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Project : GenAI Learning Path Recommender

1. Introduction

With the rapid growth of Artificial Intelligence and Generative AI, learners often struggle to choose the right learning path based on their current skills and career goals. Generic course recommendations do not consider individual backgrounds, leading to inefficient learning.

This project, **GenAI Learning Path Recommender**, is a web-based application that uses **Generative AI** to analyze a user's resume and career goal and generate a **personalized 6-month learning roadmap**. The system uses a **Retrieval-Augmented Generation (RAG)** approach to ensure recommendations are grounded in curated course data rather than hallucinated content.

2. Objectives

The main objectives of this project are:

- To analyze a user's resume and identify existing skills
- To understand the user's career goal
- To identify skill gaps between current skills and target role
- To generate a structured and realistic learning roadmap
- To demonstrate a real-world GenAI pipeline using LLMs
- To build a user-friendly web application using Streamlit

3. Scope of the Project

This project focuses on:

- Resume-based learning recommendations
- Career planning in technology domains (Software, AI, Cloud, Cybersecurity, GenAI)
- AI-assisted decision making using Large Language Models

The system is designed for:

- Students
- Early-career professionals

- Self-learners transitioning into new tech roles

4. System Overview

The application is implemented as a **web application** where users:

1. Upload their resume in PDF format
2. Enter their career goal
3. Receive a personalized learning roadmap generated by AI

The system integrates:

- Resume parsing
- Prompt optimization
- Retrieval-based context grounding
- LLM-based reasoning

5. Architecture Overview

High-Level Architecture

User



Resume Upload + Career Goal



PDF Text Extraction



Context Assembly (Resume + Goal + Course Dataset)



Prompt Optimization (ScaleDown API - optional)



LLM Reasoning (Google Gemini)



Personalized Learning Roadmap

6. Technologies Used

Technology	Purpose
Python	Core programming language
Streamlit	Web application interface
Google Gemini (LLM)	AI reasoning and content generation
ScaleDown API	Prompt optimization and token reduction
PyMuPDF	Resume PDF text extraction
JSON	Course dataset and structured context
Requests	API communication

7. Dataset Description (RAG Component)

The project uses a **curated dataset of real-world courses**, including:

- Software Engineering
- Data Science & Machine Learning
- Cybersecurity
- Cloud & DevOps
- Generative AI

This dataset acts as the **retrieval source** in the RAG pipeline. The LLM is instructed to generate recommendations **only**

8. Working Methodology (Pipeline Explanation)

Step 1: Resume Extraction

The uploaded PDF resume is processed using PyMuPDF to extract raw text.

Step 2: Context Building

The system combines:

- Resume content
- Career goal
- Course dataset

This combined text forms the **context** for the AI model.

Step 3: Prompt Optimization

The context is optionally sent to the ScaleDown API to reduce token usage. If the API is unavailable, the system gracefully falls back to the original context.

Step 4: LLM Reasoning

The optimized context and instructions are passed to the Gemini LLM, which:

- Analyzes skill gaps
- Structures a learning roadmap
- Generates a week/month-based plan

Step 5: Output Generation

The generated roadmap is displayed on the web interface and can be downloaded by the user.

9. Features

- Resume-based personalization
- Goal-driven learning roadmap
- AI-powered reasoning
- Token-efficient prompt handling
- Downloadable roadmap
- Web-based UI
- Graceful error handling for API failures

10. Sample Input and Output

Sample Input

- Resume: PDF file
- Goal:
- Become a GenAI Engineer in 6 months

Sample Output

- Skill gap analysis
- 6-month structured learning plan

- Course recommendations
- Weekly or monthly schedule

11. Advantages

- Personalized learning guidance
- Reduces confusion in course selection
- Demonstrates real-world GenAI system design
- Scalable to other domains
- Cost-aware AI usage

12. Limitations

- Depends on the quality of resume content
- Course dataset is manually curated
- Requires internet access for LLM usage
- Does not currently track learning progress

13. Future Enhancements

- Vector embeddings for smarter retrieval
- Integration with GitHub or LinkedIn profiles
- Progress tracking dashboard
- Multi-language support
- Integration with job portals
- Feedback-based recommendation improvement

14. Conclusion

The **GenAI Learning Path Recommender** successfully demonstrates how Generative AI can be applied to solve real-world problems such as personalized learning and career planning. By combining resume analysis, RAG principles, prompt optimization, and LLM reasoning, the project provides an end-to-end AI pipeline suitable for academic submission and professional portfolios.

15. References

- Google Generative AI Documentation
- Streamlit Documentation
- PyMuPDF Documentation
- Retrieval-Augmented Generation (RAG) research papers
- ScaleDown API Documentation