Learning Path Builder AI

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Abstract—Due to the blistering development of online learning, learners now access a vast quantity of learning materials including videos, articles, and online courses. Nevertheless, such a plethora of content can be extremely confusing to a novice user because the content of the learning materials is not structured and presented in a correct order. Students are not able to make a choice, where to begin and how to go ahead. To solve this issue, this paper suggests Learning Path Builder AI, an intelligent application that creates an individual and clear learning path of any subject that the user types. The suggested system is based on the Artificial Intelligence (AI) and Natural Language Processing (NLP) algorithms to process the topic that a user input enters and subdivides it into significant subtopics. These subtopics are then organized in logical sequence of basic to advanced levels, which made it easy and efficient in the learning process. The path that is generated in the learning is offered both in a textual and graphic form and this ensures that learners get a clear idea of how the topics relate to one another. The system saves time and increases efficiency of learning because it allows visual organization and presentation of the learning sequence, eliminating confusion. The given strategy promotes self-education and may be successfully implemented by students, teachers, and e-learning platforms to facilitate personalized learning opportunities.

I. INTRODUCTION

The education sector has been greatly changed with the development of digital technologies. Online learning systems enable the learners to access numerous educational materials in a very convenient way. Although this content availability is good, it also presents a significant problem: information overload. Students, especially novice learners, will have issues with choosing pertinent subjects and an appropriate learning order. Learners will skip through concepts without being guided and this leads to the incomprehensibility of concepts and demotivation.

Most of the traditional e-learning systems are generic and do not take into consideration the learning path of the learner and the prior knowledge of the learner. A variety of adaptive and intelligent learning systems have been suggested to tailor content delivery, and several indeed tend to offer content recommendation instead of a full and structured way of learning. Recent articles have highlighted the significance of the learning path generation and recommendation systems in enhancing the learner engagement and achievements of learning [1], [2].

The concept of Artificial Intelligence has become a potent element of education enabling the creation of intelligent tutoring, adaptive learning space, and customized recommendations. Artificial intelligence devices may process learner input and extract learning needs and manipulate the content. Nonetheless, there remains a necessity to have systems that would create clear and step-by-step learning pathways to learners in a simple and visual way.

In response to this need, this paper introduces Learning Path Builder AI, which is an artificial intelligence system that can be used to create learning paths structured towards any topic. The system breaks down the topic into important subtopics and organizes them in the order of prerequisite relations, and represents the learning process, in the form of graphs. The goal of this approach is to make self-learning easier, less confusing and improve the general process of learning.

II. PROBLEM STATEMENT

The high growth rate of online learning sites has facilitated access to learning materials among the students. This availability however has come with a number of challenges. The learning materials are usually spread out in various sources and lack an adequate structure. It is challenging to learners and more so beginners to choose where to begin and how to go systematically. Consequently, a large number of learners do not take basic concepts before proceeding to more advanced concepts, causing knowledge gaps.

The current e-learning systems are primarily concentrated on content recommendation or lifeless course design. Such systems do not automatically come up with a comprehensive learning roadmap to assist learners on their journey through simple to complex concepts. Moreover, the majority of systems do not have effective visualization methods, which can be used to clearly demonstrate the learning sequence and the relationship between different topics. Because of all those limitations, learners become confused, demotivated, and inefficient in learning. Therefore, it is highly required that there be an intelligent system capable of producing structured, personalised and visually comprehensible learning pathways.

III. OBJECTIVES

The key aims of the study are:

- To create and build an AI-oriented system that will produce organized learning trajectory of any topic entered by the user.
- In order to create meaningful subtopics that are automatically generated out of a given topic based on AI and NLP methods.
- To organize the discovered subtopics in a learning sequence which is easy to learn and highly advanced.
- In order to have a graphical representation of the learning path to facilitate easier understanding.

- To minimize time wasted by the learners who have to search and organize the learning materials in the process of retrieving them.
- To facilitate self learning through clear guidance and direction to the learners.

IV. LITERATURE SURVEY

A number of studies have been directed toward the enhancement of personalized learning using adaptive e-learning systems. Adaptive e-learning system is set out to provide personalized learning material according to the needs, preference and level of knowledge in the learners. The papers emphasize the significance of domain ontology and student modeling as a way of organizing the learning material and delivering it in an adaptive manner [4]–[6]. These systems enhance content relevance and fail to provide an entire structure of learning.

Systems of recommending learning paths have become popular in recent years. Studies indicate that recommendation-based strategies are effective because they assist learners in appropriate learning suggestions that are given according to learner preferences and interests [2]. Such systems help in preventing the information overload and most of them use the learner profile and feedback as a basis as opposed to automatic topic decomposition and prerequisite-based sequencing.

The Intelligent Tutoring Systems (ITS) are based on AI to offer personalized feedback, adaptive content, and support learners. The learning system powered by AI helps to improve learning experience and outcomes by adjusting the content dynamically and supporting the individual learning needs [3]. Nevertheless, most ITS plans are aimed at tutoring and evaluation as opposed to the production of a thorough learning roadmap.

As per the available literature, it is apparent that although adaptive learning, recommendation systems and intelligent tutoring systems are used in promoting personalized learning, not much has been done to automatically produce structured and visual learning pathways that learners can follow step by step.

V. RESEARCH GAP

According to the literature review, the next gaps in the research are distinguished:

- The majority of currently available systems include content recommendation and not the full development of learning paths.
- Little has been done in automatic topic decomposition and prerequisite-based learning sequence generation.
- Various adaptive learning systems do not show a clear diagram of the learning process.
- Current systems normally need a lot of learner data, but beginners might not have some previous learning profiles.
- It lacks easy and convenient systems that facilitate self-learning with minimum efforts of user.

To fill these gaps, the proposed research is to develop Learning Path Builder AI which is an automated AI-based tool that generates a structured, visual and low effort learning roadmap by applying AI.

VI. PROPOSED SYSTEM

Learning Path Builder AI is a proposed system that is an intelligent learning assistance system aiming at creating a structured and personalized learning roadmap of any topic typed by the user [1], [2]. The system will reduce confusion brought about by disorganized learning resources and equip the learners with a sense of direction on studying a topic taking is through the basic level to the advanced level.

In this system, the user will give a topic of his or her choice to learn. The system is based on the principles of Artificial Intelligence (AI) and Natural Language Processing (NLP), as it analyzes the topic and finds significant ideas related to it [3], [4]. The identified concepts are subdivided into subtopics that make sense. These subtopics are then organized in an orderly sequence of learning the relationship of prerequisites with other concepts so that only the basic concepts are learnt first before the complicated ones [5], [6].

Learning path visualization is also an important characteristic of the proposed system. The created learning roadmap is presented in graph-based display with nodes as learning subjects and edges as the learning path [7]. This graphical depiction enables the learners to find it easy to see how the topics are related to each other and which ones should be learned more.

The suggested system does not presuppose the previous profiles of learners or complicated inputs. It is easy to learn and basically concentrates on subject matter guidance to learning. The system facilitates self-learning, promotes learning, saves time and enhances the motivation of the learners by giving them a clear roadmap in learning.

VII. METHODOLOGY

The proposed system has a systematic and modular methodology to develop the structured method of learning [3], [6]. The whole process can be split into the following steps:

A. Step 1: User Input

The process will start by the user keying in a thing he or she desires to study. Input is checked to make it meaningful and worthy of analysis [1].

B. Step 2: Topic Analysis

AI and NLP applications are applied to the typed subject [3], [4]. The system recognizes important concepts, keywords, and various other related terms of the topic. This discussion assists in knowing the general outline of the topic.

C. Step 3: Subtopic Generation

The system divides the main topic into smaller topics that are meaningful based on topic analysis [5], [7]. These sub topics encompass basic, intermediate as well as advanced concepts that are necessary to have a full comprehension of the topic.

D. Step 4: Path Generation of learning

The obtained subtopics are organized in logical learning order [6], [8]. Prerequisite relationships have been established in such a way that the learners begin with simple concepts and progressively proceed to complex subjects. This action will provide an effective learning process.

E. Step 5: Graph Visualization

The graphical path of the structured learning is translated into a graph [7]. The nodes are a subtopic and the edges indicate the sequence of learning. This visualization makes the learning process easier to follow and it is more explicit to learners.

F. Step 6: Output Display

Lastly, the system shows the entire learning roadmap both in text and graphical form [2]. The learner will be able to go through the roadmap one step at a time without any misunderstanding.

This methodology will see to it that learning paths are automatically created, organized and simple to comprehend; this will make the system friendly to students, instructors and self-learners [1], [3].
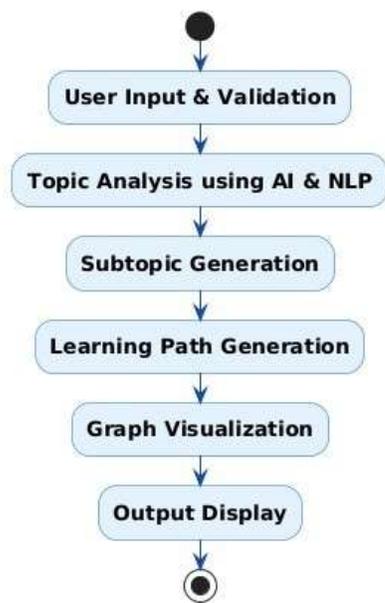

Fig. 1. Visual representation of the learning path generation process

By contrast to the existing systems of adaptive learning and recommendation addressed in the previous research, the given system is more concerned with the entire learning path creation, but not with the recommendation of the content or courses. This is in contrast to most intelligent tutoring systems which rely on profile of learners and continuous feedback. The proposed approach, which is Updated-Intelligent-Tutoring-System is efficient even with simple individuals who do not have any learning information before.

VIII. RESULTS

The experiment of the Learning Path Builder AI shows that the system can create structured and meaningful learning paths of the topics entered by the user [1], [2]. On the provision of a topic, the system is able to discover the pertinent subtopics and presents them in a logical order of simple and advanced level topics.

The visual representation of the learning path in the form of a graph enhances easier understanding of the user [7]. The graphical representation enables the learners to recognize the prerequisites and the right learning sequence easier as compared to text-only learning materials.

All in all, the findings suggest that the Learning Path Builder AI is a rather straightforward, effective, and user-friendly tool in structured self-learning.

IX. DISCUSSION

As the experiment of the Learning Path Builder AI demonstrates, the system can generate structured and meaningful learning paths of the topics typed in by the user [2], [3]. The system can find the relevant subtopics and displays the subtopics in a logical sequence.

Fig. 2. Example of a generated learning path visualization

Presentation of the learning path as a graph also makes easier comprehension of the user [7]. This removes the confusion and enhances the interaction of learners.

Compared to the current systems of adaptive learning and recommendation, the specified system will be more focused on the overall creation of the learning path, yet not on the content or courses recommendations [1], [2]. monitoring in the future.

X. CONCLUSION

Learning Path Builder AI, which is an intelligent system that builds learning paths in a structured and personalized way, was introduced in this paper through the application of Artificial Intelligence. The system solves the significant issues that learners have because of unstructured and overwhelming internet learning resources. The proposed system makes the learning process easy by automatically analyzing a topic, creating subtopics, and organizing them in a logical order, as well as visualizing the learning path.

The research demonstrates that the current adaptive learning systems and recommendation strategies are primarily centered on content delivery .

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