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Reasoning System for Generating Learner Preferences

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Abstract -The development in technology compromises new horizons for acquiring knowledge that will lead to essential transformations in e-learning. Learning material available in a multimedia form is used for the educational system and makes learning a task-driven process. Due to this, learners will be able to explore alternative course-plotting paths through knowledge and from various resources around the world. However, the construction of the e-learning content is usually presented in the same way, without considering the learner's goals for surfing, their involvement and their present knowledge. This is an issue that needs further consideration, especially when it comes to web-based teaching and improvement in technology. The learners are categorized by extensive heterogeneity with respect to education, knowledge, age, experiences, culture, professions, motivation, goals, and where learners take the primary responsibility for their personal learning.So, there is an aspiration to create specific strategies that will build personalization of e-learning systems and content.

Index Terms - elearning, Learning Object,Decision Tree ,K- Nearest Neighbour, Reasoning

I. INTRODUCTION

Rather than passively accepting and highlighting knowledge, students in the twenty-first century should adapt to new learning situations that can help them prepare for their future and add to their own unique learning. They can collaborate with teachers to define learning goals for themselves, and they can collaborate toward those goals using a mixed methodology which includes better approaches of establishing coordination with their instructor, and using strategic development. Through pre-assessment and feedback, adaptive learning provides the student with a defined path. It connects learners' various learning abilities to the most appropriate learning path. Learners can design their own individual learning course based on their interests and abilities.It controls to prevent the learner from skipping areas where they are weak. It allows the student to be more flexible. It is vital and makes learning easier when one's adapting needs and tendencies are acknowledged. Students can learn at their own pace with electronic learning.[1]Different people learn in different ways, and web learning goes out of its way to accommodate all of these differences. Instructional designers and e-learning specialists create online courses that address all types of learners and cater to all learning preferences. It makes no difference whether understudies use visual, audio, or electronic media when learning online; there is a wide range of learning approaches and gadgets that may be employed to learn while simultaneously attending to all of the demands. Today's electronic learning is superior to yesterday's, and tomorrow's online learning will surpass yesterday's.[2]

The goal of this project was to create an e-Learning system, and the end result was a method for determining a user's learning style and presenting content depending on their preferences. The proposed framework employs a wide range of personalization factors, including style, knowledge, age, learning object, and learning path. The reasoning methodologies for generating learning models provide the framework for designing e-Learning platforms. New cases are generated and verified through domain experts, and they have been recorded in a knowledge base.

II. COMPARATIVE ANALYSIS OF RECENT TECHNOLOGIES USED FOR ELEARNING

There are many different learning styles, such as visual, logical, aural, social, solitary, auditory, kinesthetic, and so on. This study [3] describes how to construct e-Learning systems using the Felder-Silverman learning style model. Learning materials should be offered to each individual based on their instructional techniques. This system creates an ontology to explain relational and object modeling. Felder and Silverman Learning Styles were used as a guide for e-Learning personalization. IEEE learning object model criteria should only be used when recommending learning objects. The Manhattan distance and fitness function were used to calculate a correlation between the learner and the learning material.

My Tutor learning system, which is based on Artificial Intelligence planning, is discussed in article [4]. To attain smaller goals, planning divides a complex task into multiple sections. A Moodle-based platform with case-based planning is being evaluated for system implementation. It's an online tutoring system for learners who want to learn how to produce, solve mechanical problems, and plan.

Gamification is the technique of using gamification components to drive students to employ a goal-oriented approach while learning, as described in article [5]. They conducted field study to determine learner motivation and interest. They assessed the performance of students in a technical English course using a survey.

The study provided in paper [6] is developed for the detection of learning style utilizing support vector machines and literature-based computers. A comparison of the support vector machine and other categorization techniques is shown. These algorithms are used to analyze the log data from the Data Structures and Algorithms class. They achieved better outcomes with a support vector machine than with a naive bayes technique.

The function of the teacher in e-Learning is to recognise students' behavior, learning preferences, and deliver information to them based on their abilities; hence, the work presented in article [7] predicts an acceptable personalization technique for the highlighted material. They create a questionnaire set for this purpose in order to get better results. They used dynamic programming on the questionnaire to change personalization parameters with a personalization strategy.It helps teachers to present their material as per personalized behavior.

Paper [8] combines artificial neural networks, data mining, and Case-Based Reasoning to provide course material to individuals based on their difficulty level and preferences. In this scenario, ANN discovers a link between students' learning choices and their attributes. Data mining is used to categorize learning results and create scenarios. These were all saved in the database and processed as historical cases in the retrieval process using Case-Based Reasoning. Table 1 shows a comparison of the various strategies employed in the eLearning system.

TABLE1: DIFFERENT TECHNIQUES FOR ELEARNING SYSTEM

Technologies	Techniques used for eLearning system
Adaptive Learning System	a. Concept Map: Identification of weak students and providing guidance and learning material to them b. Reinforcement learning: Captures cognitive states of the learner and provides material to students. Suitable for continuously changing a student's state. c. Genetic Algorithm: Identification of learner, learning style, interaction level, complexity level of learning objects using a genetic algorithm. Applicable for large sample space.
Ontology based system.	Ontology-based Learning management system generated and used by the semantic query engine. It enables user queries of learning objects across heterogeneous learning resource systems.
Cloud Computing	This is for education management system (EMS). Uses the public cloud for demonstrating learning material.
ICT	Personalization done by the k-nearest neighbor and decision tree. Provides a learning path using association rule mining.
Web Usage Mining	Extract web log data, information retrieval is carried out for personalized data.
myPTutor	It is a Moodle based system. It is based on an artificial intelligence planning concept.

2.1 CURRENT TECHNOLOGY AND TOOLS

e-Learning is virtually technology-based learning through the internet and modified local area networking. Due to an industrial uprising, the education system has undergone remarkable changes since the earlier 90s. e-Learning, by advantage of its exclusive, scattered and asynchronous nature, knowingly progresses the whole learning structure. It produces a new element of education that removes the obstruction of time, distance and socio-economic status. However, education has a different view from the learner side, content warehouse and administration, metadata managing and indexing, there is a probable benefit in Adaptive Learning Environments [9]. The responsiveness

ALE was accepted in recent years. To cope up with all these, there is a necessity of systematizing the entire structure, by managing teaching skills and experiences. Many e-Learning ethics like SCORM, LOM are offered now in the market, and they have been acknowledged by many colleges, organizations, and many Govt. and Non-Govt. Administrations. Investigators are also familiarizing various types of implementable styles in this arena in distinct phases of time. Most of these regularly provide more importance on the content management of the educational process. It was done by participating in different striking tools like visuals, simulation, videos, charts, graphs, etc. to make the system more striking and communicating.[10]

2.2 ONLINE TOOLS

a. GoogleDocs: It is a set of applications for the creation of spreadsheets, presentations as well as sharing and collaborating online documents.

b. Wikispaces: This is an online platform for shared writing and discussion.

c. WordReference: This is an online dictionary available for various languages.

d. Lingro: This is an online tool for transforming a website into communicative audio boosted glossary and it also allows for generating flashcards.

e. SMILE: This is a tool for generating linguistic practice pieces of training.

f. Video Dropbox: This is a drop box for students' video recordings for placing on a webpage.

g. Viewpoint: This is a repository for recording audio and video files online as well as updating present media.

h. Worksheets: These are for generating multiple-choice matching questions and allowing interactive audio and video recording. [11]

III REASONING SYSTEM

The Case-Based Reasoning has been used for resolving the problem from particular disciplines to ordinary tasks. It highlights previous knowledge used for future problem-solving. If a current problem occurs, it is promising to answer the solution by mentioning past experiences.

In CBR, knowledge acquisition consists of relevant, existing and earlier experiences and their representation and storage. In rule-based or model-based system, removing or extraction of rules or models are necessary. CBR is a rule-based system, so it supports relevant, useful information needed to develop any system.

CBR system records success as well as failures, and the explanation provided what the causes of system failure are. The system uses past knowledge to predict any shortcomings in the future.So, CBR system is used for avoiding repetitive mistakes.[12]

Some of the model-based systems are not able to solve a problem when information is incomplete or insufficient or not in the boundaries scope of the system. But in CBR, due to the revision and retain process, it makes an ongoing attempt to solve these types of problems.

Domain theory has not been fully defined, understood or modeled and a CBR system is reasoned only on a set of cases from the domain.[13] These cases cannot be quantified. Insufficient information can be used to build a causal model and derive a set of rules for it.

The user may make predictions of the probable success of the system. It is done by referring to previous solutions and differences between the earlier and current context of the answer.

In the CBR system, new problems are tested in the real world, and these cases are getting added in case of the library after demining their success. Adding examples, a CBR system is able to use it for the reasoning of the variability of situations with a higher degree of improvement and success.[14]It has been used for a variety of applications,

Analysis: There are many CBR medical analysis systems. These systems attempt to retrieve earlier cases based on the similarity index of the new situation and prediction based on a similar policy.

Assistance: CBR system acts as an assistant in the customer service area. They deal with the management of product or service problems.

Valuation: CBR system is used for evaluating finance and marketing domains. It is used to determine values for entities by matching it to the already known value.

Assessment: While making a decision, in some situations complex problems occurred when people used to look for similar issues for conceivable clarifications. Design of CBR systems based on the same principle to develop a decision support system to find a relevant similar case. It is predominantly good at non-homogeneous, modular and querying documents.

Design : CBR systems are used in the design process for architectural and industrial purposes. It assists the user in the design process and would need to combine with other forms of reasoning to support design.[15]

Knowledge: CBR is often used by an expert where the expert finds their thought process hard to express when solving problems. Inadequate domain traditional knowledge-based systems were likely to produce incomplete and inaccurate information. In the CBR system, knowledge acquisition is limited to the establishment of feature vectors of entities.

Incremental Process: In CBR, knowledge base allows to be developed incrementally, while maintenance of the case library is comparatively easy and can be approved out by field Professionals.

IV PROPOSED SYSTEM

This work focuses on identification of learners' needs and learner style.Initially input was taken to construct a knowledge base based on survey information gathered.Entire process decompose to four phases.These phases were retrieve,reuse,revise and retain.For the retrieval process this system gathers few information from the learner,there was matching process carried out in backend and one of the most similar case get retrieved.Similarity index calculation was done by k nearest neighbor algorithm.learner has to reuse the similar case for learning purpose.[16] But if the case is not similar as per the knowledge base then there is revising of the case was done.Revise case is presented to the domain expert to retain into the knowledge base. As per the domain expert input it was retained and increased the knowledge base dynamically.There are the different sample cases presented in Table 2

TABLE 2: SAMPLE CASE LIBRARY WITH FEATURE SET PARAMETERS

id	problem	learning style	Knowledge Level	learning object	Test performance	Path
1	DFS	Visual	Beginner	Video	9	Adapted
2	BFS	Auditory	Intermediate	Audio, Video	9	Adapted
3	A*	Visual	Beginner	Flow Chart, diagram	3	Not Adapted
4	A*	Visual	Beginner	Diagram, Case study	8	Adapted
5	IDA*	Kinesthetic	Beginner	Handson Session, Case Study	10	Adapted
5	IDA*	Kinesthetic	Beginner	Video, Charts	3	Not Adapted

There are around 419 training cases in the case library.Based on these case data and user input most relevant cases get retrieved.Depending on the input, priority is assigned to different feature vectors.As all the features above do not have the same unit (like iris flower dataset which has the same measure unit 'cm'), it normalizes them by assigning them an integer value.For calculating the total value of the training dataset row, this work considers all the feature values and for the testing dataset and skip feature value want to predict using the algorithm here this work skip learning object.This is a dynamically incremental phase of CBR whereas assignment of new index value is done by considering the test performance of the new user. Revise and Retain phase of Case-Based Reasoning is to add a new query with a new index value in the dataset. [17] This is finished by simulating the result and threshold value set. For that, initially there is load training and testing dataset so the algorithm represents the fetching of input parameters. This research work emphasizes CBR with KNN. After loading the dataset as training and testing, the next step is to check similarity. So, for finding a similar case, Euclidean distance measures are used. After calculating values of learning style, knowledge level, and test performance, the job of retaining and revising is to suggest a learning path to a new user. So, whatever score is getting for the 'x' value dataset, needs to be normalized to obtain Weight.

V IMPLEMENTATION AND RESULT

As a part of the result, the proposed framework classes' students according to the learning style as visual, auditory and kinesthetic. The result is introduced for learning style just as the recommendation of a learning object to another student. Alongside recommendation, there is also learning material that benefits a student. Learning material is available as a diagram, graph, notes, simulation, and featured content. Information such as path, learning style, and learning object gets stored in the database.[18] For this proposed system, the CBR approach is used for adaptive recommendation. Once the new case gets stored in the case library, there is an assignment of indexing to the new case. After that the learner opts for the test and if test performance is up to the threshold level, then as per the CBR process, that particular case is added to a case library. For this research work, consideration of KNN, DT, and NB for time and accuracy calculation. As per the comparison, DT gives results in a minimal amount of time, but there is a fluctuation in DT decision as compared to KNN and NB.[19] By considering the stability of decision and accuracy, KNN is suitable for the retrieval phase of the CBR process. Further, this research work analyzes the impact analysis of this system. Before using this system, only 70% of students secured 50 percent marks in a particular subject. Because of the revised process of CBR, the threshold value set is a minimum 50 percent of marks. If a learner does not secure the threshold value marks, then this system advises that the understanding level of a particular learner is not satisfactory and they should choose another learning object to understand that specific concept.[20]

After receiving the response to the questions answered by the students is to capture the learning style of an individual student. Fig 1 represents the response. So, the generated learning style of the learner is kinesthetic.

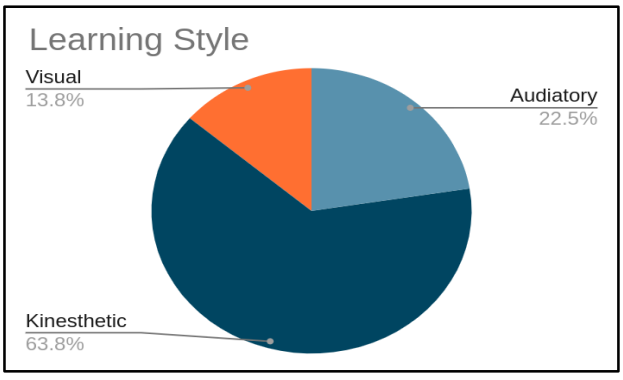

FIG 1: RESPONSES FROM LEARNER

According to the kinesthetic learning style of a new user, suggestions have to be provided to learn specific concepts. Below, fig 2 shows suggested path and learning object used by previous learner.[21]

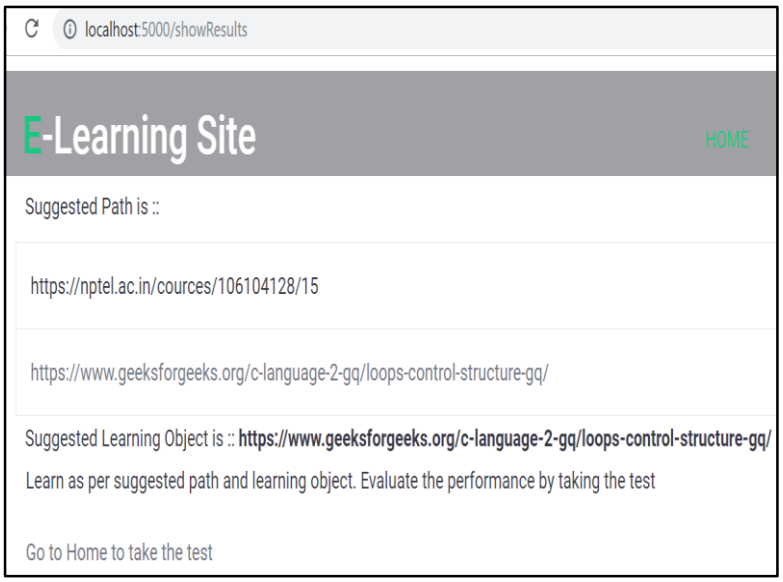

FIG 2: SUGGESTED PATH AND LEARNING OBJECT

Depending upon a score of test performance, the knowledge level gets generated as an expert, beginner and intermediate. The knowledge level is used for improvising learning paths and learning object suggestions.

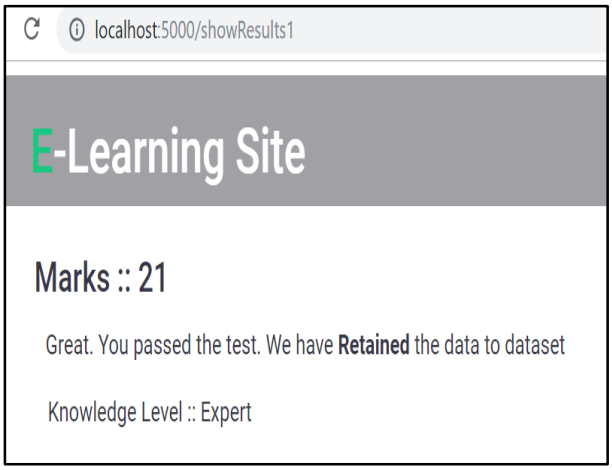

FIG 3: RETAINED PHASE OF CASE BASED REASONING

For checking the performance of the system, time calculation for Decision tree, K nearest neighbor, and naive bayes is done for 250 records. As CBR is incrementing dataset, so if the dataset size increases, then to verify the performance of the system, this work considered different dataset size comparison. Below fig 4 shows Fluctuations in time and average time of these algorithms.[22]

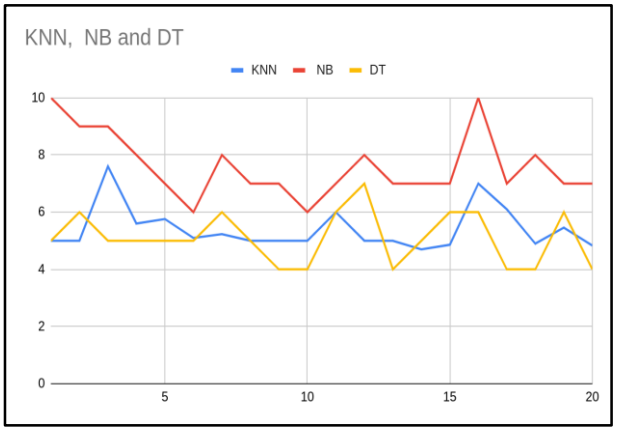

FIG 4: COMPARISON OF LEARNING ALGORITHMS

From the above diagram, it is observed that if the record size is 250 for 20 observations again, the decision tree and naive bayes solution is fluctuating and the K-Nearest Neighbour method solution is steady.Favourable results were obtained from experiments, indicating that this system works well when students and their learning behavior were unknown to the instructor. By using this model, instructors come to know the learner's learning style. Once a learner's behavior is clear to the system, it can automatically change the way of teaching. Since it is a comparative model, this research work compared different machine learning algorithms such as K-Nearest Neighbour algorithm, Decision Tree and Naive bayes. From the performance of these three, it has been observed that K-Nearest Neighbour and Decision Tree are more suitable for the dynamically incrementing model.

CONCLUSION:

As this system uses historical knowledge generated by domain experts, evidence of concepts are obtained by searching different case studies particularly the Felder-Silverman learning style and Myers Briggs personality types. For different learning styles and learning objects, this approach employed learning style model by Felder-Silverman. It is a challenging task to classify the students based on their learning performance, detection of irregular learning behaviors and e-Learning system navigation. Finally, for best results, systems' adaptability to students' requirements and capacities develops many findings and ultimately, implements the proper methodology. The fast increment in internet availability over the most recent couple of years has been a significant motivation for the development of e-Learning in the globe. A powerful internet resource, with a large number of nearby and worldwide networks, will enable web based systems for further advances. The story isn't restricted to schools alone. The outcome currently is that there are various mechanisms that help to make in-built instructional classes, standardize the learning procedure and additionally fill casual components to generally formal learning forms. A few e-Learning patterns can give us a reasonable perspective on the fate of e-Learning and how learning implements will be formed.

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