CAPSTONE PROJECT

AGENTIC AI FOR PERSONALIZED COURSE PATHWAYS

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OUTLINE

- **Problem Statement** (Should not include solution)

- **Proposed System/Solution**

- **System Development Approach** (Technology Used)

- **Algorithm & Deployment**

- **Result (Output Image)**

- **Conclusion**

- **Future Scope**

- **References**

PROBLEM STATEMENT

- Many students find it overwhelming to choose the right educational courses that suit their personal interests and future ambitions, given the abundance of available online learning options and limited individualized support.

- This uncertainty often leads to wasted effort, missed opportunities, and a lack of direction. The core challenge is to develop an intelligent, adaptive solution that can guide each student with truly personalized learning paths to help maximize their educational success.

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PROPOSED SOLUTION

- The proposed Agentic AI system collects and analyzes student data to create a personalized learning roadmap using IBM AI on Cloud Lite. It then dynamically adapts course recommendations based on student progress for a truly tailored educational experience.

- Data Collection:

    - Collect student interests, background, and progress using forms, quizzes, and interactive sessions.

    - Leverage additional data from online achievements and certification platforms.

- Data Preprocessing:

    - Thoroughly clean, standardize, and organize all incoming data, resolving missing or inconsistent values.

    - Engineer advanced features that highlight skills, learning behavior, and growth trends, prepping for AI input.

- Machine Learning Algorithm:

    - Use IBM Granite/Watsonx LLMs to analyze student dialogues, identify strengths, and interpret evolving interests.

    - Apply clustering and recommendation algorithms so personalized, dynamic pathways are suggested and updated as students progress.

- Deployment:

    - Deploy the complete solution on IBM Cloud Lite using a modular frontend/backend setup and robust APIs to interact with the AI.

    - Utilize cloud databases and storage to ensure secure, scalable, and real-time access for every learner.

- Evaluation:

    - Monitor the effectiveness using feedback loops, completion statistics, engagement analytics, and satisfaction surveys.

    - Continuously refine the recommendation engine through ongoing data evaluation and real-world student outcome measurements.

- Result:

    - Each student receives an adaptive, personalized learning roadmap with progress badges, enabling clear tracking of achievements toward their educational goals.

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SYSTEM APPROACH

System requirements :

- IBM Cloud Lite account

- IBM Watsonx and IBM Granite Model access

- Frontend: ReactJS/VueJS

- Backend: Python (Flask/FastAPI)

- Database: IBM Cloudant/DB2

- Storage: IBM Object Storage

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Library required to build the model :

- Natural Language Processing (transformers, IBM Watson libraries)

- Data Analysis (pandas, numpy)

- Frontend Libraries (Material UI/Bootstrap)

- Backend and API Integration: Flask-RESTful, Requests *(for creating and consuming REST APIs efficiently)*

- Data Visualization: matplotlib, Plotly *(for creating interactive dashboards and graphical analytics for students and admins)*

ALGORITHM & DEPLOYMENT

- **Algorithm Selection:**

  - The system utilizes advanced Large Language Models (LLMs), such as IBM Granite, in combination with NLP and clustering algorithms to deeply analyze student interests, goals, skills,. and progression

  - Model selection prioritizes adaptability and personalization, ensuring recommendations evolve in response to each learner's unique needs.

- **Data Input:**

  - Inputs include extensive student profiles (interests, prior learning, academic history, goals), module progress, feedback, and linked certification or achievement data for a holistic view.

  - Additional real-time interaction data is gathered during usage through quizzes, dialogues, and platform usage metrics.

- **Training Process:**

  - Initial training uses educational dialogue datasets and learning behavior data to align the LLM with common student queries and adaptive pathways.

  - Continuous retraining occurs with anonymized, real-world student interactions and regular feedback to refine course matching and pathway relevance.

- **Prediction Process:**

  - Dialogue-based AI captures current user preferences and skill evolution; the model dynamically recommends and adapts personalized course roadmaps at every interaction.

  - The system ensures that recommendations stay relevant by rapidly adjusting to changing student progress, feedback, and newly added certifications or milestones, motivating ongoing achievement.
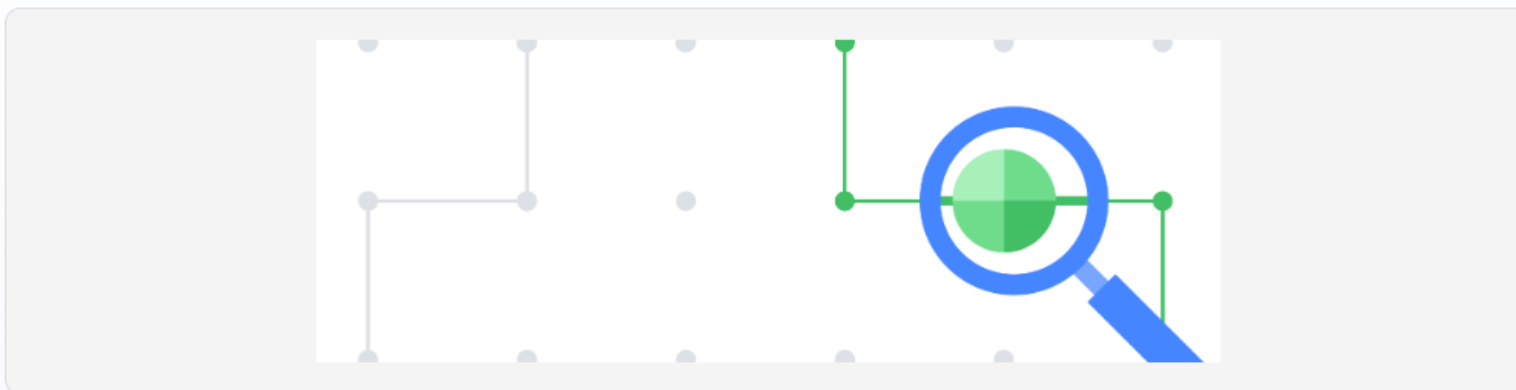
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RESULT HOMEPAGE

Personalized Course Pathways 07:43 PM

Welcome to Personalized Course Pathways

Predicts and recommends the best learning path by analyzing interests, skills, and progress for each

Quick start samples

What are your top learning interests or career goals (e.g., Frontend Development, Data Science, Cybersecurity)? →

How would you describe your current skill level and any previous achievements (e.g., beginner, intermediate, certifications earned)? →
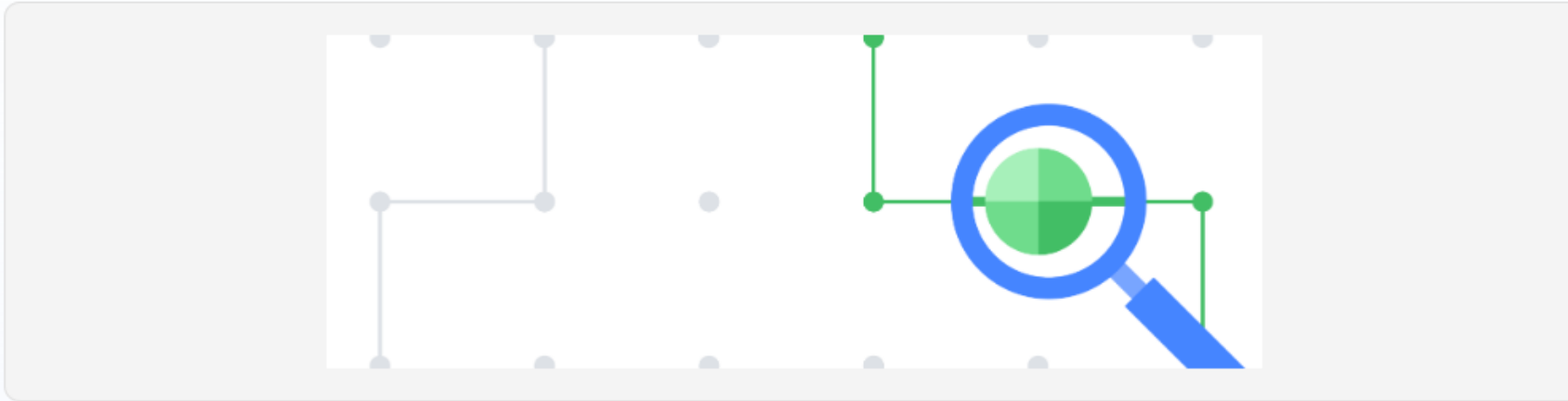
Type something... ▷

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hi i am manohar , i just completed my diplama in Computer science and i have intrest in coding ,my goal is to become software employ say a best way to reach my goal ▷

FINAL RESULT

Personalized Course Pathways 07:47 PM

Hello Manohar, it's great to hear about your interest in coding and your goal to become a software employee. To help you reach your goal, I suggest focusing on the following steps:

1. **Build a Strong Foundation in Programming:**

   - Start with the basics of programming. Languages like Python, Java, or JavaScript are good starting points.
   - Understand data structures and algorithms, as they are fundamental to coding.

2. **Learn a Programming Language:**

   - Choose a language that is widely used in the industry. Python, Java, JavaScript, and C++ are popular choices.
   - Practice coding regularly on platforms like LeetCode, HackerRank, or CodeSignal.

3. **Understand Software Development Principles:**

   - Learn about software development methodologies like Agile, Scrum, and Waterfall.
   - Understand version control systems, particularly Git.

4. **Build Projects:**

   - Start with small projects and gradually move to more complex ones.

Type something...

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Projects / education_path / Personalized Course Pathways

Share feedback β   🟢 Autosaved 8:25 AM   💾 ⌄   New agent +   **Deploy** 🚀   🔒 ⓘ

Build

AI Model: mistral-large ⚠ ⌄   ⚙ ‹

Setup   ⌄

Configuration   ⌃

Framework   **Architecture**

| LangGraph ⌄ | | ReAct ⌄ |

Instructions   **Advanced configuration**

An Agentic AI learning coach named LearnMate. Your task is to interact with students to help them identify an optimal, personalized learning path. Begin by understanding each student's interests (such as Frontend Development, Cybersecurity, UI/UX Design, etc.) and assessing their current skill level in those areas. Based on this information, dynamically create a tailored course roadmap that aligns with their interests and long-term goals. Continuously

Knowledge   ⌄

Tools   ⌃

| Add a tool | | Create custom tool |

Added tools (5)

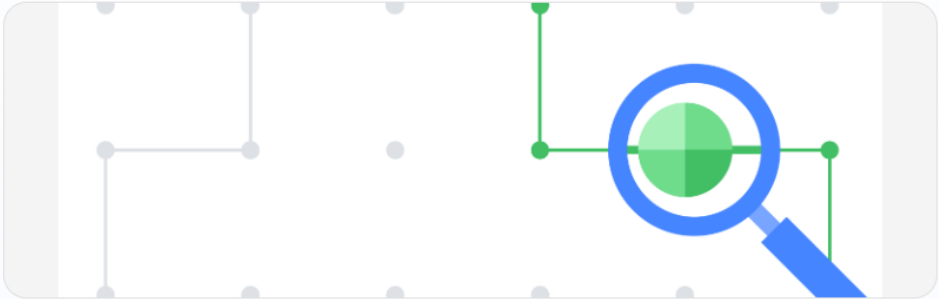**Google search**   ⚙ 🗑

Retrieve information from the internet with the Google search engine.

Agent preview

🧪 Personalized Course Pathways 08:25 AM

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Predicts and recommends the best learning path by analyzing interests, skills, and progress for each

Sample questions

| What are your top learning interests or career goals (e.g., Frontend Development, Data Science, Cybersecurity)? → |
| How would you describe your current skill level and any previous achievements (e.g., beginner, intermediate, certifications earned)? → |

Type something...   ✎ ➤

CONCLUSION

- The chatbot helps learners by giving clear, personalized guidance for building a software career.

- Users can confidently follow step-by-step advice to reach their goals.

- This tool builds motivation and provides practical next steps for beginners and recent graduates.

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FUTURE SCOPE

- Future updates may bring smarter personalization and real-time skill assessments.

- The system could expand to more career paths and offer mentorship features.

- Collecting regular feedback will allow continuous improvements and more accurate recommendations.

REFERENCES

- Resources include IBM watsonx docs and top e-learning sites like Coursera and Udemy.

- Further inspiration is drawn from AI education research and coding practice sites like LeetCode.

- Technical blogs, academic articles, and educational forums also shaped the final solution.

IBM CERTIFICATIONS

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Cheruku Manohar

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Your Solution

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IBM **SkillsBuild**　　Completion Certificate

This certificate is presented to

Cheruku Manohar

for the completion of

Lab: Retrieval Augmented Generation with LangChain

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 24 Jul 2025 (GMT)　　　　　　**Learning hours:** 20 mins

THANK YOU