, and communication between modules.

- **AI API Layer:** Connects to GPT/Gemini models for recommendations, roadmaps, and test generation [8].
- **Database Storage Layer:** SQLite/Firebase is used to store student profiles, TPO data, internship listings, and test scores.

This architecture ensures scalability, modularity, and efficient data flow across the entire system.

4.2. Implementation

The implementation involves building multiple functional modules that together form the complete guidance platform.

4.2.1. A. Login and Registration Module

- Separate login interfaces for Students and TPOs.
- Passwords encrypted using bcrypt for secure authentication.
- Role-based routing to different dashboards after login.

4.2.2. Student Module Implementation

The student interface is designed to be intuitive and interactive.

- **Profile Setup:** Students enter skills, interests, projects, and academic details.
- **AI Course Recommendation:** Node.js sends profile data to the AI API, which returns curated course and certification suggestions.
- **Learning Roadmap Generator:** The AI generates a step-by-step learning plan, including foundational topics, projects, and advanced skills.
- **Mock Test Generator:** Students choose a domain, and the AI creates a test with varying difficulty levels.
- **Results and Analytics:** Test responses are evaluated and stored. Students receive performance charts and improvement tips.

4.2.3. TPO Module Implementation

The TPO dashboard provides administrative and analytical capabilities [9].

- **Internship Management:** TPOs can add, edit, or remove internship listings.
- **Technical Course Uploads:** New courses or training sessions can be uploaded for student access.
- **Student Data Viewer:** The platform displays

complete student profiles and performance metrics.

- **Skill Gap Analysis:** The dashboard visualizes trends such as domain interest distribution, readiness level, and common weaknesses.

4.2.4. Database Implementation

- SQLite/Firebase stores all user data securely.
- Tables include students, TPO, tests, courses, internships, and results.
- Queries are optimized for fast retrieval within the desktop environment [10].

4.2.5. Testing and Validation

- Unit testing performed on student profile evaluation.
- Cross-checking of AI recommendations with student feedback.
- Validation of TPO functionalities across multiple trials.
- Usability testing to ensure smooth navigation and interface clarity.

5. Experimentation

The proposed AI-powered educational guidance platform was experimentally evaluated through three core testing processes: Student Profile Evaluation, AI-Generated Mock Tests, and TPO Dashboard Testing. Each component was tested with real student inputs and feedback from TPOs to validate accuracy, usability, and system performance.

5.1. Results

The AI Powered Educational Guidance Platform was successfully developed and tested using various student and TPO functionalities. The system effectively provides AI-based career guidance, course recommendations, skill gap analysis, resume analysis, mock tests, and campus drive management. The application was implemented using Electron.js, Node.js, SQLite, and Gemini AI API. The developed system demonstrated proper interaction between frontend, backend, AI services, and database management. The following results were obtained after implementation and testing:

5.1.1. User Authentication Result

The student and TPO registration/login system worked successfully with encrypted password storage using bcrypt hashing. The authentication

process ensured secure access to dashboards.
 Outcome:

- Successful user registration [11]
- Secure login validation Shown in Figure 1
- Separate dashboards for Student and TPO

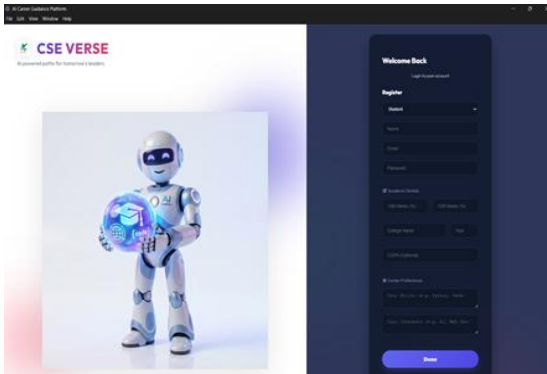


Figure 1 CSE Verse Registration Interface

5.1.2. AI Career Guidance Result

The Gemini AI integration successfully generated:

- Career recommendations
- Career roadmaps
- AI chatbot responses
- Skill gap analysis

The AI system provided personalized suggestions based on:

- Skills [12]
- Interests
- Career goals

Outcome:

- Accurate career suggestions
- Interactive AI conversation
- Personalized guidance Shown in Figure 2

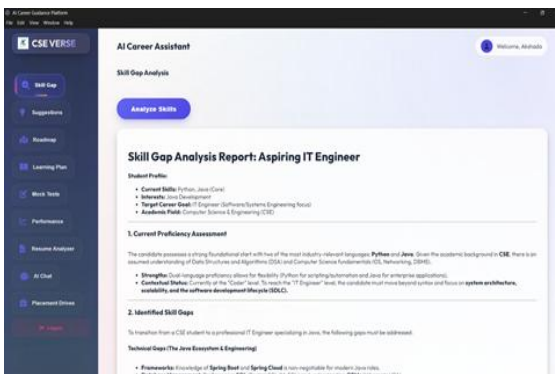


Figure 2 AI Career Assistant Skill Gap Analysis Dashboard

5.1.3. Course and Internship Recommendation Result

The Content-Based Filtering Algorithm successfully recommended courses and internships according to student profiles.

Outcome:

- Personalized recommendations
- Better learning opportunities [13]
- Improved career planning Shown in Figure 3

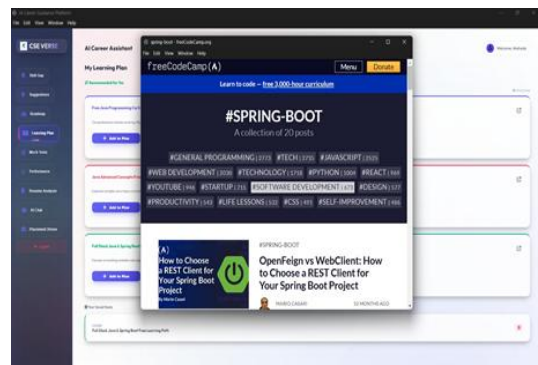


Figure 3 AI Career Assistant Course Suggestion System

5.1.4. Mock Test and Evaluation Result

The mock test module generated technical questions and evaluated student performance automatically.
 Outcome:

- Automatic score calculation
- Performance feedback Shown in Figure 4
- Identification of strengths and weaknesses

The analytics dashboard displayed student progress using graphical representation.

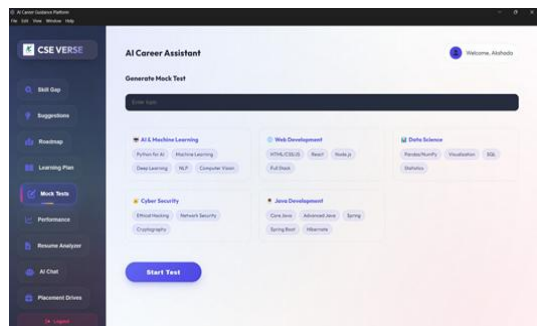


Figure 4 Personalized Mock Test Selection Dashboard

5.1.5. Resume Analysis Result

The resume analyzer successfully extracted text from

PDF resumes and generated AI-based improvement suggestions. Outcome:

- Resume correction suggestions [14]
- Skill improvement recommendations
- Better resume quality Shown in Figure 5

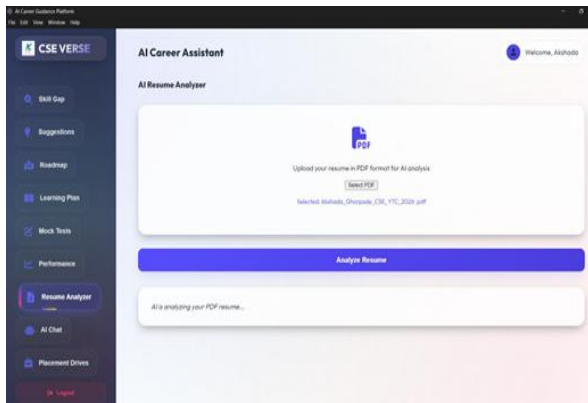


Figure 5 Automated Resume Analysis System

5.1.6. Campus Drive Management Result

The TPO dashboard successfully managed:

- Placement drives
- Internship opportunities
- Student analytics

Outcome:

- Efficient drive management
- Simplified placement process
- Better communication between students and TPOs Shown in Figure 6

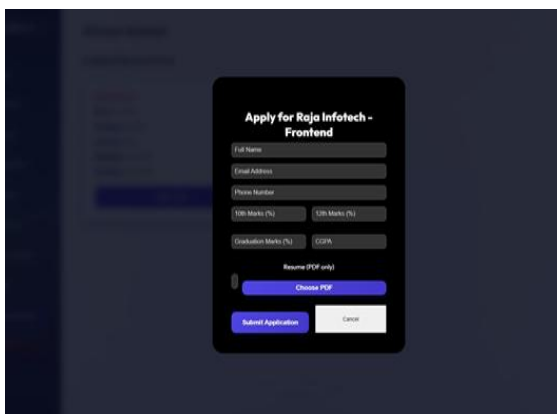


Figure 6 Job Application Submission Interface

5.2. Discussion

The developed system demonstrates how Artificial Intelligence can improve educational guidance and

placement preparation processes. Traditional career guidance systems usually provide generic suggestions, whereas the proposed platform provides personalized and intelligent recommendations based on student data. The integration of AI significantly improves:

- Decision making
- Career planning
- Learning guidance
- Placement preparation

The Content-Based Filtering Algorithm efficiently recommends suitable opportunities by matching user profiles with available resources. The AI chatbot also improves user interaction by providing real-time responses and guidance. The system successfully combines multiple functionalities into a single platform, reducing the need for students to use separate applications for career guidance, mock tests, resume analysis, and placement management. The graphical analytics and performance tracking modules help students monitor their progress and identify areas for improvement. Similarly, TPOs can manage campus activities efficiently through the dedicated dashboard. Although the platform performs effectively, some limitations such as dependency on internet connectivity and limited database scalability were identified during testing. Future improvements can further enhance recommendation accuracy, scalability, and real-time job integration. Overall, the results indicate that the AI Powered Educational Guidance Platform is an efficient, intelligent, and user-friendly solution for modern educational and career guidance systems.

Conclusion

The AI Powered Educational Guidance Platform successfully provides intelligent career guidance, course recommendations, mock tests, resume analysis, and placement support using Artificial Intelligence. The system helps students improve their career planning and skill development while also assisting TPOs in managing placement activities efficiently. The project demonstrates how AI can simplify and improve educational guidance systems in a smart and user-friendly way.

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