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Implementation and Systemic Analysis of Extended Data Mining Technique for Adaptive Learning System

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Abstract— The purpose of this work is to evaluate the necessity of the dynamic learning system which enables the learner to study more and understand more. The dynamicity is achieved by using machine learning algorithms like fuzzy clustering technique and ontological representation of the resources. We have proposed [1] and evaluated a system with fuzzy clustering and ontological clustering to find the relationship between the resources and to populate to appropriate learners which makes them to understand the concepts very quickly and there is a satisfaction level increases by giving the appropriate contents and appropriate questions to evaluate them. We have implemented this system using web technologies and given a web application with different modules for students and for tutors.

Keywords— Ontology, Learning management system, clustering, learning, XML

I. INTRODUCTION

Ontology [1] is used to identify and overcome the knowledge sharing barriers. Ontology provides a shared vocabulary, which can be used to model a domain and support reasoning about concepts. The use of ontology is a possible approach to overcome the problem of semantic heterogeneity. Ontology is proposed as a way to overcome the obstacles of knowledge integration. It is used to unify Databases, Data Warehouses, knowledge bases vocabularies and even to maintain consistency in updating Corporate Memories used in knowledge management in modern enterprises [2].

In recent years, several approaches have been proposed to solve the problem of ontology learning. These approaches include: ontology pruning [8], conceptual grouping [7], formal concept analysis (FCA) [5], association rules [6], pattern extraction [3] and conceptual learning [4]. However, these approaches do not consider all available information to make a realistic decision. They are often focused on limited types and neglect others. There are different learning systems [14] [15] [16] [17] [18] [19] so while building any such adaptive systems we must address the different styles of learning. The student's interaction with the system could impact the learning behavior. Hence obtrusively asking the students might not motivate the students to use the system for a longer time [10][11][12][13].

We have used Ontologies [1] to represent the data and the meta-data information about the data. In this paper data represents the resources that have to be presented to the end user who is the learner.

This work is an extension of the [] in which we have proposed a system and in this research work the evaluation of the proposed system and the analysis of the proposed work will be explained in detail with the detailed analysis.

There is also a need to represent the meta-data about resources which has been represented as text format. And also there is a need to find irrelevant learning contents before the system analyze learning contents. Ontology has been used to represent the data and the relationship amongst data in various applications like data mining, data migration. Several algorithms are used to cluster the data but fuzzy clustering helps us to cluster the data and associate the cluster to different data points based on the weighage.

We had proposed a learning management system for the students based on the several attributes like user likeliness, resource availability and other parameters. In this learning management system resources are categorized into various types and the relationship between the resources are represented using ontological tree which will be implemented in the form of XML and stored in the database.

In our proposed system, there are various types of resources that a user can view in the learning system. And also user can set their preference because some of the users are interested in videos and some may interested in presentation so we have a option where the user can enter and save his/her preference.

This preference is stored in the system and based on the preference ontological tree is created and the unwanted resources are eliminated using outlier detection which gives only the appropriate resources to the system.

Based on the ontology tree, fuzzy clustering is applied to cluster the resources by which various resources and users are clustered and if the user is in particular cluster appropriate resources are presented to the user based on the preference, learning resources availability.

System architecture and implementation details are explained in section II, section III describes about the data sets that we took for this work and section IV describes about the analysis, results and section V concludes the system and describes about the future work.

II. ARCHITECTURE AND IMPLEMENTATION DETAILS

2.1. Architecture of Proposed System

The ontology tree and clustering happens on the below parameters:

Resource category

Identification of the resources category based on the different projects and objectives. These projects and objectives are identified by the tutors and are created in the system. Teachers/trainers can add various resources based on the project and objectives.

Preferences

Preferences are categorized into subject level and resource category level.

This subject level preference is used to present the contents for the learners of different skill set.

Based on the skill set of the users which are initially received from the user for the particular subject, our proposed system presents the resources to the learners.

2.2. Advantages of the proposed System

- Dynamic Ontology creation which enables more levels of abstraction
- Outlier elimination which gives only related information to user which improvises user learning satisfaction
- Dynamic adaptation to the user whenever the content changes
- Dynamic adaptation to the whenever the user preference changes
- Dynamic content presentation based on the skill set of the user

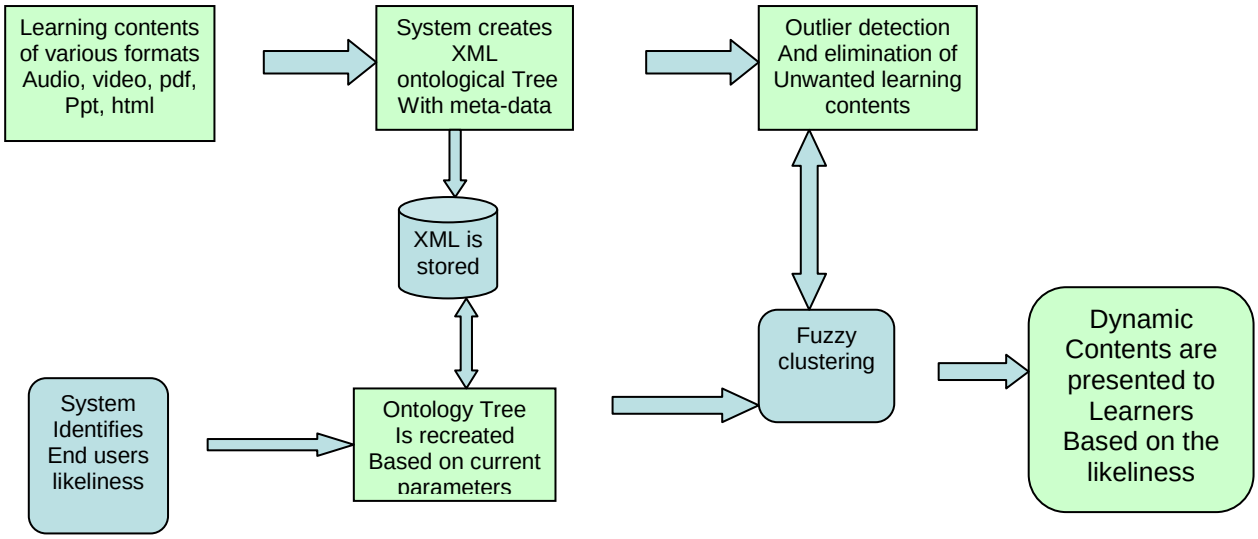


Fig. 1. Architecture of Learning Management System

2.3. Different modules of Proposed System

1. **Tutor module** – which enables to create various modules/ subjects and provides and interface to add the resources
2. **Ontology Structuring** – which creates the representation for the resources in the form of xml
3. **Outlier Detection and Elimination** – which determines the outliers and eliminates the outliers based on the current properties
4. **Clustering module** – creates the clusters of resources and associates the learners to the particular clusters
5. **Learner module** – which creates an interface to enroll into particular subject/ module and set/change the preference of the learning methodology
6. **Presentation Module** – which creates the user interface for the learners and dynamic contents are presented accordingly

III. DATA SETS AND ANALYSIS

We have developed different modules in different time frame and our prime motive is to collect resources for the courses which we have designed. There are different types of resources basically there are of pdf, ppt, videos or flash animations, html or text oriented resources. Each learner will be setting their preferences during the initial pages based on the preference also, dynamic contents will be shown to the user.

Table 1 explains about the different courses we formulated to students and the number of resources that are available in the system, in total we have 720 resources available for three different courses and each course has two different levels and based on the different levels for which students are enrolled, resources are clustered and they are presented to the users dynamically.

In total we have asked 15 students to use the system with the different preferences either pdf or presentation or video or text oriented courses. Figure 1 explains about graphical representation of number of resources available in the system for a particular course.

Table 1. Courses and total number of resourses.

Courses	PDF	PPT	Video/SWF	Text/Html
Java Basics	20	33	22	32
Java Intermediate	21	27	33	29
Java Advanced	15	44	20	20
Operating System - Basics	10	25	15	27
Operating System - Advanced	14	29	33	30
Distributed Computing - Basics	20	44	22	33
Distributed Computing - Advanced	21	19	33	29
Total	121	221	178	200

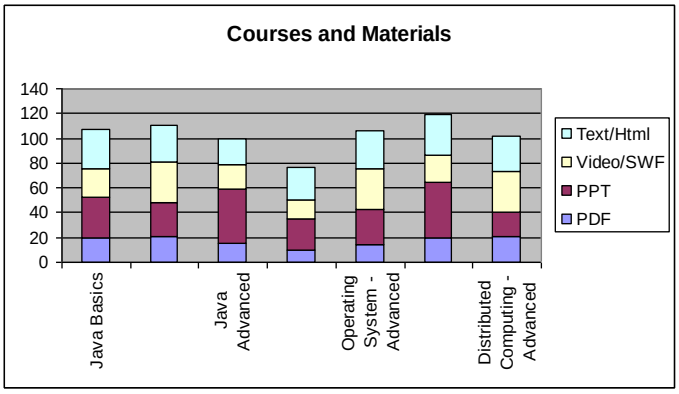


Figure 2 Course materials and resources

Figure 3 explains about the total number of views by the students from which we can infer that most of the students would prefer video based courses which had a greatest hit of 1750 views followed by the presentation of 1250 hits and followed by the pdf of 1050 views and there is a least view of 550 views for the text/ html mode.

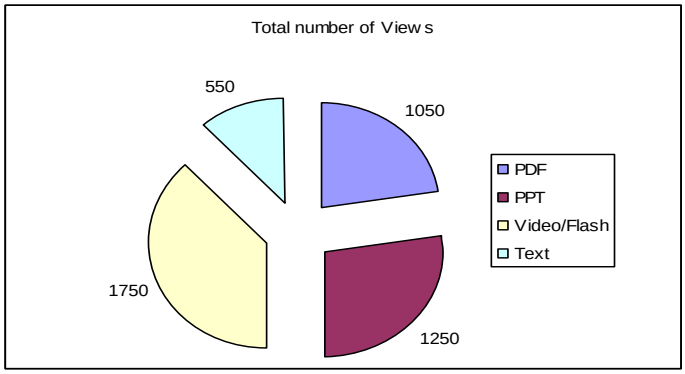


Figure 3 Total number of Views

IV. SYSTEM ANALYSIS AND EVALUATION RESULTS

We have asked students to take up the exams before and after completion of the course. From the exam results we could infer that there is an increase in exam results marks in the students in the same course. This had increased the competency level for a particular course. Students who had low marks is having improvement in their marks but students who already had secured more marks than eighty percent is having a slight increase in the marks even after they gone through our learning system. Figure 4 explains the evaluation results before and after this course and marks are tabluated.

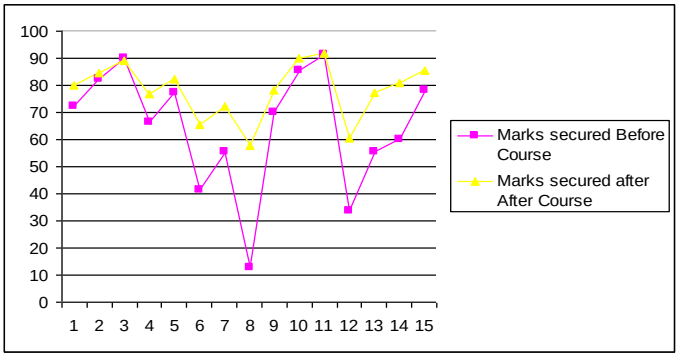


Figure 4 Students evaluation

Figure 5 explains about the satisfactory feedback from the students after the evaluation of the courses. From the below figure we can infer that most of the students have given a satisfactory level around 4 which gives a better evaluation of our system.

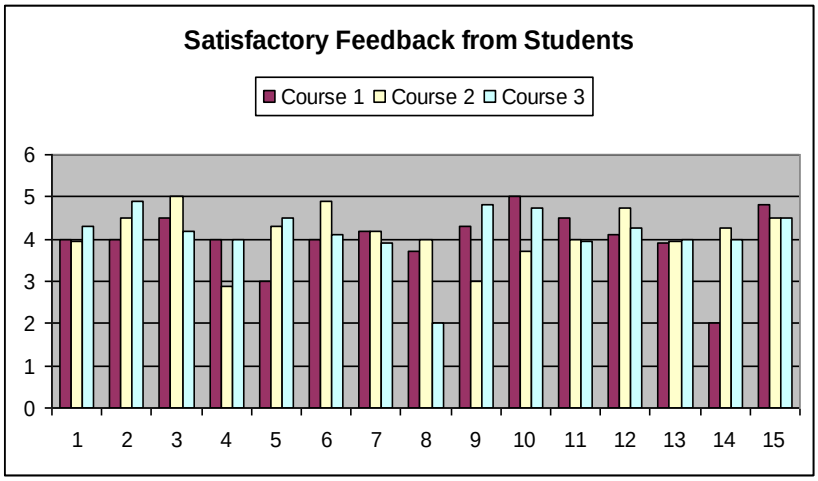
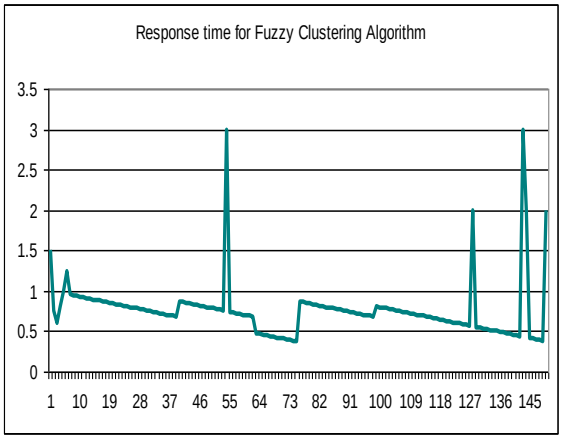
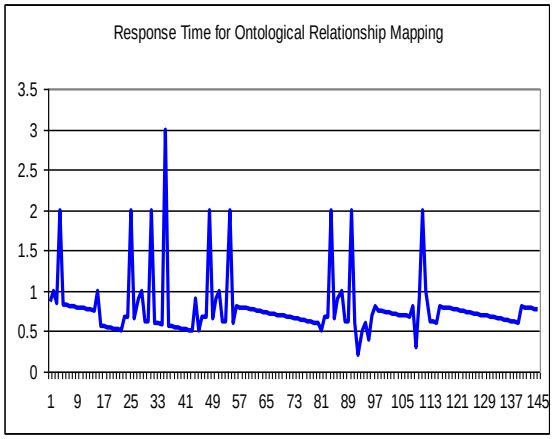


Figure 5 Satisfactory evaluations after exams

Figure 6 explains about the response time of the system during different instances, we have taken a sample of 150 instances for which the response time has been got and plotted. From that we could infer that the average response time of the system for clustering is 0.75 seconds and the average response time for ontology relationship mapping is 0.78 seconds. The average response time for the outlier detection is 0.25 seconds.





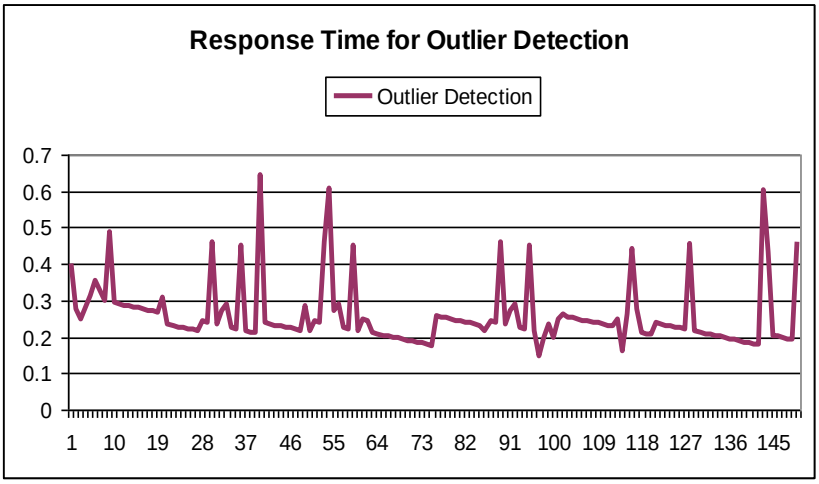


Figure 6 Response time graph – System performance analysis

Figure 7 gives the picture of the exam module where the student can select the answer and when the next question is clicked, based on the preference, questions are displayed adaptively.

Figure 8 gives the picture for the resource consolidation to the students based on the preference and outcome of clustering, outlier detection and ontology mapping.

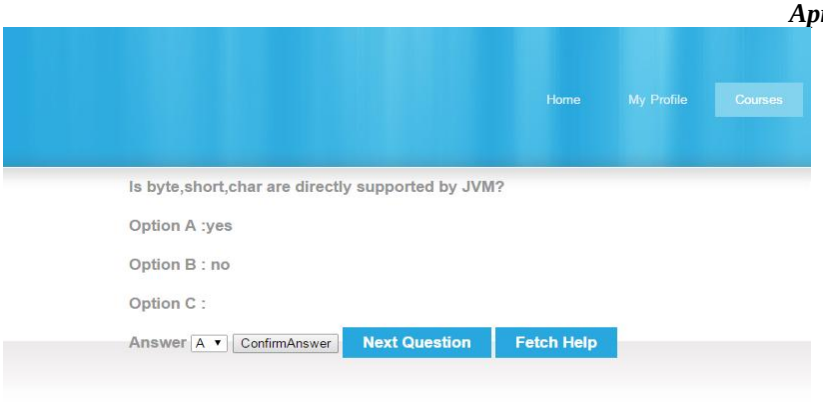
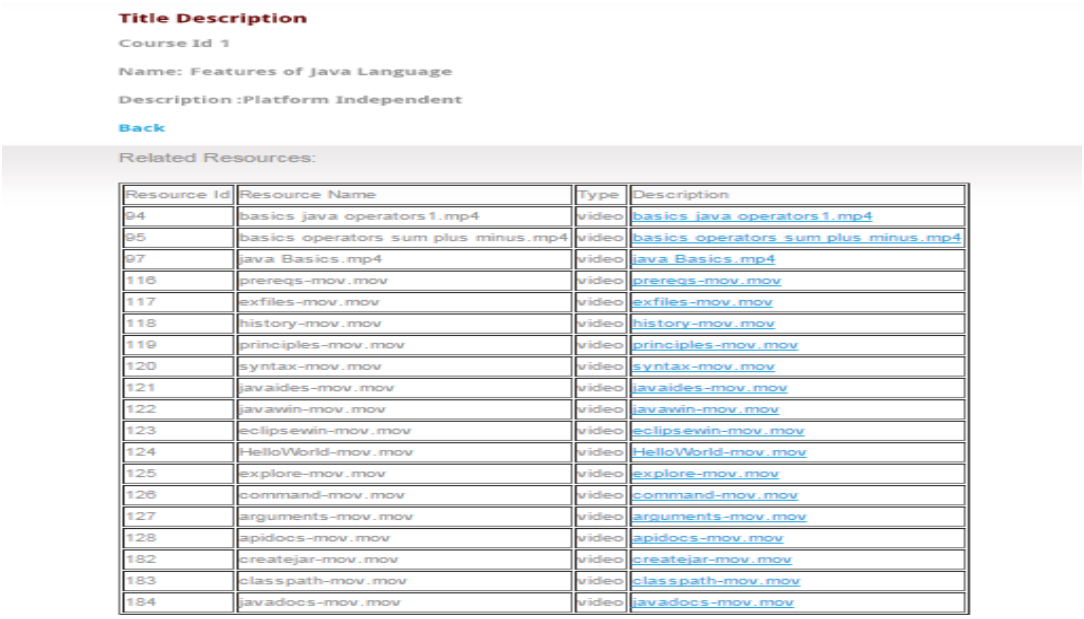


Figure 7 Exam module screen print



Resource Id	Resource Name	Type	Description
94	basics java operators1.mp4	video	basics java operators1.mp4
95	basics operators sum plus minus.mp4	video	basics operators sum plus minus.mp4
97	java Basics.mp4	video	java Basics.mp4
116	prereqs-mov.mov	video	prereqs-mov.mov
117	exfiles-mov.mov	video	exfiles-mov.mov
118	history-mov.mov	video	history-mov.mov
119	principles-mov.mov	video	principles-mov.mov
120	syntax-mov.mov	video	syntax-mov.mov
121	javaides-mov.mov	video	javaides-mov.mov
122	javawin-mov.mov	video	javawin-mov.mov
123	eclipsewin-mov.mov	video	eclipsewin-mov.mov
124	HelloWorld-mov.mov	video	HelloWorld-mov.mov
125	explore-mov.mov	video	explore-mov.mov
126	command-mov.mov	video	command-mov.mov
127	arguments-mov.mov	video	arguments-mov.mov
128	apidocs-mov.mov	video	apidocs-mov.mov
182	createjar-mov.mov	video	createjar-mov.mov
183	classpath-mov.mov	video	classpath-mov.mov
184	javadocs-mov.mov	video	javadocs-mov.mov

Figure 8 Resource consolidations – screen print

V. CONCLUSIONS

This research work describes about the implementation of the Learning management system for different learning groups which should enable the motivation for learning and the satisfaction towards learning. This is done by collecting various resources like audio, video, pdf, ppt, html and so on and presenting it to appropriate learning groups based on the likeliness. This work also describes about the various system parameters and their analysis and in future this system parameters could be optimized

Advantages

- Resources are represented in the form of Ontology which gives the metadata and the relationship between the resources
- Since outliers are eliminated in prior to clustering which could provide the efficient clustering approach
- Our System would increase the learning capacity of the learners
- Dynamic contents are presented in a very efficient way
- Learners would be very much interested to learn more using our systems
- Performance of the learners in the particular subject is increased and we will make a comparatively analysis with and without the system.

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