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SkillBridge – An AI Based Smart Learning And Career Advancement

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Abstract: This paper presents the implementation of Skill-Bridge, an AI-powered smart learning and career guidance platform designed to assist students in skill development and career preparation. The system integrates multiple AI-based modules such as course generation, quiz generation, roadmap planning, resume analysis, and Ai resource generation. The platform uses modern web technologies and AI APIs to generate personalized learning paths and provide real-time feedback. The system architecture, module implementation, and functionality of each component are discussed. The proposed system aims to bridge the gap between academic learning and career readiness by providing an integrated ecosystem for learning, assessment, and professional development.

Index Terms **– Ai Agents, Career Guidance, Roadmap Generation, Course generation.**

I. INTRODUCTION

In today's fast-changing world of education and employment, learners are expected to develop a wide range of skills that align with continuously evolving industry requirements. The demand for industry-relevant knowledge, practical skills, and career readiness has increased significantly in recent years. However, traditional education systems often follow rigid and standardized curricula that do not adapt to the individual needs of learners. Such systems provide limited personalization and often fail to guide students toward appropriate career paths, making it difficult for learners to identify the right skills, track their progress, and prepare effectively for job opportunities [1], [12].

Artificial Intelligence (AI) is emerging as a transformative technology capable of improving modern educational systems. AI-driven platforms enable personalized learning experiences by analyzing user behavior, understanding learning preferences, and generating adaptive learning content. These systems can recommend relevant study materials, create quizzes for knowledge assessment, and provide career-related guidance based on user interests and skill levels. By moving beyond the traditional one-size-fits-all learning model, AI allows educational platforms to deliver customized and learner-centered educational experiences that improve engagement and learning outcomes [14], [2].

Several recent studies have explored the use of AI for supporting career development and learning processes. AI-based career guidance systems can analyze user profiles and provide recommendations related to job opportunities and skill development. Similarly, AI-driven assessment systems can automatically generate quizzes and evaluate learner performance, helping students identify knowledge gaps and improve their understanding [5], [6]. Other research has focused on AI-powered resume analysis and interview preparation tools that assist users in optimizing resumes and practicing job interviews through simulated environments [7], [9], [10].

Overall, the goal of the Skill-Bridge platform is to provide a comprehensive solution that enhances learning efficiency, improves career readiness, and supports students in making informed decisions about their future.

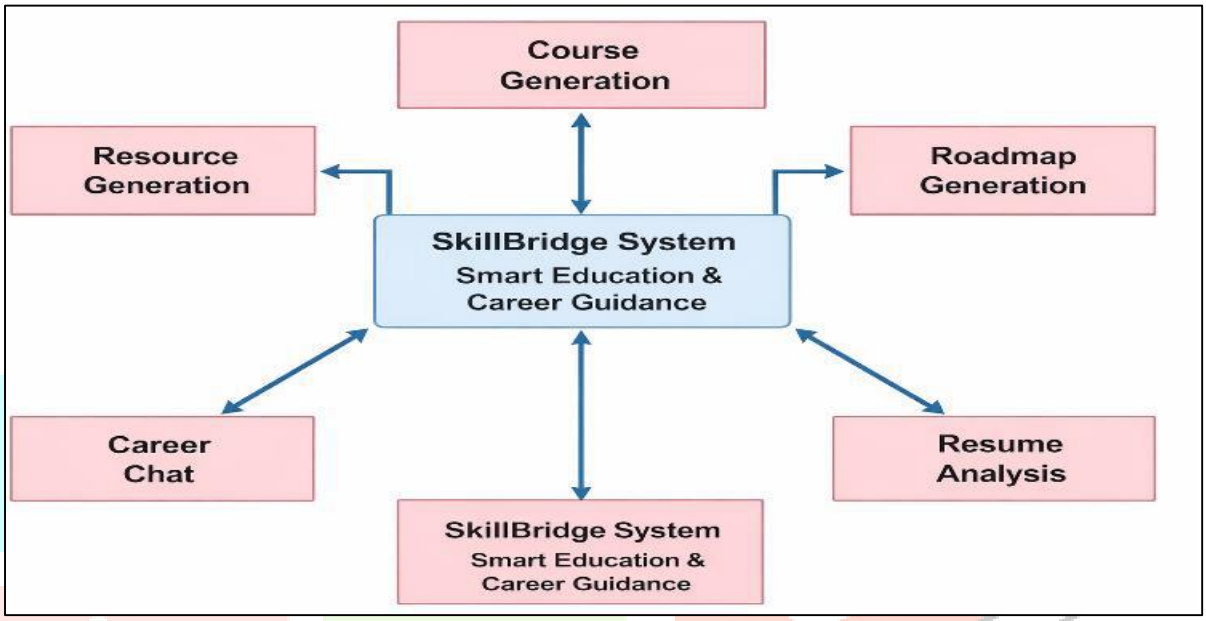


Fig 1.1 Overview of SkillBridge – smart learning application

This fig indicates the architecture of the SkillBridge System, which is a smart education and career guidance platform. The central component is the SkillBridge System, which connects multiple AI-powered modules designed to support students in their learning and career development.

II. Literature Review

Recent advancements in Artificial Intelligence (AI) have significantly influenced the development of intelligent learning and career guidance platforms. Many researchers have proposed systems that utilize AI and machine learning techniques to improve learning experiences, automate assessments, and assist users in career preparation.

Several studies have explored AI-based systems for career development and job recommendation. Research presented in [1] focuses on enhancing job recommendations and career development using artificial intelligence. The proposed system analyzes user profiles, skills, and job market trends to provide personalized job suggestions. While the system helps users identify suitable job opportunities, it primarily focuses on job matching and does not provide structured learning resources or skill development pathways that support long-term career growth.

Another study presented in [4] introduces a machine learning-based web platform for resume creation and analysis. The system assists users in building structured resumes using predefined templates and provides suggestions to improve the quality and organization of resumes. Although the platform enhances resume-building capabilities, it lacks additional features such as career guidance, interview preparation, and integrated learning support.

Research on AI-powered assessment systems discussed in [5], [6] highlights the use of natural language processing techniques for automatic quiz generation. These systems can generate questions from learning materials and automatically evaluate student performance. Adaptive quiz systems have been shown to improve learner engagement and help identify knowledge gaps. However, these systems mainly focus on assessment and do not include career development or professional guidance functionalities.

Similarly, studies presented in [3] and [9] demonstrate the use of AI-based interview simulation systems that allow users to practice interview questions in a virtual environment. These systems evaluate user responses and provide feedback on communication skills and answer quality. While such platforms help users improve interview performance and gain confidence, they often operate as standalone systems and are not integrated with broader learning platforms.

Research in the area of intelligent learning systems discussed in [16] and [17] emphasizes the importance of personalized learning environments that adapt to individual learner needs. These systems recommend courses, generate learning resources, and track learner progress using AI algorithms. Although such systems significantly improve the learning experience, many of them do not include integrated career guidance tools such as resume analysis, career planning, and interview preparation.

Although the existing systems provide valuable functionalities, most of them focus on a single aspect of learning or career preparation. There is a lack of comprehensive platforms that integrate learning resource generation, career guidance, resume analysis, and career support tools within a single ecosystem.

To address these limitations, the **SkillBridge platform** is proposed as an integrated AI-based smart learning and career guidance system. The platform combines multiple modules including course generation, resource generation, roadmap generation, resume analysis, and career chat assistance to provide a unified environment that supports both skill development and career preparation.

III. Methodology

This section describes the methodology used to design and implement the **SkillBridge Smart Learning and Career Guidance Platform**. The system is developed using modern web technologies and generative AI to provide personalized career guidance, learning roadmaps, and educational resources. The platform follows a **modular architecture** where each feature operates as an independent module while interacting with shared services such as the database and AI engine

3.1 Technology Stack

The system is implemented using the following technologies:

Table 3.1 Technology stack

Technology	Purpose
Next.js	Full-stack framework for building the web application
JavaScript	Core programming language for frontend and backend logic
Tailwind CSS	Styling and responsive UI design
GeminiAI API	Generative AI for content generation and intelligent responses
Inngest	Event-based workflow and request tracking for AI operations
Neon PostgreSQL	Cloud-based database for storing user data and generated content

The architecture integrates AI services with a scalable web application to deliver real-time learning and career guidance functionalities.

3.2 System Architecture Workflow

Below is the general workflow followed by the system:

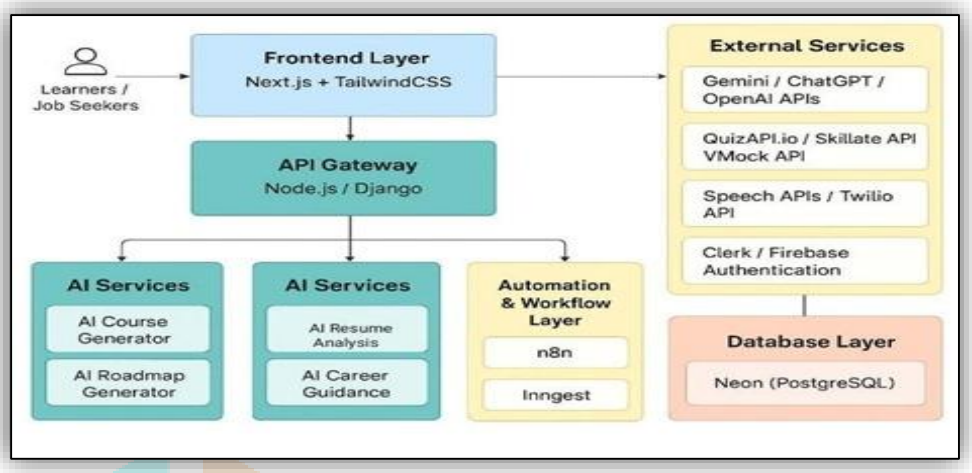


Fig 3.1 System architecture

This architecture ensures efficient handling of AI requests and structured storage of generated outputs for future access.

3.3 Career Chat Module

The **Career Chat module** provides AI-based career guidance through a conversational interface. The system allows users to ask career-related questions and receive structured responses generated by the AI model.

To ensure that the chatbot remains focused on career guidance, a **prompt restriction mechanism** is implemented. The AI agent is provided with system instructions that restrict responses to career-related topics only. If a user asks questions unrelated to career development, the chatbot responds with a predefined message indicating that it can only answer career-related queries.

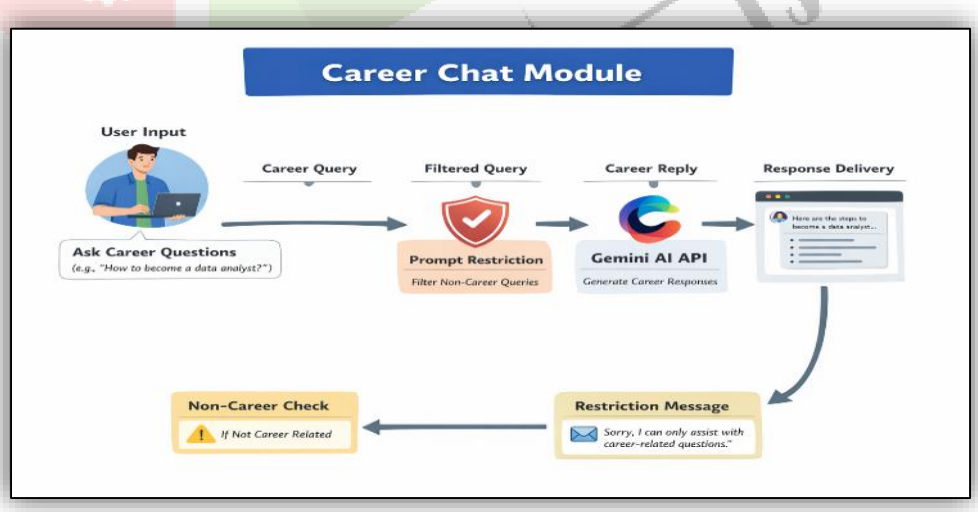


Fig 3.2 Career Chat Workflow

The chatbot provides structured and procedural answers, including skill recommendations, learning paths, and career advice.

3.4 Roadmap Generation Module

The Roadmap Generation module creates a structured learning path based on a specific skill or career goal provided by the user.

When a user enters a skill (for example, *Java Full Stack Developer*), the system sends the request to the Gemini AI API, which generates a detailed roadmap including:

- Learning stages
- Recommended technologies
- Estimated timelines
- Learning resources

The generated roadmap is stored in the Neon PostgreSQL database and visualized using an interactive canvas interface to improve readability and navigation.

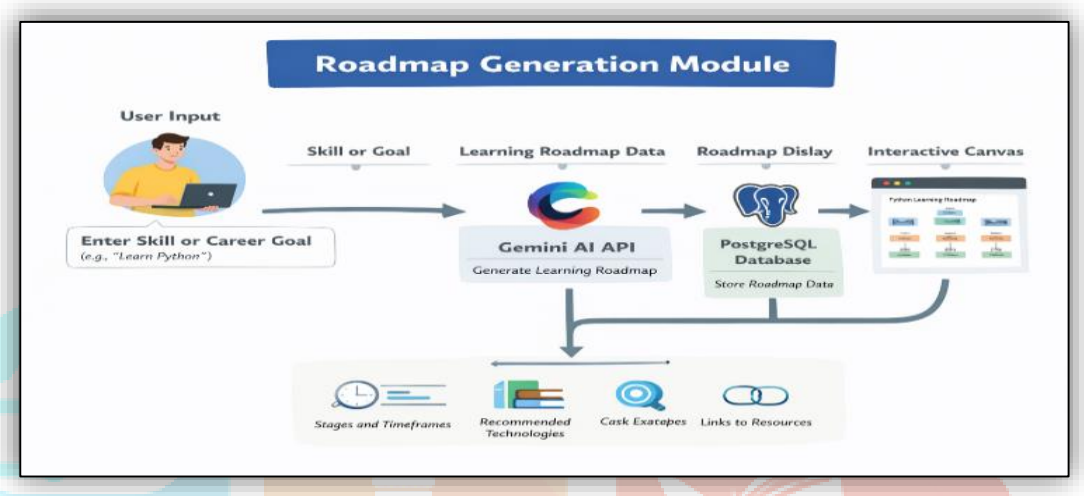


Fig 3.3 Roadmap Generator Workflow

The roadmap includes step-by-step milestones, timestamps, and official learning resources, providing a structured pathway for skill development.

3.5 Course Generation Module

The Course Generation module automatically creates structured learning content based on user preferences.

Users provide inputs such as:

- Skill or topic
- Learning level (beginner/intermediate/advanced)
- Difficulty level
- Time Avaibility
- Video inclusion preferences

These parameters are passed to the Gemini AI API, which generates a comprehensive course structure. The generated course includes:

- Chapter-wise content
- Detailed explanations
- Code examples
- Practical exercises
- Reference videos from YouTube

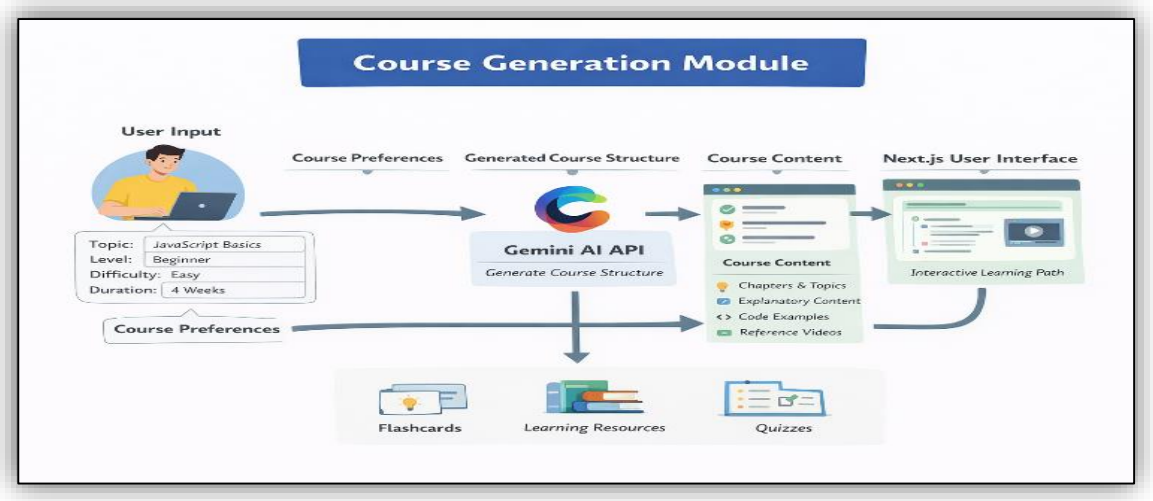


Fig 3.4 Course generation Workflow

This module provides an interactive and personalized learning experience by combining AI-generated explanations with external learning resources.

3.6 Resource Generation Module

The **Resource Generation module** recommends high-quality learning materials related to a selected topic or skill.
After receiving the topic from the user, the system queries the
AI model to generate a curated list of resources such as:

- Online tutorials
- Documentation
- Video tutorials
- Practice platforms

These resources are organized according to relevance and learning progression.

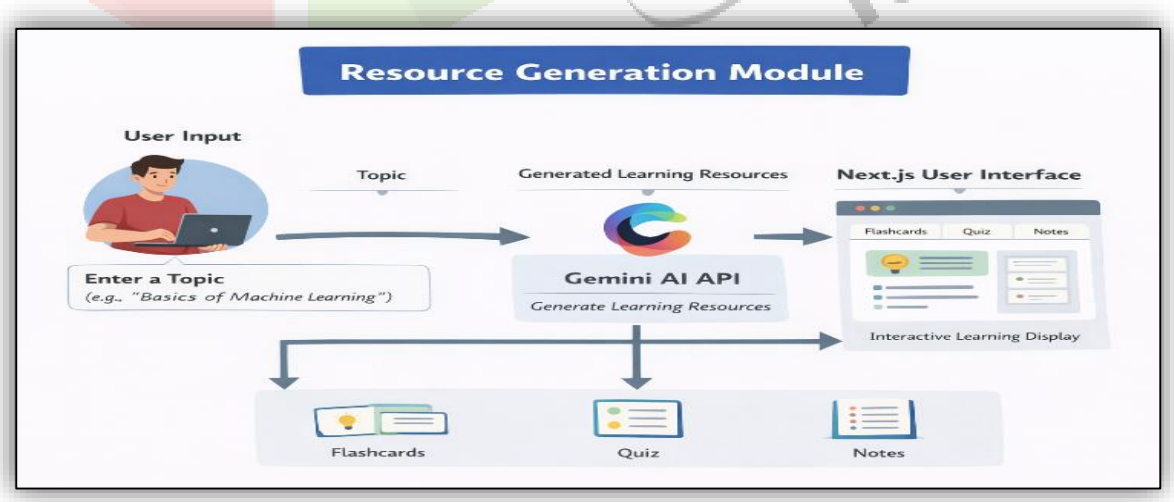


Fig 3.6 Resource Generation Workflow

This feature ensures that learners can easily access reliable resources without manually searching across multiple platforms.

3.7 Resume Analysis Module

The **Resume Analysis module** helps users evaluate and improve their resumes using AI. Users upload their resumes, which are then analyzed by the AI system to identify:

- Missing sections
- Weak descriptions
- Skill gaps
- Keyword improvements

The AI generates suggestions that help optimize resumes for job applications

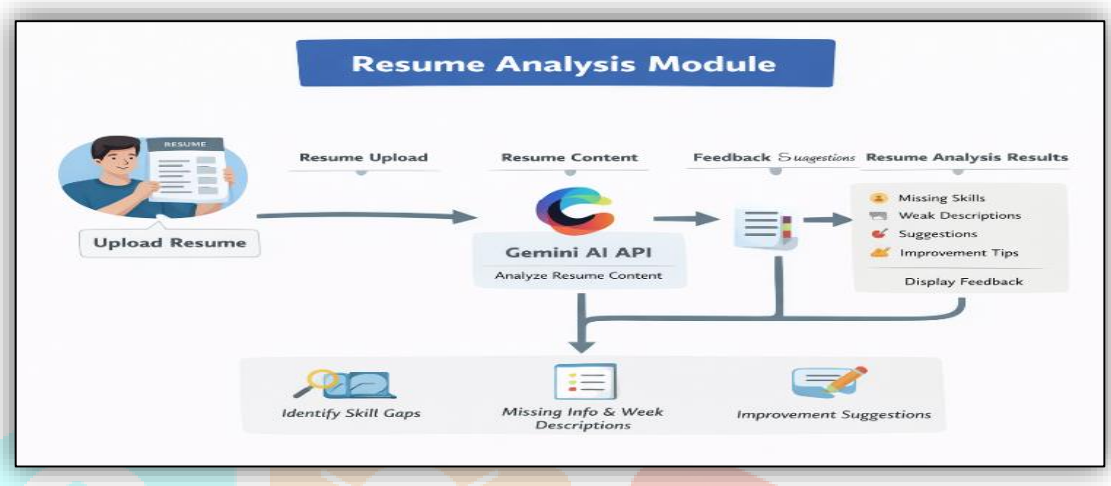


Fig 3.7 Resume Analysis Workflow

This module helps users improve resume quality and align it with job market requirements.

3.8 Key Advantages of the Methodology

The proposed methodology provides several benefits:

- Integration of learning and career development tools in one platform
- Use of generative AI for personalized content creation
- Interactive visualization of learning roadmaps
- Automated content generation for courses and resources
- Efficient AI workflow management using Inngest

IV. System Implementation and result Descusion

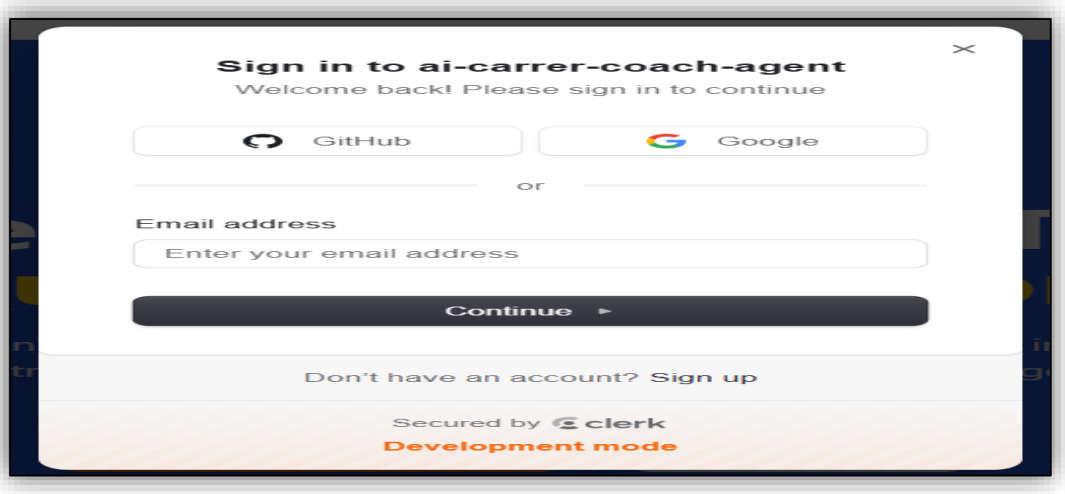
The proposed system is developed by dividing the entire application into several functional modules. Each module performs a specific task and collectively contributes to the overall working of the system. The modular structure improves system organization, scalability, and ease of maintenance.

4.1 User Registration and Authentication Module

The user registration and authentication functionality of the system is implemented using **Clerk**, a modern authentication and user management platform. Clerk provides secure and scalable solutions for handling user sign-up, login, and session management.

When a new user accesses the platform, they can create an account by providing basic details such as email address and password. Clerk manages the authentication process and securely stores user credentials using industry-standard security mechanisms. The platform also handles user sessions, ensuring that only authenticated users can access protected features of the system.

Clerk simplifies the implementation of authentication by providing pre-built components for sign-up, login, and user profile management. It also supports additional features such as email verification and secure session handling, which improves the overall reliability and security of the application.



Img 4.1 Cleark Authentication

This image shows the **sign-in interface of the AI Career Coach Agent application**. It is a login modal powered by **Clerk authentication** that allows users to securely access the platform.

The interface provides multiple sign-in options such as **GitHub**, **Google**, or **Email address**. Users can enter their email and continue with authentication. It also includes an option for new users to **sign up** if they do not already have an account. The message at the bottom indicates that the system is currently running in **development mode** and is secured by Clerk.

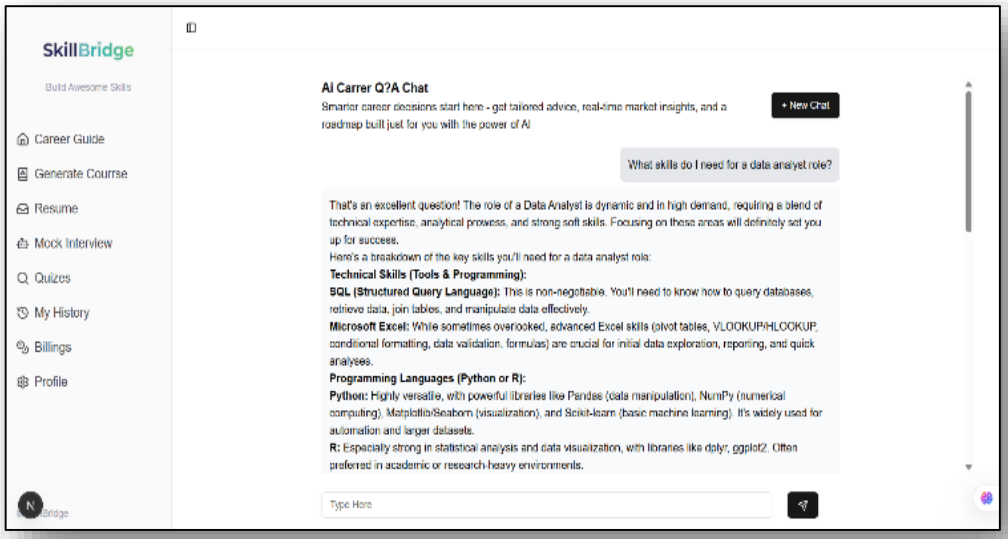
4.2 Career Chat Module

The **Career Chat module** provides users with AI-based career guidance through a conversational interface. This feature allows users to ask questions related to career development, skill improvement, and job preparation. The responses are generated using the **Gemini** API integrated into the system.

To maintain the relevance of responses, a **prompt restriction mechanism** is implemented. The AI model is instructed through a predefined prompt to generate answers only for career-related queries. If a user asks questions outside the career domain, the system responds with a message indicating that it can only provide guidance on career-related topics.

The chat interface is developed using **Next.js** and styled with **Tailwind CSS** to ensure a responsive and user-friendly experience. Requests are managed using **Inngest**, which handles AI request processing before sending them to the Gemini API.

This module enables users to quickly obtain structured career guidance and recommendations through an interactive chat-based system.



Img 4.2 Career Chat Bot

This image shows the Career Chatbot feature of the SkillBridge system. The Career Chatbot is an AI-powered assistant that helps users with career-related guidance and questions.

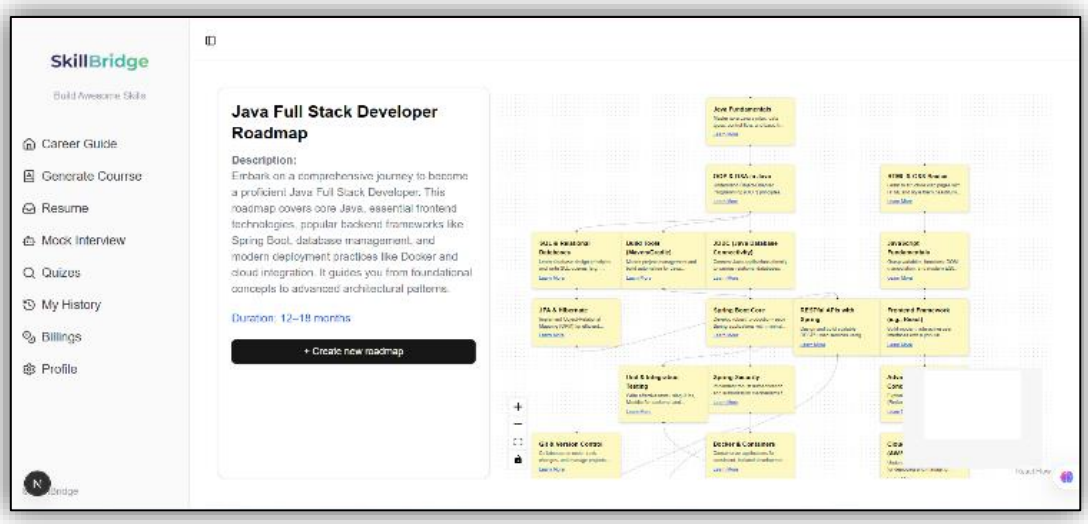
Users can type their queries in the chat box, such as asking about required skills, career paths, or industry trends. The chatbot then analyzes the question and provides detailed responses, suggestions, and learning guidance. In the example shown, the chatbot explains the skills needed to become a Data Analyst, including technical skills, programming languages, and analytical tools.

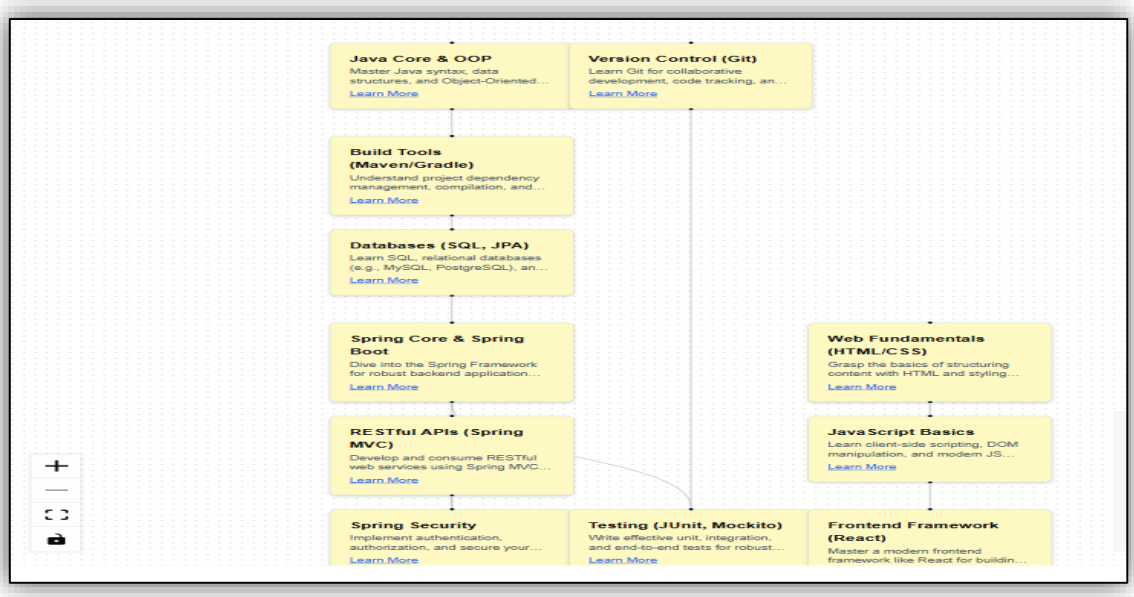
4.3 Roadmap Generation Module

The **Roadmap Generation module** creates a structured learning path based on the skill or career goal provided by the user. When a user enters a specific skill, the system sends the request to the **Gemini** API, which generates a step-by-step roadmap for learning that skill.

The generated roadmap includes important stages of learning, recommended technologies, estimated timeframes, and links to relevant learning resources. The generated data is stored in the **Neon** for future access.

To improve user experience, the roadmap is visualized using an interactive canvas interface built with **Next.js**, allowing users to clearly view the sequence of steps required to achieve their learning goals.





Img 4.3 Roadmap Generator result

This image shows the result of the Roadmap Generator feature in the SkillBridge system. The roadmap visually presents a structured learning path for becoming a full-stack developer.

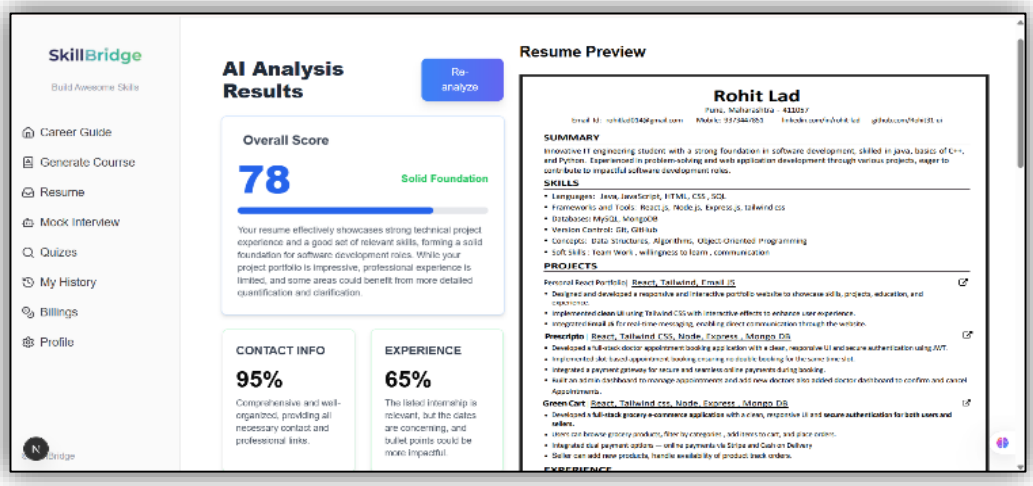
Each box in the roadmap represents an important topic or skill, such as Java Core & OOP, Version Control (Git), Build Tools (Maven/Gradle), Databases (SQL, JPA), Spring Core & Spring Boot, RESTful APIs, and Spring Security. It also includes frontend technologies like HTML, CSS, JavaScript, and React.

The topics are connected with arrows, showing the step-by-step progression of learning, where users start with fundamental concepts and gradually move toward advanced technologies.

4.4 Resume Analysis Module

The **Resume Analysis module** helps users evaluate and improve their resumes using AI-based feedback. Users upload their resume, and the system processes the document to extract relevant information such as skills, education, and experience. The extracted content is then analyzed using the **Gemini** API to identify missing information, weak descriptions, and potential skill gaps.

Based on this analysis, the system generates suggestions to improve the resume, including recommendations for better wording, additional skills, and structural improvements. The results are displayed to the user through the web interface developed with **Next.js**, helping users create more effective resumes for job applications.



Img 4.4 Resume Analysis result

This image shows the **result of the Resume Analysis feature** in the SkillBridge system. The system analyzes the uploaded resume and provides an **AI-based evaluation of different sections**.

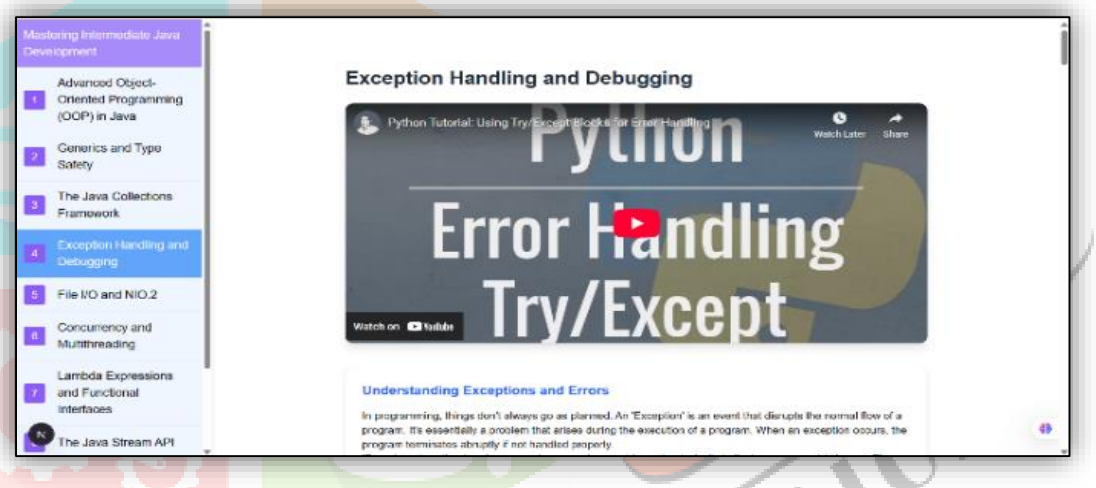
On the left side, the **AI Analysis Results** panel displays the **overall resume score**, which is **78**, indicating a **solid foundation**. It also provides detailed scores for different sections such as **Contact Information, Experience, Skills, and Projects**, helping the user understand the strengths and weaknesses of their resume.

On the right side, the **Resume Preview** shows the actual resume content, including **summary, skills, and project details**. This allows users to compare their resume with the analysis results.

4.5 Course Generation Module

The **Course Generation module** automatically creates structured learning content based on user preferences. Users provide inputs such as the topic, learning level, difficulty, and preferred learning duration. These inputs are processed and sent to the **Gemini** API, which generates a detailed course structure.

The generated course typically includes chapter-wise explanations, learning content, and relevant examples. To enhance the learning experience, the system also retrieves related video references and learning materials. The course content is then displayed through the interface developed using **Next.js**, allowing users to follow a structured and personalized learning path.



Img 4.5 Course generation result

This image shows the **result of the course generation module** in the system. The interface presents a structured learning page for a selected topic. On the **left side**, a sidebar displays the list of course topics such as Advanced OOP, Security, Java Collections Framework, Exception Handling and Debugging, File I/O, Concurrency and Multithreading, and others, allowing users to easily navigate between different lessons.

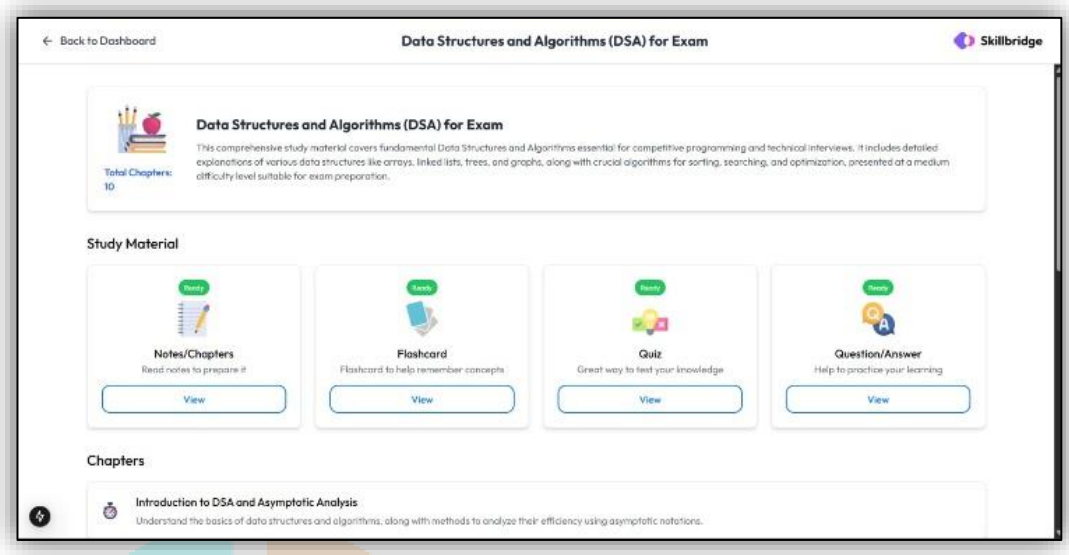
In the **main content area**, the selected topic **"Exception Handling and Debugging"** is displayed. A **video fetched from YouTube** is embedded at the top to help users understand the concept visually. Below the video, there is a **text explanation describing the topic in detail**, helping learners understand the concept step-by-step.

Additionally, the page also includes **relevant code snippets/examples** related to the topic so that users can see how the concept is implemented in practice. Overall, the generated course page combines **topic navigation, video learning, textual explanations, and required code examples** to provide a complete learning experience.

4.6 Resource Generation Module

The **Resource Generation module** helps users quickly review and reinforce their understanding of a selected topic. After receiving the topic from the user, the system sends the request to the **Gemini** API, which generates concise learning materials for revision.

The generated resources include **flashcards, quizzes, and summarized notes** that allow users to quickly recap important concepts. Flashcards help in remembering key terms, quizzes enable self-assessment, and notes provide a short explanation of the topic.



IMG 4.6 RESOURCE GENERATOR RESULT

This image shows the result of the resource generation module in the system. It presents a dedicated learning resources dashboard for the course Data Structures and Algorithms (DSA) for Exam.
At the top, the page displays the course title along with a short description explaining that the course covers important DSA concepts such as arrays, linked lists, trees, graphs, and algorithms commonly used in technical interviews and competitive programming.

Below the description, the Study Material section provides multiple learning resources designed to help users quickly revise and strengthen their understanding of the subject. These resources include:

- Notes/Chapters: Provides detailed notes and chapter-wise explanations for theoretical understanding.
- Flashcards: Helps learners quickly remember key concepts and important terms.
- Quiz: Allows users to test their knowledge through short assessment questions.
- Question/Answer: Helps users practice common interview or exam-related questions.

Each resource card includes a View button that allows users to open and access the selected material. At the bottom, the Chapters section lists the course topics, starting with Introduction to DSA and Asymptotic Analysis, enabling structured and sequential learning.

V. Future Work

Although the current implementation of the SkillBridge platform provides several useful AI-based learning and career guidance features, there are multiple opportunities to further improve the system. The following enhancements can be considered for future development:

- **Real-Time Job Market Analysis**

The platform can be enhanced by integrating real-time job market data. This feature would analyze current industry trends and identify high-demand skills. Based on this information, the system could recommend relevant skills and learning paths that align with current employment opportunities.

- **Skill Gap Analysis**

A skill gap analysis feature can be introduced to compare a user's existing skills with the requirements of specific career roles. The system could then suggest the missing skills and recommend appropriate courses or resources to help users bridge those gaps.

- **Mobile Application Development**

Developing a mobile application version of the platform would improve accessibility and convenience. Users would be able to access career guidance, learning resources, and revision tools directly from their smartphones.

- **Integration with Job Portals and Professional Platforms**

Future versions of the system could integrate with professional networking platforms and job portals. This would allow users to directly apply for jobs and showcase their developed skills and improved resumes.

- **Advanced Personalized Learning Recommendations**

The system could incorporate advanced recommendation algorithms to provide more personalized learning paths based on user behavior, performance, and interests.

VI. Conclusion

This paper presented the design and implementation of **SkillBridge**, an AI-powered platform developed to support both learning and career development in a unified environment. The system integrates multiple intelligent modules including career chat, roadmap generation, course generation, resource generation, and resume analysis to provide users with personalized guidance and learning support.

By leveraging modern web technologies such as **Next.js**, **Tailwind CSS**, and cloud-based database solutions like **Neon**, the platform offers a responsive and scalable web application. The integration of the **Gemini** API enables the system to generate intelligent responses, structured learning paths, course content, and resource materials dynamically.

The implemented modules allow users to interact with an AI assistant for career guidance, generate learning roadmaps based on specific skills, access structured course content, review topics through flashcards and quizzes, and improve their resumes through automated analysis and feedback. These features collectively create a comprehensive ecosystem that bridges the gap between skill development and career preparation.

Overall, the SkillBridge platform demonstrates how generative AI can be effectively utilized to enhance learning experiences and provide practical career guidance. By combining multiple AI-driven functionalities within a single system, the platform simplifies the process of acquiring new skills and preparing for professional opportunities. The proposed system provides a foundation for future advancements in intelligent learning and career guidance platforms

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