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MindMap Mentor: AI-Generated Concept Maps

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***Abstract:** In this paper, we describe a tool coined as artificial intelligence-based student learning evaluation tool (AISLE). The main purpose of this tool is to improve the use of artificial intelligence techniques in evaluating a student's understanding of a particular topic of study using concept maps. Here, we calculate the probability distribution of the concepts identified in the concept map developed by the student. The evaluation of a student's understanding of the topic is assessed by analyzing the curve of the graph generated by this tool. This technique makes extensive use of XML parsing to perform the required evaluation. The tool was successfully tested with students from two undergraduate courses and the results of testing are described in this paper.*

I. INTRODUCTION

Mind Map Mentor – AI Generated Concept Maps is a smart educational system that automatically converts text, notes, or study material into visual concept maps using Artificial Intelligence. The main goal of this project is to help students and learners understand complex topics easily by representing information in a graphical and structured format.

In traditional learning methods, students usually read long paragraphs and manually create notes or diagrams, which takes a lot of time and effort. Concept maps are useful in organizing information, but creating them manually can be difficult and time-consuming. To solve this problem, this project uses AI techniques such as Natural Language Processing (NLP) and machine learning to automatically extract important concepts and relationships from input text.

The system analyzes the given content, identifies key ideas, and connects them logically to form a concept map. This map visually shows how different concepts are related, making learning more interactive and effective. It also helps students in revision, exam preparation, and better understanding of subjects.

The project provides a user-friendly interface where users can input text or upload study material, and the system generates an interactive concept map instantly. Users can view, edit, and export the generated maps according to their needs.

Overall, Mind Map Mentor improves the learning experience by combining Artificial Intelligence with visual learning techniques, making education simpler, faster, and more efficient.

II. LITERATURE SURVEY

Literature survey is an important part of project development because it helps in understanding the existing research, technologies, and methods related to the proposed system. For the project Mind Map Mentor – AI Generated Concept Maps, the literature survey mainly focuses on concept maps, artificial intelligence, natural language processing, and educational learning tools. Many researchers have worked on concept mapping as an effective technique for improving knowledge understanding and memory retention.

One of the most important research works in this area is Concept Maps: Theory, Methodology, Technology by Joseph D. Novak and Alberto J. Cañas. This paper explains that concept maps are graphical tools used to represent knowledge in the form of nodes and links. Each node represents a concept, and the links show the relationship between concepts. The study highlights that concept maps support meaningful learning by helping students connect new ideas with previously learned concepts. It also explains how digital tools can be used to create and manage concept maps. However, traditional concept maps require manual creation, which can consume time and effort. Another important research paper is From Text to Maps: Automated Concept Map Generation Using Fine-tuned Large Language Model by Wagner Perin and team. This paper introduces the use of Artificial Intelligence for generating concept maps automatically from textual content. The system uses a fine-tuned Large Language Model to read the input text, identify important concepts, and generate relationships between them. This approach reduces manual work and helps users quickly convert large amounts of information into understandable visual maps. The research shows that AI-based automation can significantly improve the speed and efficiency of concept map creation.

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III. EXISTING SYSTEM

The existing system, concept maps are generally created using manual methods or basic software tools without the support of Artificial Intelligence. Students, teachers, or users need to read the study material and manually identify important concepts and then draw connections between them to form a concept map. This process is time-consuming and requires good understanding of the subject.

Some digital tools are available for creating mind maps, but they only provide a drawing interface where users manually add nodes and links. These tools do not automatically extract information from text or suggest relationships between concepts. Therefore, the entire workload depends on the user.

In educational environments, students usually prepare notes and diagrams manually while studying. This traditional approach often leads to inconsistencies, incomplete maps, and difficulty in organizing large amounts of information. It also becomes challenging when dealing with complex topics that contain many interconnected ideas.

IV. PROPOSED SYSTEM

The proposed system, Mind Map Mentor – AI Generated Concept Maps, is an AI-based intelligent application designed to automatically convert textual information into structured and interactive concept maps. This system aims to overcome the limitations of the existing manual and semi-manual concept mapping methods by introducing automation and smart learning techniques.

In this system, users can input study material such as text, notes, or documents. The system then uses Artificial Intelligence techniques like Natural Language Processing (NLP) and machine learning to analyze the input data. It identifies important keywords, concepts, and relationships between them. Based on this analysis, the system automatically generates a concept map in a graphical format.

The generated concept map clearly shows the connection between different ideas using nodes and links, making it easier for users to understand complex topics. The system also provides an interactive interface where users can view, edit, rearrange, and customize the map according to their needs. Additionally, the maps can be exported for future reference or study purposes.

V. MODULES

A. User Interface Module

The User Interface (UI) module is the front-end part of the system that allows users to interact with the application. It provides a simple and user-friendly dashboard where users can enter text, upload documents, and view generated concept maps. This module ensures easy navigation and smooth interaction by including buttons, input fields, menus, and visualization screens. It also allows users to zoom, drag, and edit the concept maps. The UI module plays a key role in making the system accessible and easy to use for students and teachers.

B. Ask AI Module

The Ask AI module allows users to interact with the system using natural language queries. Users can ask questions related to the uploaded content or generated concept map. The AI processes the question and provides meaningful answers based on the input data. This module works like a smart assistant that helps users understand topics better. It improves learning by giving instant explanations, summaries, and clarifications.

C. Mind Map Generation Module

The Mind Map Generation module is the core part of the system. It automatically creates visual concept maps from processed text. After extracting concepts and relationships, this module arranges them into a structured graphical format using nodes and edges. The generated mind map shows how different ideas are connected, making it easier for users to understand complex topics visually.

D. Key Concepts Extraction Module

This module is responsible for identifying the most important concepts from the input text. It uses Natural Language Processing (NLP) techniques to remove unnecessary words and extract meaningful keywords and phrases. These key concepts form the foundation of the mind map. The accuracy of this module directly affects the quality of the generated concept map.

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E. Quiz Generation Module

The Quiz Generation module creates questions based on the extracted concepts and generated mind map. It helps users test their understanding of the topic. The system can generate multiple-choice questions, short answers, or fill-in-the-blank questions. This module improves learning efficiency by allowing users to revise and evaluate their knowledge.

F. Language Translation Module

The Language Translation module allows users to convert input text and generated concept maps into different languages. This feature makes the system more accessible to users from different language backgrounds. It uses AI-based translation techniques to ensure accurate meaning is preserved while converting text. This module is especially useful in educational environments where multilingual support is needed.

VI. SYSTEM ARCHITECTURE

A. Hardware Requirements

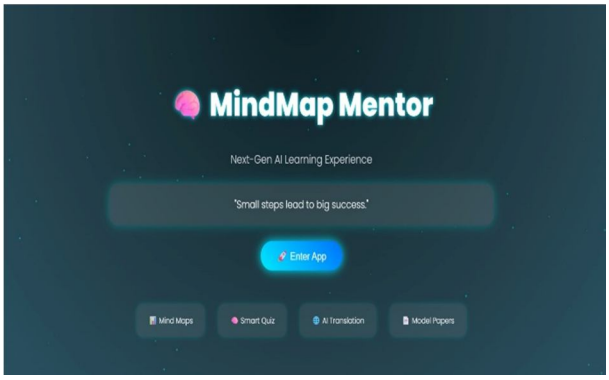
The hardware requirements specify the physical components needed to support the system.

- Processor: Intel Core i3 or higher (i5 recommended for better performance)
- RAM: Minimum 4 GB (8 GB recommended for AI processing tasks)
- Hard Disk: Minimum 10 GB free space
- Internet Connection: Required for AI services and API integration

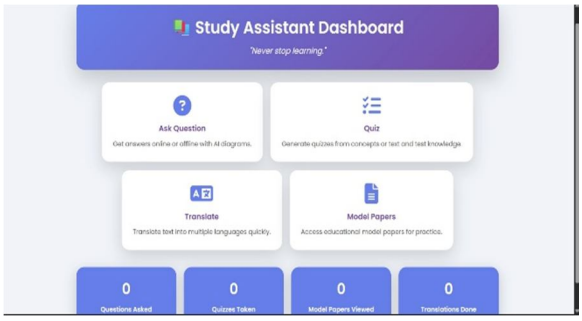
B. Software Requirements

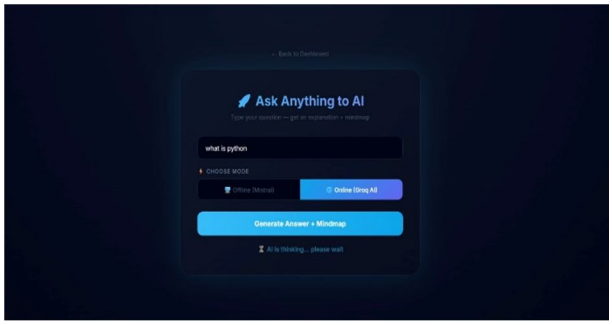
The software requirements include the tools, programming languages, and platforms used to develop and run the system.

- Operating System: Windows 10/11, Linux, or macOS
- Programming Language: Python / JavaScript (based on implementation)
- Frontend Technologies: HTML, CSS, JavaScript, React.js (optional)
- Backend Framework: Flask / Django / Node.js



VII. RESULT AND ANALYSIS





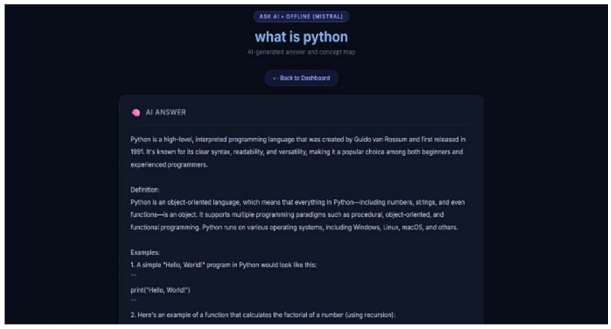


Fig 9: Generation of model papers

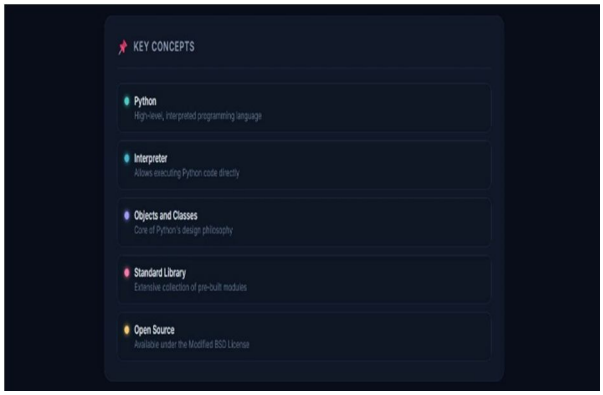


Fig 6 : Input interface with details



Fig 6: Generation of mind map



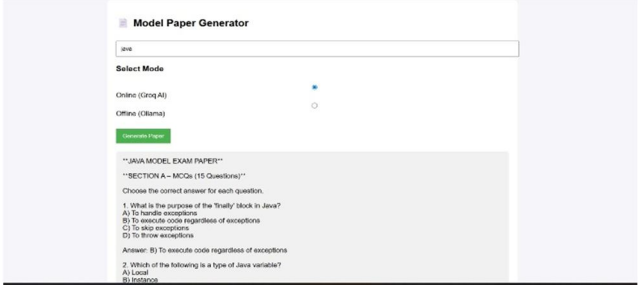


Fig 8: Generation of model papers

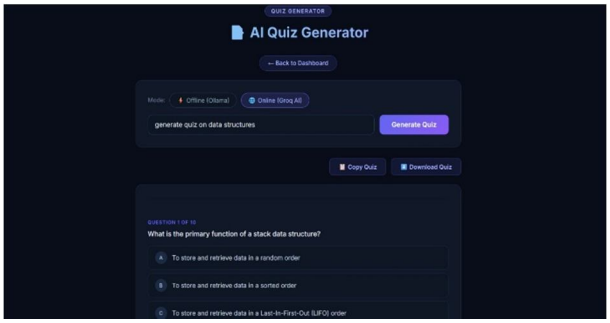


Fig 7: Language translation
Fig 9: Generation of quiz

VIII. CONCLUSION

The *Mind Map Mentor AI* project demonstrates how artificial intelligence can enhance learning by automatically generating structured concept maps from complex information. By transforming unorganized content into visually connected ideas, the system helps users better understand relationships, improve memory retention, and simplify knowledge acquisition.

Throughout the project, we explored techniques in natural language processing, knowledge representation, and intelligent visualization. The AI model successfully analyzed input data, identified key concepts, and organized them into meaningful hierarchical and associative structures. This reduces the manual effort required to create mind maps and makes the learning process more efficient and interactive.

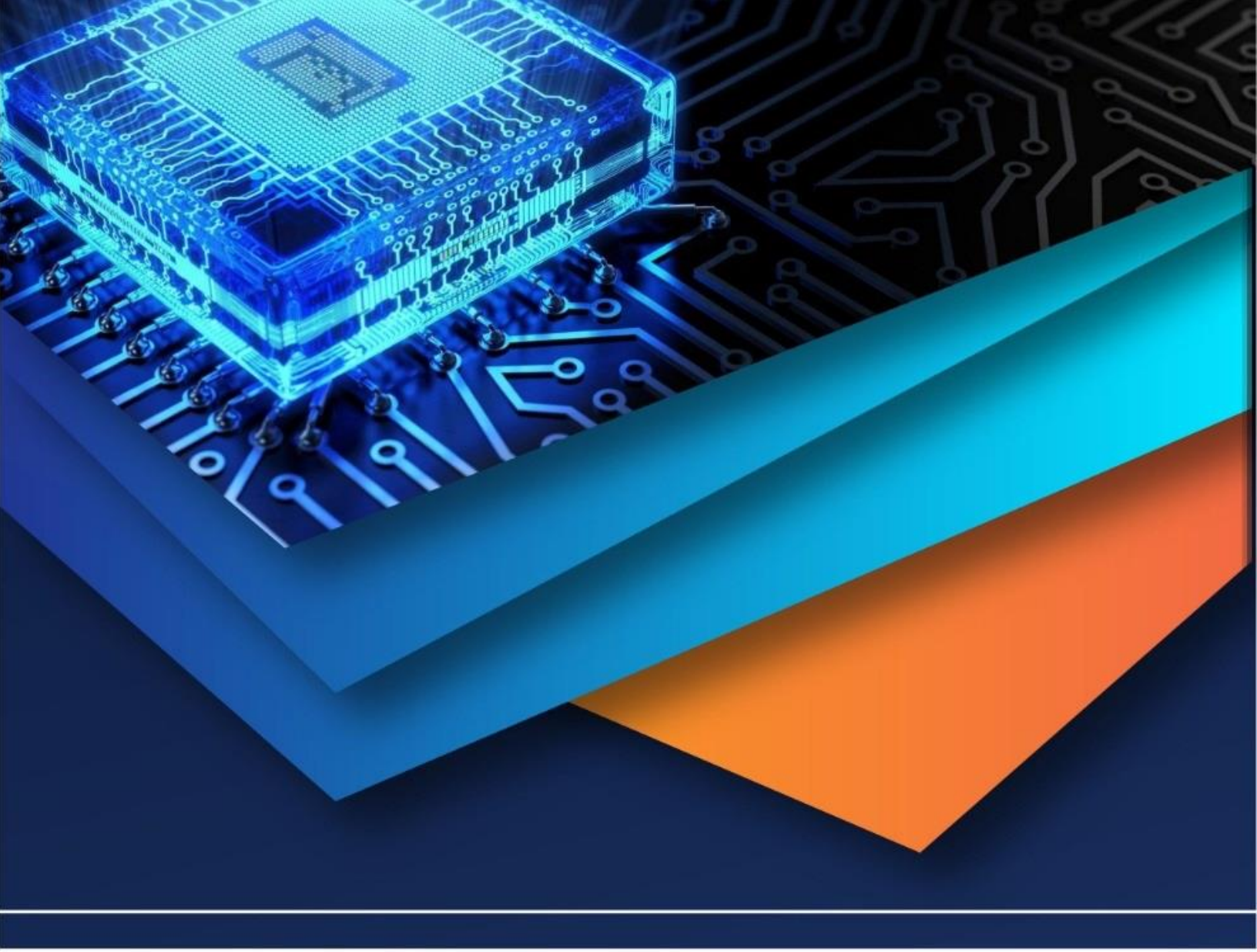
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