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Research Paper

INTERACTIVE COURSE ROADMAP GENERATOR

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ABSTRACT

High-quality online education is now available on a number of e-learning platforms, including Coursera, Udemy, Khan Academy, and FreeCodeCamp. But choosing what to learn first and in what order can be difficult for students. For organised learning to solve this, a personalised learning route is necessary. Personalised learning routes are generated by the Interactive Course Roadmap Generator according to the selected domain. It aids students in following a structured topical order. Flask is used for the backend, MongoDB Atlas is used for the database, and HTML, CSS, and JavaScript are used for the front end of the system. A PDF export function is also included for offline use.

Key Words: *Interactive Learning, Personalized Roadmaps, Adaptive Education, PDF Export, E-Learning Platform.*

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I. INTRODUCTION

Traditional approaches to learning, such as following generic course sequences or static technology roadmaps, often fail to address the unique requirements of individual learners. Different people have different goals some may want to prepare for a job interview, others may want to work on a specific project, and some may simply want to explore a new domain. Existing static roadmaps cannot adapt to the learner's prior knowledge, time availability, or preferred learning style. This gap is filled by the Interactive Course Roadmap Generator, which offers a dynamic, adaptable, and user-driven learning roadmap. After letting users choose their area of interest for example, web development, data science, or artificial intelligence it instantly creates a customized course plan that includes the subjects to be learnt, the sequence in which they should be learnt, and recommended readings. The system's created roadmaps are interactive, unlike static charts, allowing users to add or delete topics, change the learning path, and monitor their progress. The system is constructed with HTML, CSS, and JavaScript for an easy-to- use frontend, Flask for backend processing, and MongoDB Atlas for cloud-based data storage. Additionally, roadmaps can be exported as PDFs for convenient offline consumption and sharing. The Interactive Course Roadmap Generator connects the dots between information availability and real-world learning pathways by fusing the flexibility of online learning with the framework of a guided curriculum, enabling students to attain their objectives.

II. LITERATURE SURVEY

A literature review is a detailed study of existing research, models, and systems related to a specific topic. It helps identify gaps, limitations, and improvements that can be addressed in the proposed project. I studied recent papers such as Hybrid Human-AI

Curriculum Development (Tavakoli et al., 2021) explored AI- assisted learning design but lacked flexibility for real-time updates. Adaptive and Personalized Exercise Generation for Online Learning (Sachan, 2023) introduced adaptive learning tools but focused only on limited subjects. A Pre-Trained Graph- Based Model for Adaptive Sequencing of Educational Documents (Vie et al., 2024) used graph models for sequencing but was complex and domain-restricted. These models had issues with offline access, personalization, and scalability. On the other hand, the Interactive Course Roadmap Generator offers a user-friendly online platform with dynamic, editable roadmaps. By enabling learner control, cross-domain flexibility, and offline access via PDF downloads, it fills in previous research gaps and makes learning more user-centric and adaptive.

III. RELATED WORK

This project's related work focusses on how current online learning systems deliver structured, but frequently static, content. Although platforms such as Coursera, Udemy, and Khan Academy provide a variety of educational resources, they do not offer individualized sequencing that is suited to the needs of each learner. Although several studies have looked into adaptive learning systems that employ data- driven techniques and artificial intelligence (AI) to increase engagement, the majority do not provide user-controlled customization. Furthermore, conventional e-learning frameworks don't adapt dynamically to the preferences or progress of learners. Though they only offer course recommendations rather than detailed roadmaps, some models make use of recommendation systems. The project uses HTML, CSS, and JavaScript for an interactive frontend, while Flask (Python) manages backend logic and APIs. MongoDB Atlas serves as a secure cloud database for storing user data and roadmaps. Additionally, this system integrates real-time progress tracking and feedback mechanisms to further personalize the learning experience, ensuring learners can follow a structured yet flexible path tailored to their goals.

IV. EXISTING METHOD

Platforms like edX, Skill share, and LinkedIn Learning provide structured courses with limited customization. AI- driven systems such as Smart Sparrow and Knewton recommend learning paths, but user control is often restricted to preset rules. Moodle and Blackboard allow teachers to create lesson plans and monitor progress but rely mostly on manual setup and do not adapt dynamically. Google Classroom and similar LMSs focus on organizing content and tracking completion without interactive roadmap visualization. Overall, these systems provide guidance but do not offer fully dynamic and customized learning paths, highlighting the need for solutions that integrate interactivity, personalization, and real-time roadmap generation.

PROPOSED SYSTEM

The Interactive Course Roadmap Generator is designed to provide learners with a personalized, adaptive, and interactive roadmap for skill development. Unlike existing static roadmaps, this system allows users to dynamically generate, modify, and track their learning paths based on individual goals, time availability, and current skill levels. The system combines a user-friendly web interface with a powerful backend to ensure seamless user experience. Users can register, log in, select a course or technology they wish to learn, and instantly view a customized roadmap. The platform also supports real-time editing, allowing learners to rearrange, add, or remove topics according to their needs. Additionally, the system integrates features like: Export options to save roadmaps as PDF for offline use. Secure authentication to protect user data. Centralized learning resources linked to each roadmap step.

SYSTEM ARCHITECTURE

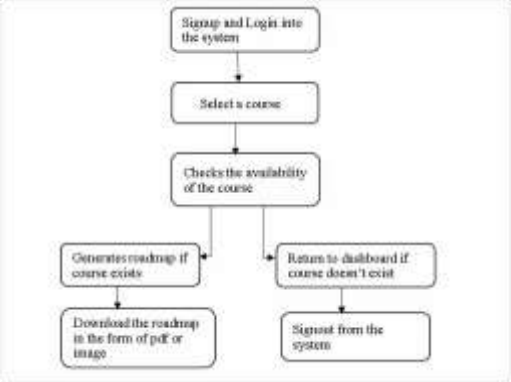


Fig1: Architecture of Interactive Course Roadmap Generator

METHODOLOGY DESCRIPTION

User Login: The process begins with user authentication, which serves as the secure entry point to the system. A user initiates this step by entering their credentials, typically a username and password, into a login interface. The system's immediate and critical task is to verify these credentials against its secure user database.

Course Selection: Once authenticated, the user proceeds to select a course from the available options. The system presents a comprehensive list or catalogue of all accessible courses. After the user browses and chooses a specific course of interest, the system records this selection, preparing to move to the next stage of generating a personalized learning path.

Roadmap Generation: Upon course selection, the system's core functionality is activated, as it checks if the course exists and then generates a path for it. The system first verifies the existence of the course in its database. If the course is found, the Roadmap Generation Engine: Takes over, employing an algorithm to create a structured sequence of topics or modules specifically tailored to the user's needs and the chosen subject.

Download Options: After the path is generated and displayed, the user is given the option to download the roadmap in the form of a PDF or image. This feature provides a convenient way for users to save and access their learning plan offline.

Exit from System: Finally, the user can exit from the system. When the user chooses to log out or simply closes their browser, the system ensures that the session is securely terminated.

V. RESULTS AND DISCUSSION



Fig2: Homepage

This is the homepage for the Interactive Course Roadmap Generator. The platform helps users plan their learning journeys exporting personalized, dynamic roadmaps for any tech or course.



Fig3: Available Roadmaps

This is available courses page for the Interactive Course Roadmap Generator, showcasing a wide range of 100+ programming languages and technologies.
The user can choose from various options like Python, Java, C++, and many more.

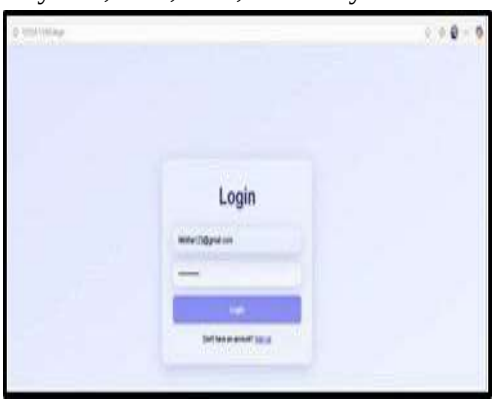


Fig4: Login Page

This is the login page for a web application. The

interface is clean and simple, featuring fields for a user's email and password along with a "Login" button.



Fig5: Dashboard Page

This is the dashboard of the Roadmap Generator web application. It features a simple interface where a user can input a topic, such as "Python roadmap," and click the arrow to generate a learning path, along with a "Logout" button.

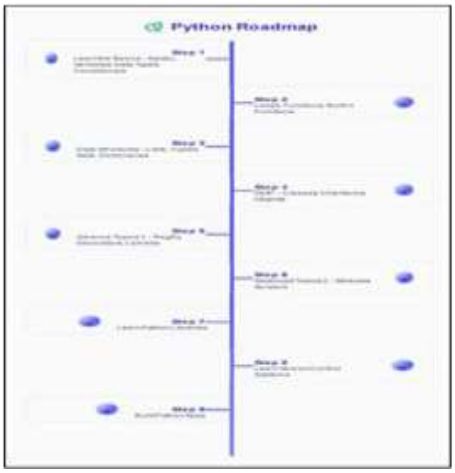


Fig6: Sample generated Roadmap

This is a dynamically generated Python learning roadmap outlining a clear, step-by-step path from fundamental concepts to more advanced topics. It presents the learning journey in a visually organized timeline, with nine distinct steps covering key areas like basic syntax, data structures, OOP, and libraries.

VI. CONCLUSION

The system successfully generates personalized, dynamic learning roadmaps tailored to user needs, providing a flexible, user-centric solution that overcomes the limitations of static learning plans. By including real-time progress tracking, the system helps learners stay on schedule and monitor their achievements.

FUTURE SCOPE

In future it can be adopted to AI recommendations for new courses, Gamification: badges, points, leaderboards, Mobile application for Android/iOS, Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Crown Business, 2011.

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