VIVEKANAND EDUCATION SOCIETY'S INSTITUTE OF TECHNOLOGY
Department of Computer Engineering

Project Report on

Adaptive E-learning System

In complete fulfillment of the Fourth Year, Bachelor of Engineering (B.E.) Degree in Computer Engineering at the University of Mumbai Academic Year 2017-2018

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(2017-18)

VIVEKANAND EDUCATION SOCIETY'S INSTITUTE OF TECHNOLOGY
Department of Computer Engineering

Certificate

This is to certify that ***Leena Chavan, Swapnali Ghumkar, Krishna Shahri, Ashish Mishra*** of Fourth Year Computer Engineering studying under the University of Mumbai have satisfactorily completed the project on "***ADAPTIVE E-LEARNING SYSTEM***" as a part of their coursework of PROJECT-II for Semester-VIII under the guidance of their mentor ***Mr. Richard Joseph*** in the year 2017-2018.

This thesis/dissertation/project report entitled ***Adaptive e-learning System*** by ***Leena Chavan, Swapnali Ghumkar, Krishna Shahri, Ashish Mishra*** is approved for the degree of ***Bachelor of Engineering in Computer Science***.

Programme Outcomes	Grade
PO1,PO2,PO3,PO4,PO5,PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2	

Date:

Project Guide: Internal and External

Report Approval
For
B. E (Computer Engineering)

This thesis/dissertation/project report entitled ***Adaptive E-learning System*** by ***Leena Chavan, Swapnali Ghumkar, Krishna Shahri, Ashish Mishra*** is approved for the degree of ***Bachelor of Engineering in Computer Science***.

Internal Examiner

External Examiner

Head of the Department

Principal

Date:
Place:

Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ACKNOWLEDGEMENT

We are thankful to our college Vivekanand Education Society's Institute of Technology for considering our project and extending help at all stages needed during our work of collecting information regarding the project.

It gives us immense pleasure to express our deep and sincere gratitude to Assistant Professor **Mr. Richard Joseph** (Project Guide) for his kind help and valuable advice during the development of project synopsis and for his guidance and suggestions.

We are deeply indebted to Head of the Computer Department **Dr.(Mrs.) Nupur Giri and** our Principal **Dr. (Mrs.) J.M. Nair,** for giving us this valuable opportunity to do this project.

We express our hearty thanks to them for their assistance without which it would have been difficult in finishing this project synopsis and project review successfully.

We convey our deep sense of gratitude to all teaching and non-teaching staff for their constant encouragement, support and selfless help throughout the project work. It is great pleasure to acknowledge the help and suggestion, which we received from the Department of Computer Engineering.

We wish to express our profound thanks to all those who helped us in gathering information about the project. Our families too have provided moral support and encouragement at several times.

Computer Engineering Department
COURSE OUTCOMES FOR B.E PROJECT

Learners will be able to,

Course Outcome	Description of the Course Outcome
CO1	Able to apply the relevant engineering concepts, knowledge and skills towards the project.
CO2	Able to identify, formulate and interpret the various relevant research papers and to determine the problem.
CO 3	Able to apply the engineering concepts towards designing solution for the problem.
CO4	Able to interpret the data and datasets to be utilized.
CO5	Able to create, select and apply appropriate technologies, techniques, resources and tools for the project.
CO6	Able to apply ethical, professional policies and principles towards societal, environmental, safety and cultural benefit.
CO7	Able to function effectively as an individual, and as a member of a team, allocating roles with clear lines of responsibility and accountability.
CO8	Able to write effective reports, design documents and make effective presentations.
CO9	Able to apply engineering and management principles to the project as a team member.
CO10	Able to apply the project domain knowledge to sharpen one's competency.
CO11	Able to develop professional, presentational, balanced and structured approach towards project development.
CO12	Able to adopt skills, languages, environment and platforms for creating innovative solutions for the project.

ABSTRACT

E-learning environments are being used more efficiently by the rapid growth in internet and multimedia technologies. Adaptive learning is a kind of learning environment which provides individual learning. It can customize the learning style according to the individual's personality and characteristics. Although there are a lot of e-learning systems having adaptive learning feature, they do not satisfy all adaptive learning aspects. Adaptive E-learning, refers to a training concept in which technology is introduced step by step in all aspects of the business of training. It is the newest paradigm in modern learning approaches. One of the key factors in such systems is the correct and continuous identification of the user learning style, such as to provide the most appropriate content presentation to each individual user.

We propose a recommender system for e-learning by utilizing a hybrid feedback method that extracts a user's preference and Web-browsing behavior. This system is capable of recommending learning content of potential interest to a user and also the likely Web-browsing action on the current item using a novel similarity measure approach. The recommender is adaptive to individual user's preference as well as one's changing interest in Web-based learning activity.

The system is able to deliver the learning objects composing a course either by following the organization defined in the course's manifesto, or by dynamically choosing the sequence in which the learning objects that compose a lesson should be delivered. The latter sequencing is done on the basis of the learner responses to tests.

TABLE OF CONTENTS

1. Introduction 1
- 1.1. Introduction 1
- 1.2. Motivation 1
- 1.3. Problem Definition 2
- 1.4. Relevance of the Project 3
- 1.5. Methodology used 3

2. Literature Survey 5
- 2.1. Research Papers 5
- 2.2. Papers or books 15
- 2.3. Patent search 17

3. Requirement 18
- 3.1. Functional Requirement 18
- 3.2. Non-Functional Requirement 18
- 3.3. Constraints 19
- 3.4. Hardware and Software Requirements 19
- 3.5. System Block Diagram 20

4. Proposed Design 21
- 4.1. System Design /Conceptual Design (Architectural) 21
- 4.2. Detailed Design 22
  - 4.2.1. Flowchart 22
  - 4.2.2. Use case Scenario 1 for user accessing courses 23
  - 4.2.3. Use case Scenario 2 for admin 23
- 4.3. Project Scheduling & Tracking using Timeline 24

5. Implementation 25
- 5.1. Implementation steps 25
- 5.2. Code 26

6. Testing 28

7. Result Analysis 29
- 7.1. Output Screenshots 29
- 7.2. Observation and Analysis 31

8. Conclusion 32
- 8.1. Limitations 32
- 8.2. Conclusion 33
- 8.3. Future Scope 33

References 34

Appendix 36

LIST OF FIGURES

Sr. No.	Title	Page no.
2.1.1	Relationship between learning activities and type	6
2.1.2	Recommender Architecture	7
2.1.3	Browser-action provider Architecture	8
2.1.4	Typical Browsing behavior	8
2.1.5	Conceptual Model	9
2.1.6	Psychology of learner and different abstraction of learning object	11
2.1.7	Intention of learner	12
2.1.8	Traditional and Socratic sequencing	14
3.5.1	System block diagram	20
4.1.1	System Architecture	21
4.2.1	Flowchart	22
4.2.2	Use case scenario 1	23
4.2.3	Use case scenario 2	23
4.3.1	Task in Gantt chart	24

CHAPTER 1: INTRODUCTION

1.1 Introduction

E-learning and distance education via the Internet is a means of current and promising teaching. However, it suffers from defects mainly related to the relative absence of the teacher and, therefore, the difficulty of adapting teaching to the level and behavior of the learner. Paper-based exams and traditional exams are often based on the Classical Test Theory which centers around statistical characteristics like reliability, validity and distinction and so of. But there are still shortcomings for CTT — it neglects the relationship between candidates' scores and difficulty of questions, i.e. the difficulty relative to the candidates. While, the Item Response Theory can stabilize questions' parameters freeing from the influence of tested samples. So, compared with CTT, IRT has the following advantages:

● More accurate estimation for questions' parameters.

● Comprehensive revolution to equivalence to tests.

● Definitions for such integrated quality index as information and function to be a more scientific criterion for selecting questions.

● More suitable for adaptive testing system.

If a system can correctly extract a user's intention from his/her Web-browsing behavior, when coupled with the user's personal preference, making good personalized recommendation is possible. User's evaluation feedback and browsing behavior are monitored to provide recommendation.

1.2 Motivation

The general purpose of educational platforms is to provide students with information as well as with practical opportunities in order to help learners to acquire certain skills and to increase their active knowledge about a studied topic. However, different learners may have different characteristics, prior knowledge, motivation or needs. This diversity commonly requires the presentation of different information to different learners in a different format. That is why it is very important to develop adaptive educational systems which consider various aspects of individual students and tailor the learning process to meet the actual learner's needs. The aim of this project is the presentation of an adaptive e-learning system based on learner knowledge and learning style. The research indicate that an adaptive e-learning system based on learner

knowledge and learning style has a higher level of perceived usability than a non-adaptive e-learning system. This may also increase the level of satisfaction, engagement and motivation of learners and therefore enhance their learning. The goal behind this project is to enrich the personalized support provided in online educational settings by taking into account the influence that emotions and personality have in the learning process. Following educational requirements for adaptive systems can be identified:

- Information should adapt to what a learner already knows or can do.
- Information should adapt to a learners' learning capabilities.
- Information should adapt to a learners' learning preferences or style.
- Information should adapt to a learners' performance level and knowledge state (i.e. system should provide feedback)

1.3 Problem Definition

E-learning environments are being used more efficiently by the rapid growth in internet and multimedia technologies. E-learning and distance education via the Internet is a means of current and promising teaching. However, it suffers from defects mainly related to the relative absence of the teacher and, therefore, the difficulty of adapting teaching to the level and behavior of the learner.

The platforms of distance education can be seen as learning systems which are used by three types of stakeholders (or actors): Teacher, learner and administrator. The teacher can put his courses online, add multimedia educational resources and supervise the activities of learners. The learner consults or downloads online courses, has a view of the evolution of his work and conducts exercises. Sometimes, he can contact a teacher or other learners via a forum. Concerning the administrator, he installs and maintains the system. Depending on the platforms, the administrator may have a more or less important role.

One of the major challenges of e-learning is learner autonomy. Learner autonomy refers to a learner's ability to set appropriate learning goals and take charge of his or her own learning. However, autonomous learners are dependent upon teachers to create and maintain learning environments that support the development of learner autonomy Adaptive e-learning will improve the use of platforms by offering courses tailored to the results, behavior's, tastes of learners, unconsciously.

1.4 Relevance of the Project

Adaptive learning technologies are potentially transformative in that they may be able to change the economics of tutoring. In an age of constrained budgets and overworked teachers, adaptive learning is bringing a spark back into the classroom and completely innovating the way education is approached.

● **Personalized Learning**. Personalization in teaching and learning happens best when content delivery, assessment, and mastery are "adapted" to meet student's' unique needs and abilities. Adaptive e-learning is the use of technology, which comes in the form of heavily automated digital learning platforms driven by predictive modeling, learning analytics.

● **It's Progressive**. One of the keys to any training is making sure that the trainee feels like they have advanced from the training. Adaptive learning can aid this by using technology to test how much was learnt in a training session or from training content. Quizzes and gamification can test someone's knowledge on the go with instant feedback as to how they've done. If they do well, they feel that they have learnt something and that they are making progress. Adaptive learning supports progression through offering extra content in a convenient way.

● **Improves understanding.** When teachers are standing in front of a classroom, it can be difficult to know whether the students really 'get it.' With adaptive learning, the method and pace of instruction is customized for each individual student, which could improve their chances of truly understanding new academic concepts.

● **Addressing Higher Ed's Greatest Pain Points.** Proponents are quick to claim that adaptive learning can break the "iron triangle" of cost, access, and quality, by substituting technology for labor and conversely allowing best in class pedagogy and analytics to improve the quality of education.

1.5 Methodology used

Adaptations in learning environment are based on well-organized models and processes. A large amount of information in adaptive e-Learning systems is needed to represent domain knowledge and to model the student learning behavior. This information can be divided into three main models: a domain model, a student model, and an adaptive model.

● **Domain Model**

A domain model contains information regarding the course and is built on a conceptual network of concepts. Every course contains an objective and description which describes the course concisely, the learning level at which the learner can learn the course and the intended audience

for the course. A chapter is comprised of many concepts. A concept essentially is a unit of knowledge which presents different types of learning objects which have many representations such as examples, exercises, questions etc. These representations are in the form of learning objects.

- **Learner Model**

It contains all student information, for example, their domain knowledge, behaviour, learning level, and other information. This model contains information about the learner, which is used to adapt the content. All the learner-related data (learner's' profile, including personal information, personality type and dominant personality type) are stored in this model. Customized content delivery to the learner on the basis of learner's personality type and the learning level chosen by the learner for a particular course is possible due to this model.

- **Adaptive Model**

An adaptive model incorporates the adaptive theory of an adaptive e-Learning system by combining the domain model with the learner model. The process of adaptive modelling starts with selecting representative nodes by analyzing the student needs from the learner model. Nodes can be classified into different types of knowledge: basic knowledge, including knowledge of definitions, formulas, and other matter; procedural knowledge, addressing relations among steps; and conceptual knowledge, referring to relations between concepts that draw details into a bigger picture. Each kind of knowledge requires different strategies, so nodes will be presented to learners in different fashions. The next step is to make a decision about which learning objects from which nodes should be represented, so that they can be used by learners until they are finished with that node. The last step is to repeat the process until each node is completely selected.

CHAPTER 2: LITERATURE SURVEY

2.1 Research papers

2.1.1 F. Trif, C. Lemnaru, R. Potolea, "Identifying the User Typology for Adaptive E Learning Systems", IEEE International Conference on Automation Quality and Testing Robotics (AQTR), 2010-

- **A. Abstract of the paper-** K-means clustering is used to understand the relativity between different learning types. The learning activities are grouped into clusters and then the clusters are mapped with the learning types. All different ways of learning types and activities have been understood will use them as a part in my proposed system. .This paper only gives the learning style suggested by one of the expert. There are many experts who have different ways to estimate the learning style. Here, clustering is used to know the users category. Others methods can give better results than clustering like DBSCAN or DBSCALE
- **B. Inference drawn**: In this paper, we came across I have come across 4 main types of learning types namely,

  Type 1 – Meaning directed style

  Type 2 – Reproduction directed style

  Type 3 – Application directed style

  Type 4 – Undirected style

Scales (Intermediate Attributes)	Types
Part A: Study activities	
Processing strategies	
Relating and structuring (ssdeep1)	I
Critical processing (ssdeep2)	I
Memorizing and rehearsing (ssstep1)	II
Analyzing (ssstep2)	II
Concrete processing (concrete)	III
Regulation strategies	
Self-regulation of learning process and results (ssselfr1)	I
Self-regulation of learning content (ssselfr2)	I
External regulation of learning process (ssexter1)	II
External regulation of learning results (ssexter2)	II
Lack of regulation (lackreg)	IV
Part B: Study motives and study views	
Learning orientations	
Personally interested (interest)	I
Certificate-oriented (certific)	II
Self-test oriented (selftest)	IV
Vocation oriented (vocation)	III
Ambivalent (ambivale)	IV
Mental models of knowledge	
Construction of knowledge (construc)	I
Intake of knowledge (intake)	II
Use of knowledge (use)	III
Stimulating education (stimed)	IV
Cooperative learning (cooper)	IV

Fig 2.1.1 Relation between learning activity and learning type

2.1.2 Kosuke Takano, Kin Fun Li, "An Adaptive e-Learning Recommender Based on User's Web-Browsing Behavior", IEEE International Conference on P2P, Parallel, Grid, Cloud and Internet Computing, 2010

A. Abstract of the paper- In this study, we propose a recommender system for e-learning by utilizing a hybrid feedback method that extracts a user's preference and Web-browsing behavior. This system is capable of recommending learning content of potential interest to a user and also the likely Web-browsing action on the current item using a novel similarity measure approach. The recommender is adaptive to individual user's preference as well as one's changing interest in Web-based learning activity.

B. Inference Drawn: In this paper, there are two types of feedbacks from the user, which helps in the detection of influential browsing behavior.

● Explicit Feedback: In explicit feedback, a user evaluates an item on the recommended list, by navigating to the linked page or giving it a score according to his/her preference. The recommender then associates the specific item with certain influential browsing behaviors.

● Implicit Feedback: In implicit feedback, our system suggests influential Web Browsing behaviors associated with a user's preferred item on the Web browser. This suggestion can be disabled if a user does not want to have it shown on the browser. If a user takes the suggested Web – browsing action, the system regards the content is associated with the user's frequent browsing behaviors. We call the browsing action taken as suggested, user's implicit feedback.

● Hybrid: Combination of both Implicit and Explicit.

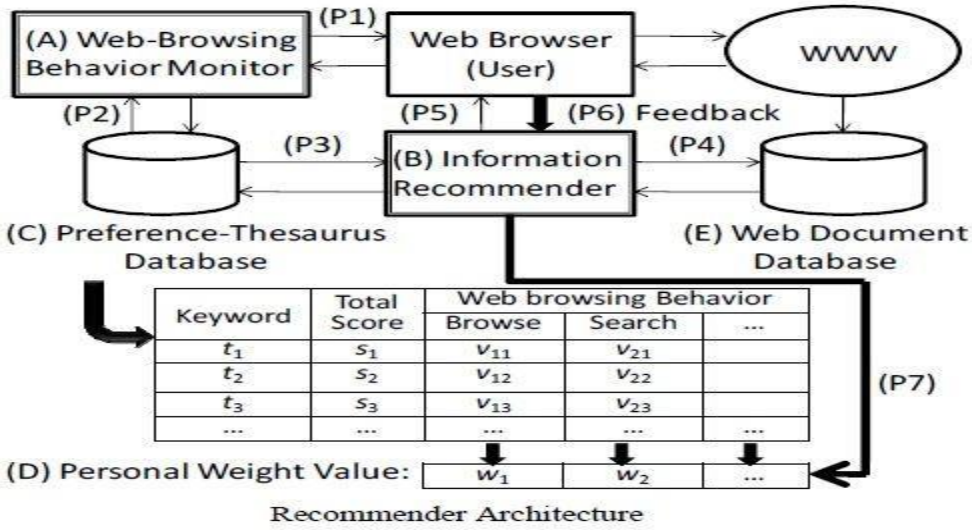
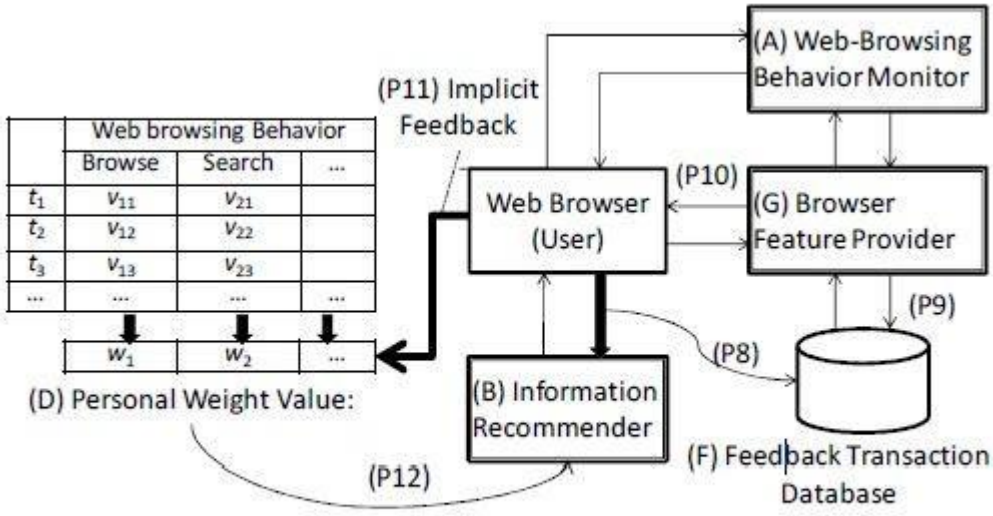


Fig 2.1.2 Recommender Architecture



Browser-Action Provider Architecture

Fig 2.1.3 Browser-Action Provider Architecture

TYPICAL WEB-BROWSING BEHAVIORS

ID	Web-browsing behavior	Term set to be extracted
I_1	Web pages browsed	Terms appeared on the Web pages
I_2	Terms on Web pages selected by mouse-click	Terms selected
I_3	Terms on Web pages copied onto the clipboard	Terms copied onto the clipboard
I_4	Keywords searched within Web pages	Search keywords
I_5	Web pages saved	Terms appeared on the saved Web pages
I_6	Web pages printed	Terms appeared on the Web pages printed
I_7	Web pages bookmarked	Terms appeared on the Web pages bookmarked
I_8	Search keywords input to the Web search engines	Search keywords input to the Web search engines
I_9	Web pages browsed from search results	Terms appeared on the returned Web pages browsed

Fig 2.1.4 Typical Browsing Behaviors

2.1.3. Deng Shaoling, "Using learning styles to Implementing Personalized e-learning System", IEEE International Conference on Management and Service Science (MASS), 2011

A. Abstract of the paper- Personalized e-learning implementation is recognized one of the most interesting research areas in the distance web-based education. Since the learning style of each learner is different we must to fit eLearning to the different needs of learners. This paper discusses teaching strategies matching with learner's personality using the Myers-Briggs Type Indicator (MBTI) tools. Based on an innovative approach, a framework for building an adaptive learning management system by considering learner's preference has been developed. The learner's profile is initialized according to the results obtained by the student in the index of learning styles questionnaire and then fine-tuned during the course of the interaction using the Bayesian model. Moreover, an experiment was conducted to evaluate the performance of our approach. The result reveals the system effectiveness for which it appears that the proposed approach may be promising.

B. Inference Drawn: Here are different Elements of Learning Object

- Visual: Instance to pictures or photographs, tables, graphs and flowcharts.
- Aural: Video recordings (visual and aural).
- Verbal: Video & Audio recordings, discussions and conversations.
- Physical : Learning by doing
- Social: Group work (activity) or Group studies.
- Solitary: Work Individually
- Logical: Graphs and flowcharts.

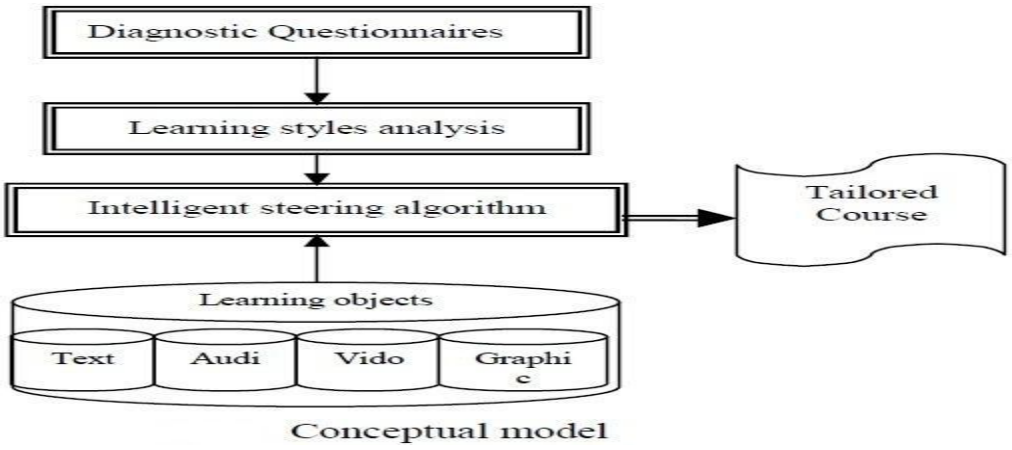
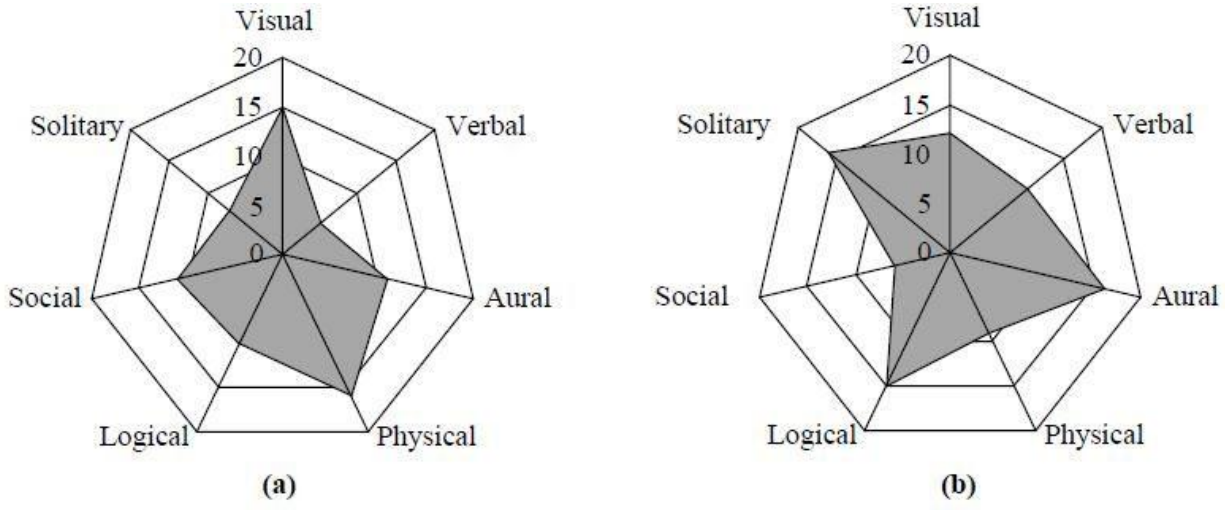


Fig 2.1.5 Conceptual Model

This paper consists of Elements of Learning Objects. These learning styles can be transferred on to the learning objects



Elements learning object consist of different percentages of different elements. We have understood the different elements and we feel that a learning object cannot consist of all the elements. These elements can guide us to know the preference of the user's browsing behavior. Tailored courses are easy to create if we know the user's preference, behavior and intention. For creating a tailored course background knowledge about the user is very important.

2.1.4. Manju Bhaskar, Minu M Das, Dr. T. Chithralekha, Dr. S. Sivasatya, "Genetic Algorithm Based Adaptive Learning Scheme Generation For Context Aware ELearning", Manju Bhaskar et. al. / (IJCSE) International Journal on Computer Science and Engineering Vol. 02, No. 04, 2010, 1271-1279

A. Abstract of the paper- Context aware e-learning system helps to provide elearning contents which are customized according to the learner's context. For generating context aware contents many adaptation parameters have to be considered. Customized learning path is one such adaptation parameter. In the existing e learning systems, learning paths is generated using several approaches. But in order to generate context aware contents, the profile context, infrastructure context, preference and learning context of learner have to be considered in addition the learning path. These context parameter values together constitute for the learning scheme of a learner. Hence learning path generation has to evolve into a learning scheme generation which accommodates the entire learner's context. There are no learning scheme generation algorithms

reported in the literature. In this paper a genetic algorithm based adaptive learning scheme for context aware e-learning has been described.

B. Inference Drawn: In this paper, we came across:

- The Psychology of the Learner
- The Intention of the Learner
- Different abstractions of Learning Object

Relation between Psychology of the Learner and Different abstractions of Learning Object

Relation between Intention of the Learner and Different abstractions of Learning Object

Comparative study of which algorithms and techniques support which of the learning styles, elements, etc.

Type of learner	Order of Abstraction
Extrovert	Concept, Demonstration, Case Study, Simulation, Example, Detailed Concept
Introvert	Concept, Detailed Concept, Example, Simulation, Case Study, Demonstration
Sensate	Concept, Case Study, Example, Simulations, Demonstration, Detailed concept
Intuitive	Concept, Detailed Concept, Demonstration, Simulation, Example, Case Study
Feeler	Concept, Case Study, Simulation, Demonstration, Example, Detailed Concept
Thinker	Concept, Detailed Concept, Example, Demonstration, Simulation, Case Study
Judger	Concept, Example, Case Study, Simulation, Demonstration, Detailed Concept
Perceiver	Concept, Detailed Concept, Demonstration, Simulation, Case Study, Example

Fig 2.1.6 Psychology of the Learner and Different abstractions of Learning Object

Intention	Abstractions of learning object
Research	Concept, Detailed Concept, Example, Case Study, Demonstration, Simulation
Survey	Detailed Concept, Example, Case Study
Interview	Concept, Example, Case Study
Seminar	Detailed Concept, Case Study, Demonstration, Example
Project	Detailed Concept, Case Study, Example, Simulation, Demonstration
Assignment	Detailed Concept, Example, Case Study
Basic Introduction	Concept, Example

Fig 2.1.7 Intention of the Learner and Different abstractions of Learning Object

2.1.5 Xiaoping Li, ZhenghongWang, XiaobingWu, Yinxiang Li, Hongjian Dong, "The Design of Adaptive Test Paper Composition Algorithm Based on the Item Response Theory", 6th IEEE Joint International Conference on Information Technology and Artificial Intelligence Conference (ITAIC), 2011.

A. Abstract of the paper- The design of adaptive test paper composition algorithm based on the item response theory is proposed and the ultimate goal of adaptive test is to measure the candidate's' potential accurately. According to the item response theory, candidates' testing behavior is the reflection of their potential language ability and a potential of a candidate can be estimated directly by his/her item response together with a particular item response model .

B. Inference Drawn: In this paper, we came across Classical Test Theory and Item Response Theory. The biggest advantage of Item Response Theory is that the estimations of item parameters have nothing to do with the sample being tested. It speculates the candidate's' ability through characteristic function of the question, combining the answer of the candidates. The characteristic function can be divided into one-parameter, two-parameter and three-parameter by the number of parameters in the

Item Response Logistic model:

One-parameter: $$P(\theta) = \frac{1}{1+e^{-D(\theta-b)}}$$

Two-parameter: $$P(\theta) = \frac{1}{1+e^{-Da(\theta-b)}}$$

Three-parameter: $$P(\theta) = c + (1-c)\frac{1}{1+e^{-Da(\theta-b)}}$$

In the formula above, D=1.702 is constant of scale factor ; θ is the ability value of the candidate; P(θ) is the probability of one whose ability value is θ answering the question correctly ; a is the distinction of a question ,i.e. the slope of characteristic curve , the larger the value of whom ,the larger the distinction of the question on candidates ; b is the difficulty of a question, i.e. the projection on the X axis of characteristic curve ; c is the guessing coefficient of the question , i.e. the intercept of the characteristic curve ,and it shows that however the ability of the candidates ,it is easy to guess the question correctly when the value is larger .

In this paper the main four problems are discussed: Entry Level Item Selection Ability Estimate Termination. In this paper, we have understood IRT and how learner's ability can be taken into consideration for adaptive e-learning. Here the difficulty of the question and distinction of the question are also important factors. The guessing coefficient is also taken into consideration which helps the system to understand the seriousness of the test given by the user.

2.1.6 Rafael Morales and Ana Silvia Agüera, "Dynamic Sequencing of Learning Objects", IEEE 2002.

A. Abstract of the paper- This paper describes a prototype of a learning management system we have developed following the Sharable Content Object Reference Model (SCORM) by the Advanced Distributed Learning Initiative. The system is able to deliver the learning objects composing a course either by following the organization defined in the course's manifesto, or by dynamically choosing the sequence in which the learning objects that compose a lesson should be delivered. The latter sequencing is done on the basis of the learner responses to tests. Some problems in the way of transforming dynamic sequencing into intelligent sequencing of learning objects are discussed.

B. Inference drawn- In this paper, we have come across two types of dynamic sequencing of learning objects.

- Traditional Sequencing
- Socratic Sequencing

We have learned the sequencing of learning objects and feel that it can also be implemented on Elements of Learning object. This sequencing can be done with the help of the bayesian predictor which totally depends on the history of use. Changing the sequence after every test is not worth and hence the system should wait and understand the behavior of the user for some iteration. The browsing behavior can be of a large help in such a case.

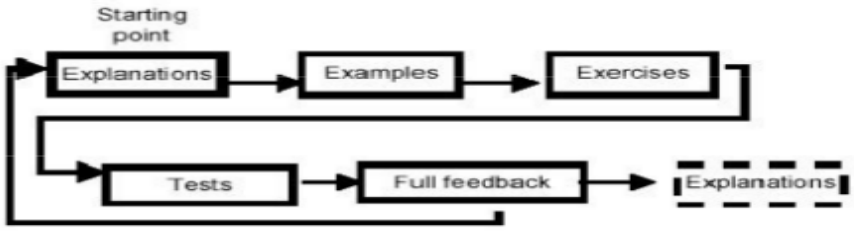


Fig 4.6.1: Traditional Sequencing

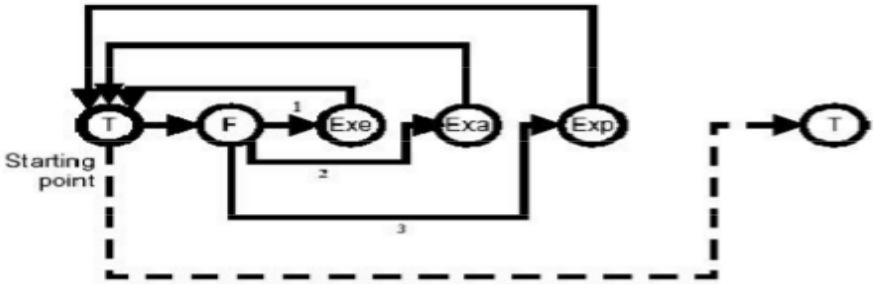


Fig 4.6.2: Socrating Sequencing

Fig 2.1.8 Traditional and Socratic Sequencing

2.1.7 Design an active e-learning system

Abstract- Active learning provides a powerful mechanism to enhance depth of learning and get learners involved with learning process instead of passively participate in it. And e-learning get popular with the advances of the Internet. The objective of this paper is to design a kind of active e -learning system. In this paper, the design basis including students' requirements, related experiences and system design engineering are analyzed firstly. And then, we proposed the workflow of the system and designed the function modules of the active e-learning system. The designs focus on students' activeness and include most active learning function or tools. To test the system effect, we conducted a beginning application in e-commerce course. Related data proved this kind of active e-learning system is welcomed

Inference drawn- In this paper, the design basis including students' requirements, related experiences and system design engineering are analyzed firstly. And then, we propose the workflow of the system and designed the function modules of the active e-learning system.

2.1.8 Senthil V Kumaran and A Sankar. Article: Recommendation System for Adaptive E-learning using Semantic Net International Journal of Computer Applications

63(7):19-24, February 2013.

Abstract of the paper -In the e-learning system an abundant amount of information is created and delivered to the learners over electronic media. Learners are often getting confusion by the flow of information and have difficulty in selecting the topic to learn that satisfies their needs and interests. There are several researches have been performed to provide personalized learning paths for individual learners. But many of them collect the learners' interest, habits and behavior from their profile and based on that they recommend learning path. It is the fact that the learners' interest, learning attitude and need will vary from time to time and course to course. In this paper a recommendation system is proposed using semantic net that helps the learners by offering a more intelligent approach to navigating and searching course content. In this the learner will get more personalized and contextual recommendation. The results show that semantic net based methods enable interoperability of heterogeneous course content representation and result in accurate recommendations. The validity of the proposed model is shown using sample learners and performance measures for the recommendation effects are given for evaluating the proposed system.

Inference drawn- In this paper a recommendation system is proposed using semantic net that helps the learners by offering a more intelligent approach to navigating and searching course content. In this the learner will get more personalized and contextual recommendation. The results show that semantic net based methods enable interoperability of heterogeneous course content representation and result in accurate recommendation

2.2 Books/Articles referred/ newspaper referred:

We have referred to the following websites and books to gather information related to our system:

1. https://elearningindustry.com/adapting-to-adaptive-learning

Inference drawn:

Adaptive Learning features can be incorporated at various levels of content organization. Four levels have been proposed in this discussion: Learning Object, Sequence, Course, and set of Courses. In general, only the first two levels are suitable for building Adaptive Learning features

so, they are available on every Learning Management System platform. Higher levels of adaptivity require a close relation between the tool used to create the content and the Learning Management System to deliver it to the users. As for the learning materials, counting and analysis of Mistakes (the cumulative number of errors) has been proposed to build Adaptive Learning algorithms as the measure of students' performance as it is useful both in terms of the retrieval practice and metacognition.

It is also clear that the Adaptive Learning content preparation requires more effort than traditional single-track content, since more content has to be developed to cover every track yet only a portion of it will be used by an individual student. Unfortunately, there is no mystical algorithm will remove this requirement! Choosing the right authoring tool is crucial as its capability, functionality, and usability determine whether Adaptive Learning content can be built by authors and editorial staff or whether the development process has to be outsourced to software programmers.

2. http://www.sciencedirect.com/science/article/pii/S1877042810006816

Inference drawn:

One likely reason for the lack of success is that just placing lecture notes on the internet does not train. This situation can be improved through the use of training software such as Intelligent Tutoring Systems (ITS). ITS incorporate built-in expert systems in order to monitor the performance of a learner and to personalize instruction on the basis of adaptation to learners' learning style, current knowledge level, and appropriate teaching strategies in e-Learning systems. While Adaptive Hypermedia systems (AH) do provide instruction in skills, it is generally less advanced than comparable ITS instruction. E-learning systems are web-based learning so that learners can access online courses via Internet without adaptation based on Learner's' behavior. Therefore, it is a challenge to make e-Learning systems to be more "adaptive". Both ITS and AH are normally used for computer-based instruction. However, adaptive hypermedia is better suited for the instruction of concepts whereas intelligent tutoring system generally assists in the use of these concepts to solve problems. Therefore, a general instruction system requires both of these instructional approaches in order to provide a full learning environment. In this paper, describes a conceptual for combining ITS and AH into Adaptive Intelligent Tutoring System (AITS) for e-learning systems that allows knowledge to be stored in such a way that is not only independent of the knowledge domain, but also supports the storage of transfer knowledge relationships and prerequisite knowledge relationships. The

conceptual results show that this innovative approach is helpful to the learners in improving their learning achievements.

2.3 Patent search

System and method for adaptive learning-An adaptive learning system and method ("ALS") for optimized, automated learning is disclosed. The optimal sequencing method is adaptive in the sense that it continuously monitors a student's speed and accuracy of response in answering a series of questions, performing a series of classification tasks, or performing a series of procedures, and modifies the sequencing of the items presented as a function of these variables. One goal of the technique is to teach the subject matter in the shortest possible time. The optimal sequencing method may be used independently or in conjunction with disclosed perceptual learning and hunting methods.

Method and apparatus for generating a data classification model using interactive adaptive learning algorithms- A data classification method and apparatus are disclosed for labeling unknown objects. The disclosed data classification system employs a learning algorithm that adapts through experience. The present invention classifies objects in domain datasets using data classification models having a corresponding bias and evaluates the performance of the data classification. The performance values for each domain dataset and corresponding model bias are processed to identify or modify one or more rules of experience. The rules of experience are subsequently used to generate a model for data classification. Each rule of experience specifies one or more characteristics for a domain dataset and a corresponding bias that should be utilized for a data classification model if the rule is satisfied. The present invention dynamically modifies the assumptions (bias) of the learning algorithm to improve the assumptions embodied in the generated models and thereby improve the quality of the data classification and regression systems that employ such models. A dynamic bias may be employed in the meta-learning algorithm by utilizing two self-adaptive learning algorithms. In a first function, each self-adaptive learning algorithm generates models used for data classification. In a second function, each self-adaptive learning algorithm serves as an adaptive meta-learner for the other adaptive learning algorithm.

CHAPTER 3: REQUIREMENTS

3.1 Functional Requirements

Functional requirements may be calculations, technical details, data manipulation and processing and other specific functionality that define what a system is supposed to accomplish. Behavioral requirements describing all the cases where the system uses the functional requirements are captured in use cases. Generally, functional requirements are expressed in the form "system must do requirement". The plan for implementing functional requirements is detailed in the system design.

● Upload and organize elements

● System should be able to upload video files, image files, HTML files presentation slides specified by user. Then user should be able to organize these files over the timeline and associate them with time and create cue points. It should then convert these media elements into compatible format.

● Learners should not have to wait unduly long for loading learning materials.

● The system should support collaborative learning and ensure a good match between collaborative groups.

● The system should provide learners an accessible and available communication tools.

● The system needs to support the accessibility to learning materials in different contexts.

● Learners should have learning materials that fit their learning styles.

● The system should learn and analyze the user's behavior.

3.2 Non-Functional Requirements

In systems engineering and requirements engineering, a non-functional requirement is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviors. This should be contrasted with functional requirements that define specific behavior or functions. The plan for implementing non-functional requirements is detailed in the system architecture. On-functional requirements define how a system is supposed to be. Functional requirements are usually in the form of "system shall do ".

3.2.1 Performance Requirement

The application must be on very high standard servers to accommodate the huge amount of data and requests for access to the server from a large number of users at the same time.

3.2.2 Safety Requirement

The database of the application must be located in a special secure server and must be backups to other servers directly at specific times to avoid loss and damage data.

3.2.3 Usability Requirement

In the application, the user interface must be familiar to user, so that the user can easily do his tasks without any training or help.

3.2.4 Availability Requirement

The application should be available at all times, meaning the user can access it using a device application.

3.3 Constraints

- User knowledge about the computer is needed.
- Internet connection is required for using this application.
- The application is not fully accurate.

3.4 Hardware & Software Requirements

3.4.1 Hardware Requirements

PROCESSOR	PENTIUM
RAM	128MB
HARD DISK	20GB

3.4.1 Software Requirements

OPERATING SYSTEM	LINUX, WINDOWS
LANGUAGE	HTML, CSS, PHP
DATABASE SERVER	XAMPP

3.5 System Block Diagram

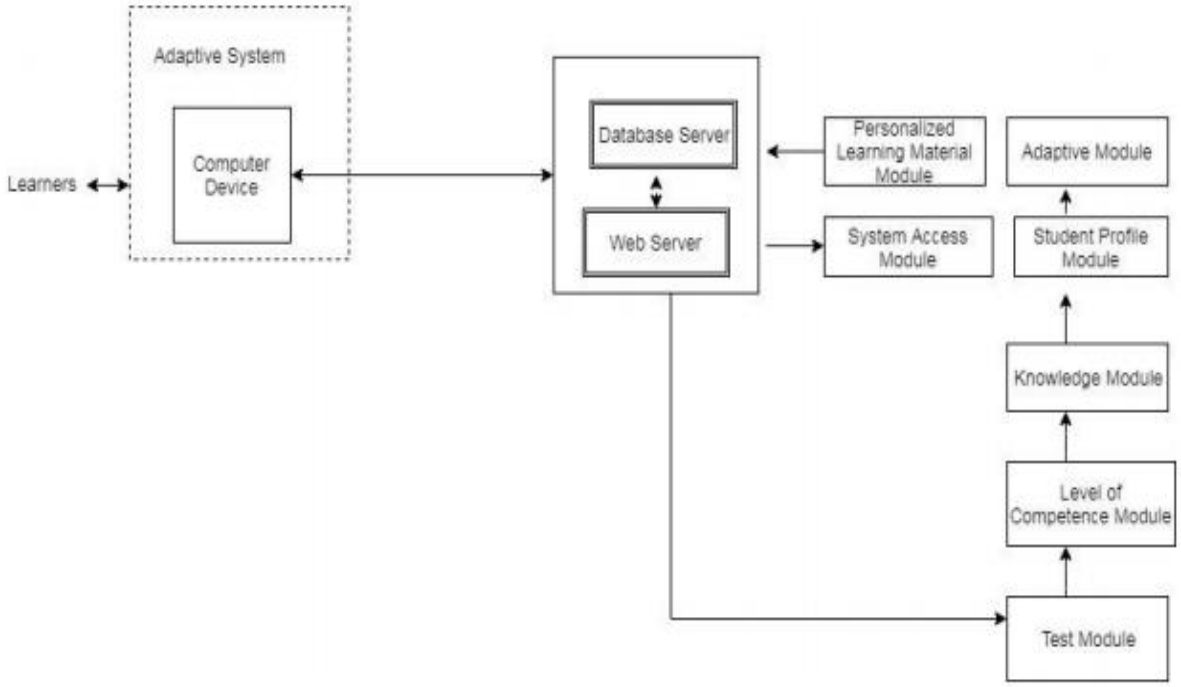


Fig 3.5.1: System block diagram for adaptive eLearning

CHAPTER 4: PROPOSED DESIGN

4.1 System Design / Conceptual Design (Architectural)

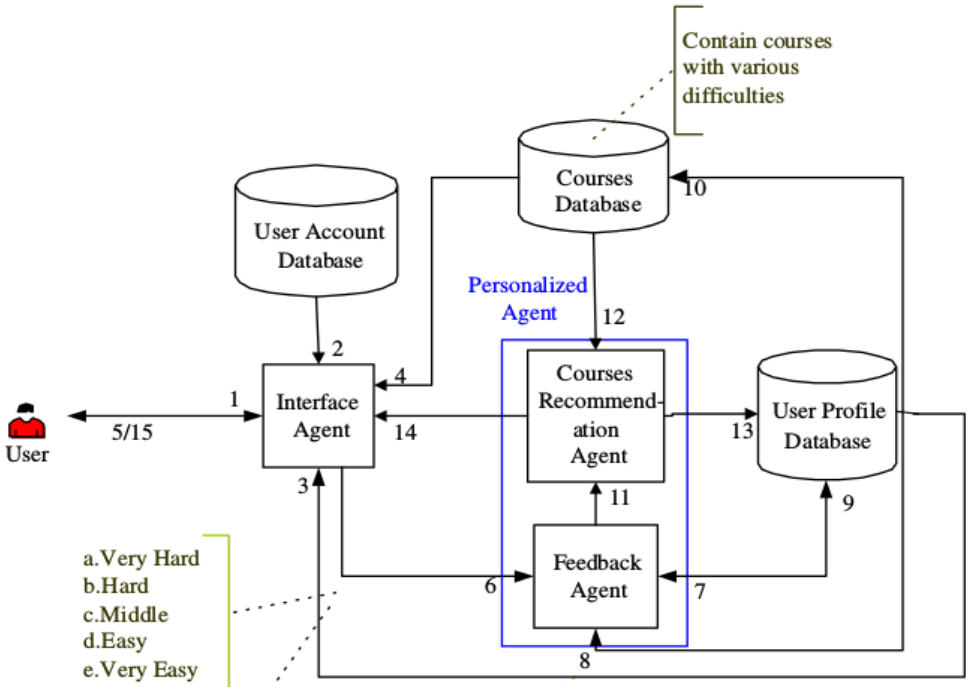


Fig 4.1.1: System Architectural diagram for Adaptive E-Learning

4.2 Detailed Design

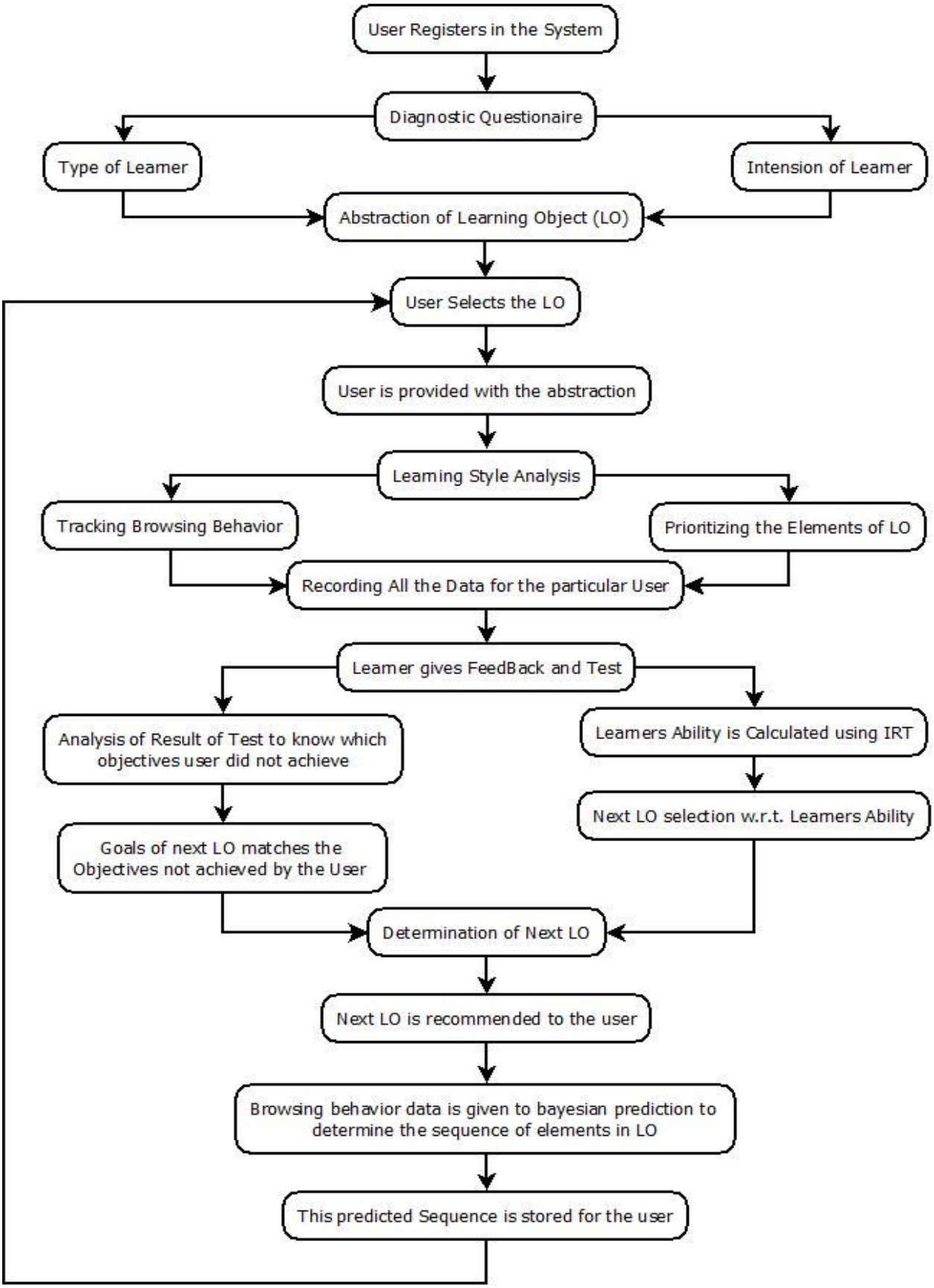


Fig 4.2.1: Flowchart for Adaptive E-Learning system

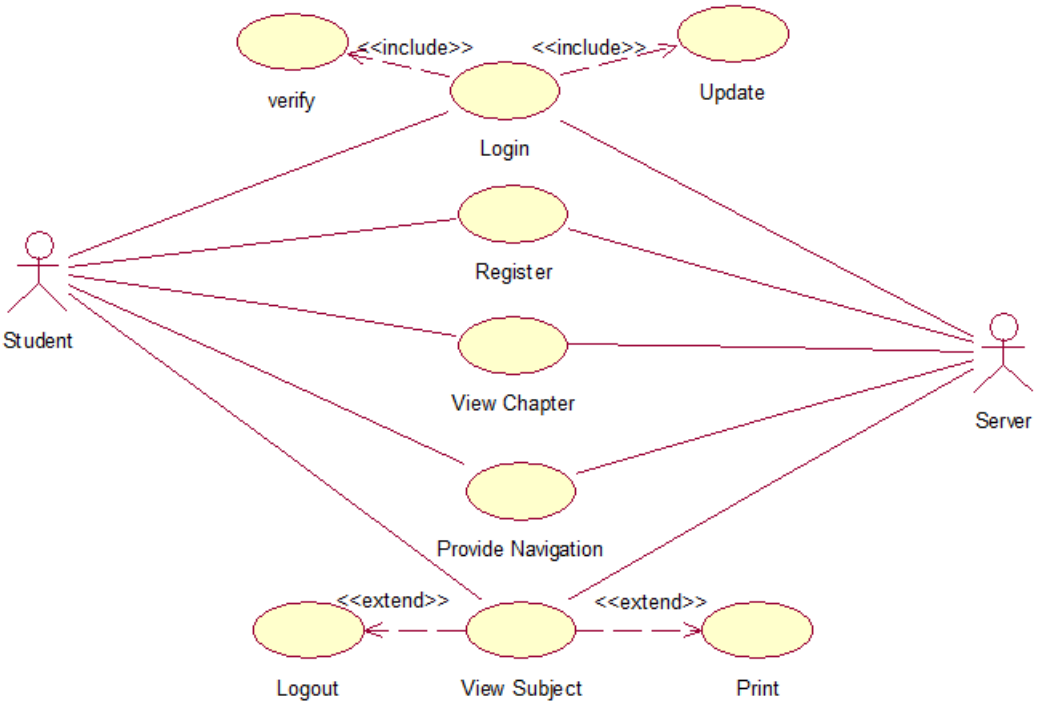


Fig 4.2.2: Use case Scenario 1 for student accessing courses

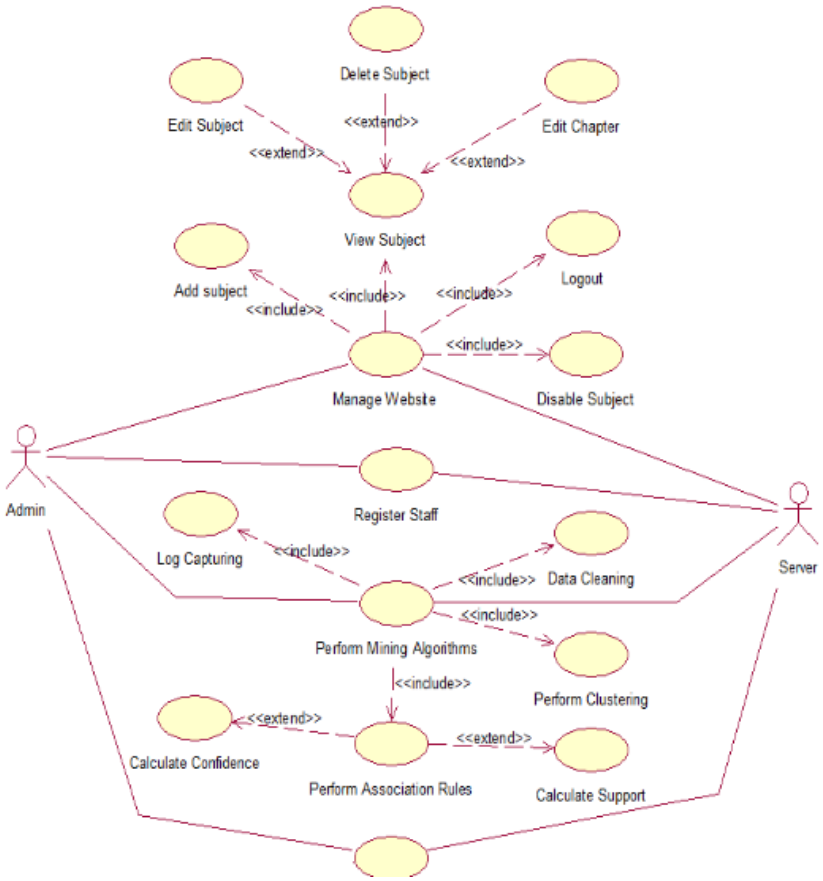


Fig 4.2.3: Use case Scenario 2 for admin

4.3. Project Scheduling (Gantt Chart)

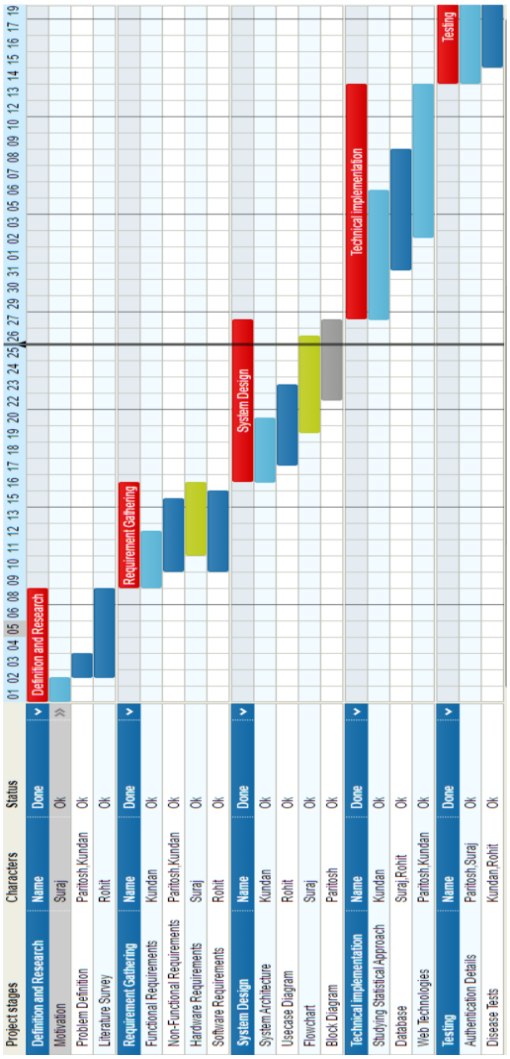


Fig 4.3.1: Task in Gantt Chart and Timeline

CHAPTER 5: IMPLEMENTATION

5.1 Implementation steps

1. Learner registers himself into the system.

2. The next step the learner is presented with is a questionnaire, so that the system can understand the learner.

    a. Type of the Learner is known, with the help of the questionnaire.

    b. Intention of the learner is known. Intention can be different in every case.

3. The abstraction of learning object (LO) is known with the help of step 2.

4. Learner then browses for what he needs and selects the LO.

5. Learner is provided with the abstraction with the help of data collected in step 2.

6. Learning Style Analysis takes place for the learner as he starts with the selected LO.

7. All the data for the particular learner is recorded for his profile.

8. Now when the learner finishes with the LO, he has to go through a test and a feedback session. The test is based on the LO that he studied and the feedback is about the system. The test results obtained are used for two important criteria's:

    a. To understand where the LO and the learner lacked in attaining the objectives.

    b. To understand the Learners Ability.

9. The next LO is selected by the system by taking both the criteria into consideration.

10. The selected LO is recommended to the learner.

11. Now the data of the browsing behavior of the learner from the step 6, is given to the Bayesian predictor to generate a sequence of the elements of LO that suits the learner's behavior.

12. The predicted sequence is stored for the user in his profile and produced at the time when the learner selects the next LO recommended to him by the system.

5.2 Code

IRT:

```
"""
"""
# Input data from json convert to list
theta = [1,2,3,4]
r = [2,1,0,2]
f = [2,2,2,2]

# cont = [{'id': '1', 'uid': '5', 'topic': 'BFS', 'q1': '1', 'q2': '1', 'q3': '1', 'q4': '1', 'q5': 2, 'q6': 2, 'q7': 2,
'q8': 2}]
# r = []
# x = list(cont[0].values())
# for i in range(3,7):
#    d = int(x[i])
#    print(d)
#    r.append(d)
# print(r)
# t = []
# for i in range(7,11):
#    d = x[i]
#    print(d)
#    t.append(d)
# print(t)
# Calculating Difficulty

dif_q1 = r[0]/f[0]
print(dif_q1)
dif_q2 = r[1]/f[2]
print(dif_q2)
dif_q3 = r[2]/f[2]
print(dif_q3)
dif_q4 = r[3]/f[3]
print(dif_q4)
d = [dif_q1,dif_q2,dif_q3,dif_q4]
print(d)
# Calculating Discrimination
# x =[]
# u1 = [1,1,1,1]
# u2 = [1,0,1,0]
# a = u1[0]
# b = u2[0]
# x.append(a)
# x.append(b)
# print(len(x))
# Input data from json fil
r = [2,1,0,2]
```

```
u1 = r
print(u1)
f = [2,2,2,2]
u2 = f
print(u2)
import numpy as np
i=1
a = []
for i in range(4):
    upper = u1[i]
    lower = u2[i]
    p = (upper - lower)/1
    a.append(p)

print(a)
l = 0
k = 0
O = 1
q1 = []
for j in range(15):
    for i in range(4):
        O = 1/(1+2.71**-(a[i]*(O-d[i])))
        print(O)
        l += a[i]*(u1[i]-O)
        k += (a[i]**2)*(O)*(1-O)
        if(k!=0):
            Oi = O + (l/k)
        else:
            Oi = O
    if(O<0.001):
        break
    q1.append(Oi)
print(l)
print(k)
print(O)
print(q1)
print(Oi)
O = 1
q2 = []
for i in range(4):
    O = 1/(1+2.71**-(d[i]*(O-a[i])))
    l = d[i]*(u2[i]-O)
    k = (d[i]**2)*(O)*(1-O)
    if(k!=0):
        Oi = O + (l/k)
    else:
        Oi = O
    q2.append(Oi)

print(Oi)
```

CHAPTER 6: TESTING

6.1 Testing

Software testing is an investigation conducted to provide stakeholders with information about the quality of products or services under test. Software testing can also provide an objective, independent view of the software to allow the business to appreciate and understand the risks of software implementation. Test techniques include the process of executing a program or application with the intent of finding software bugs, errors or other defects.

6.1.1 Test Case ID: 01

Test Case Description: To check student authentication using valid username and password.

Modules to be tested: Login.

Expected Result: If fields are left empty a message “Please fill out this field” is displayed.

If incorrect value is submitted a message “Incorrect input” is shown.

Actual Result: PASS

6.1.2 Test Case ID: 02

Test Case Description: To check whether admin is able to manage the users.

Modules to be tested: Admin module.

Expected Result: The admin is able to add and delete the users successfully.

Actual Result: PASS

6.1.3 Test Case ID: 03

Test Case Description: To check questionnaire module works properly.

Modules to be tested: Questionnaire

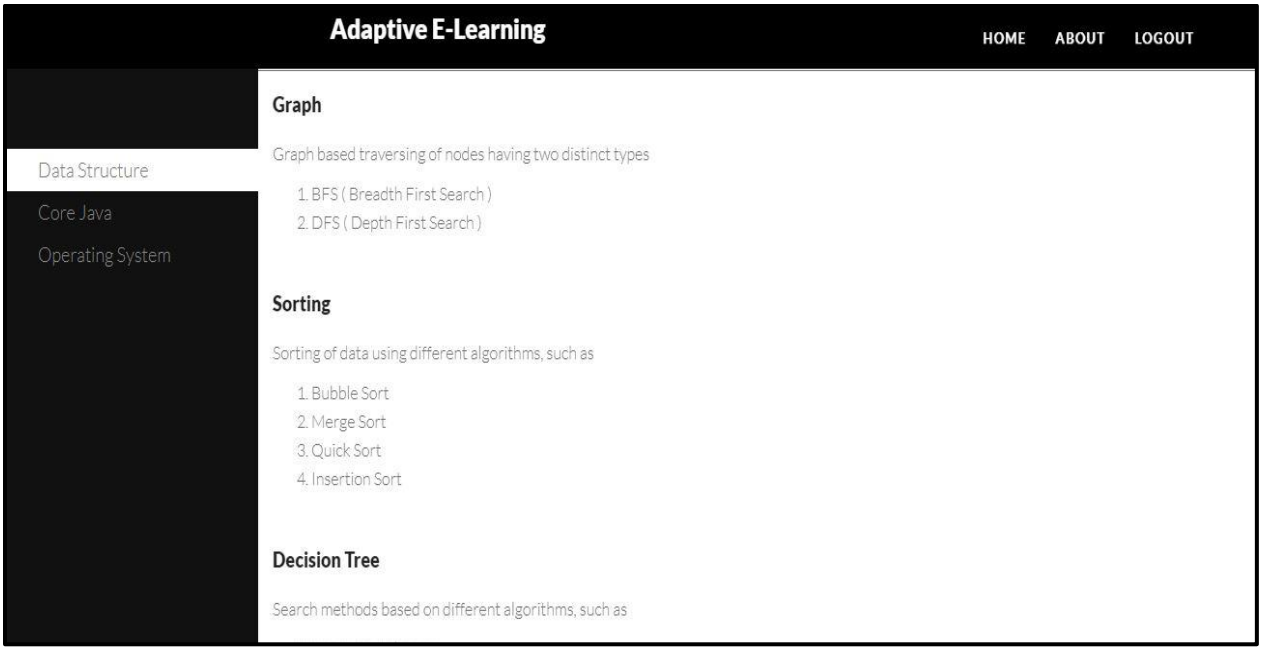
Expected Result: If all fields are answered correctly, then person's personality is judged.

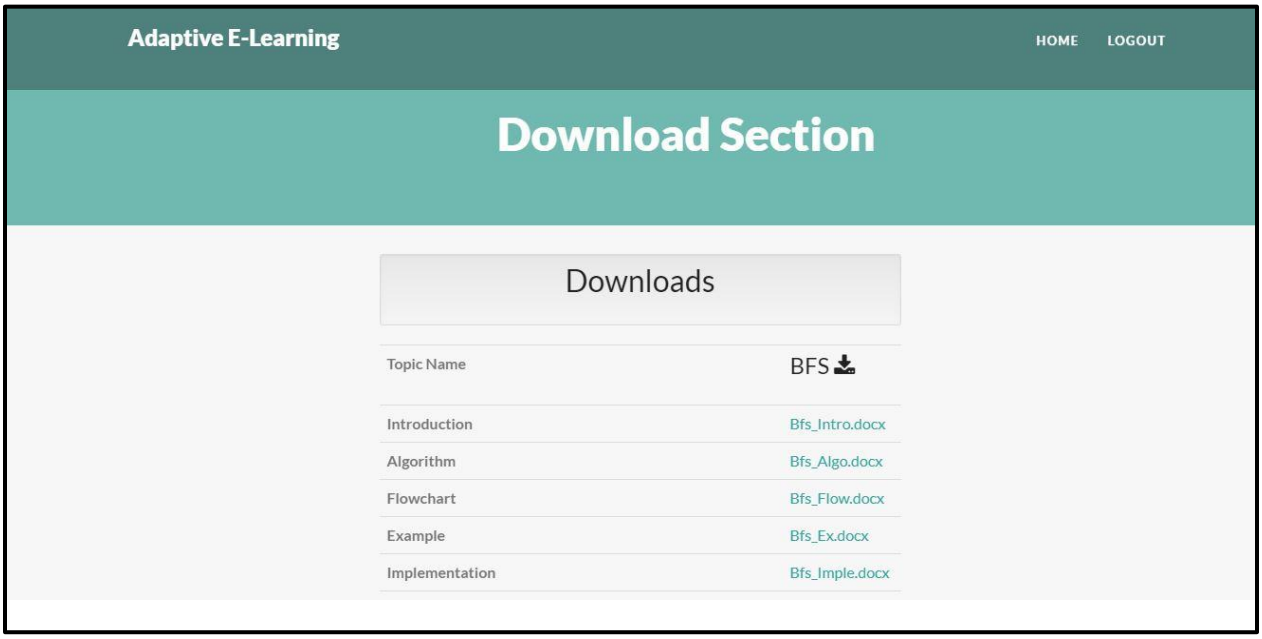
Actual Result: PASS

CHAPTER 7: RESULT ANALYSIS

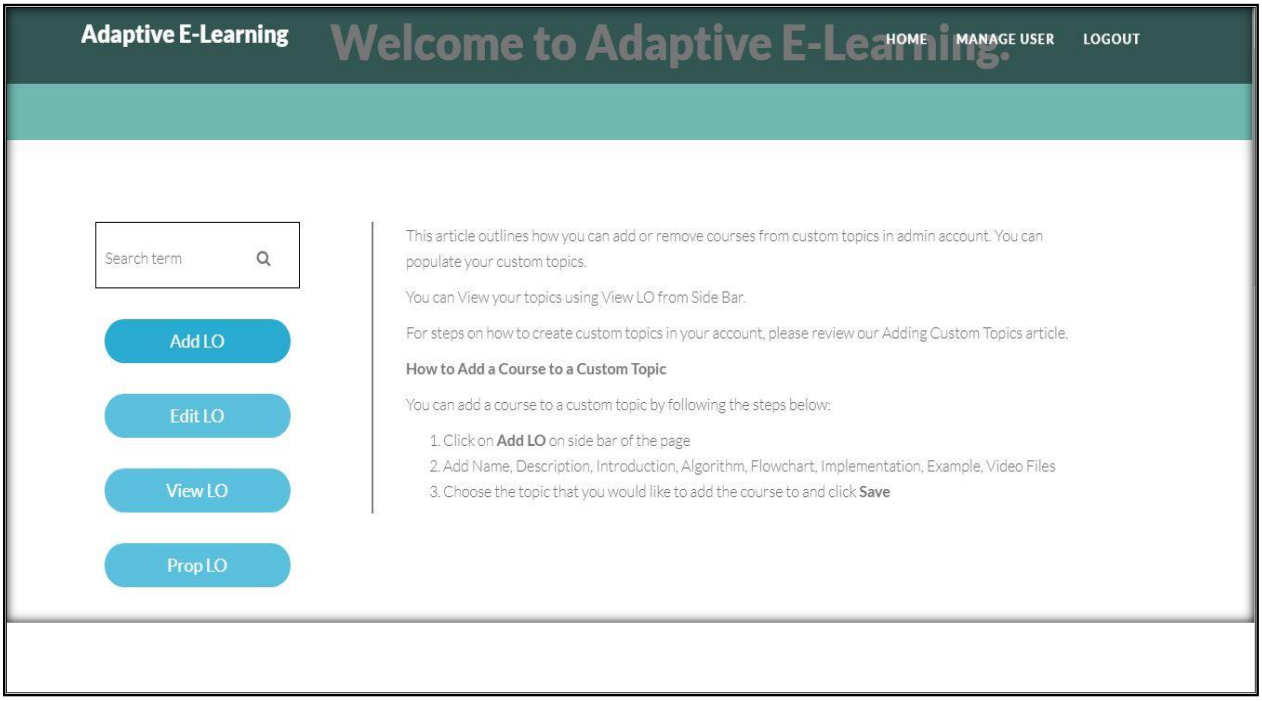
7.1 Output Printouts

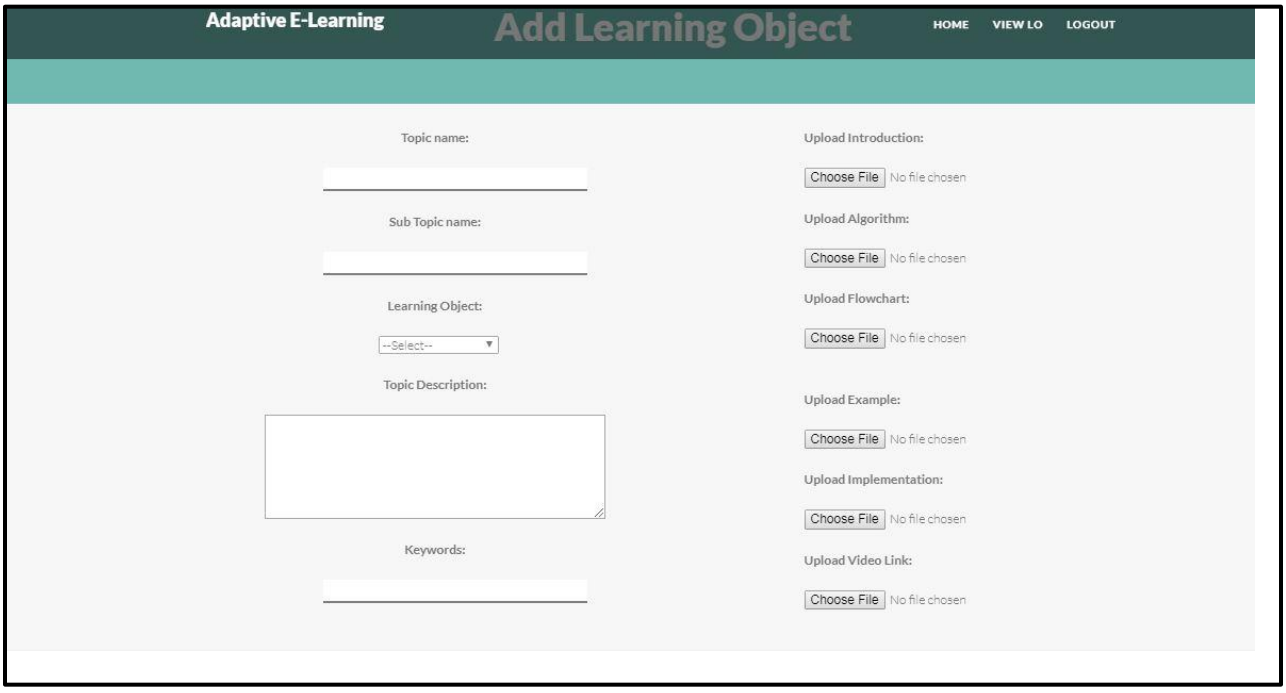
User:

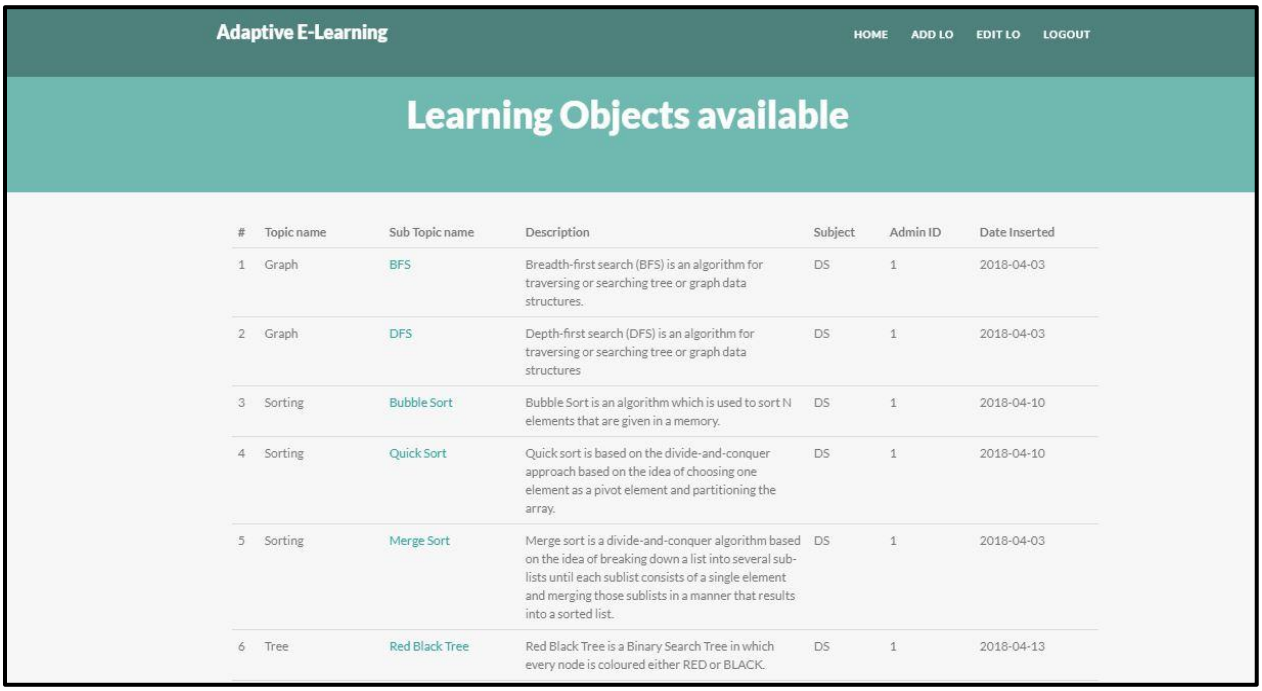




Admin:


Adaptive E-Learning
Welcome to Adaptive E-Learning.
HOME
MANAGE USER
LOGOUT
Search term
Add LO
Edit LO
View LO
Prop LO
This article outlines how you can add or remove courses from custom topics in admin account. You can populate your custom topics.
You can View your topics using View LO from Side Bar.
For steps on how to create custom topics in your account, please review our Adding Custom Topics article.
How to Add a Course to a Custom Topic
You can add a course to a custom topic by following the steps below:
1. Click on Add LO on side bar of the page
2. Add Name, Description, Introduction, Algorithm, Flowchart, Implementation, Example, Video Files
3. Choose the topic that you would like to add the course to and click Save


Adaptive E-Learning
Add Learning Object
HOME
VIEW LO
LOGOUT
Topic name:
Sub Topic name:
Learning Object:
--Select--
Topic Description:
Keywords:
Upload Introduction:
Choose File No file chosen
Upload Algorithm:
Choose File No file chosen
Upload Flowchart:
Choose File No file chosen
Upload Example:
Choose File No file chosen
Upload Implementation:
Choose File No file chosen
Upload Video Link:
Choose File No file chosen



7.2 Observations & Analysis

- Type of user is obtained through questionnaire.
- Based on type of learner and his intention abstraction of Learning Object is provided.
- User attempts the quiz.
- Based upon the quiz learning ability is calculated and next leaning object is recommended.

CHAPTER 8: CONCLUSION

8.1 Limitations

- Although the ideas behind the adaptive learning systems are dreams of all educators, the implementation of these ideas is really difficult. While the idea “adaptation based on individual differences” sounds good, it may cause problems if these differences and appropriate methods/materials to pertain these differences are not identified correctly.
- The system has to identify the differences such as background, prior knowledge about the content, learning style and offers a learning environment to suit these differences. If the systems are not carefully designed, it will not bring advantages only cause problems.

8.2 Conclusion

Item Response Theory	Ant Colony Optimization
Input to the system is the result of the test or feedback given by the learner in the last iteration.	A history of actual fact is given as the input to the system.
It is not time consuming as it only depends on test result of last iteration and so the computation is less.	It is time consuming as it depends on the history of facts and so it needs heavy computation.
Learner’s ability is taken into consideration.	Learner’s ability is not taken into consideration but it can be calculated but after many iterations.
Precision less than ACO	More precision as the data is collected over time.

This proposed system will take user’s nature, preference, browsing behavior and intention into consideration. Hence this system will be adaptive in nature with almost all aspects.

8.3 Future Scope

- Support of 100% knowledge acquisition in application fields such as aviation, traffic, different complex procedures, risk management, decision support, research on learning, and others.
- Improvement of content structuring, development of user-centered contents and of contents supporting various learning styles like verbal, physical, logical, social and solitary.
- Development of low cost eye-tracking systems, which are possible to apply in a standard computer working place.

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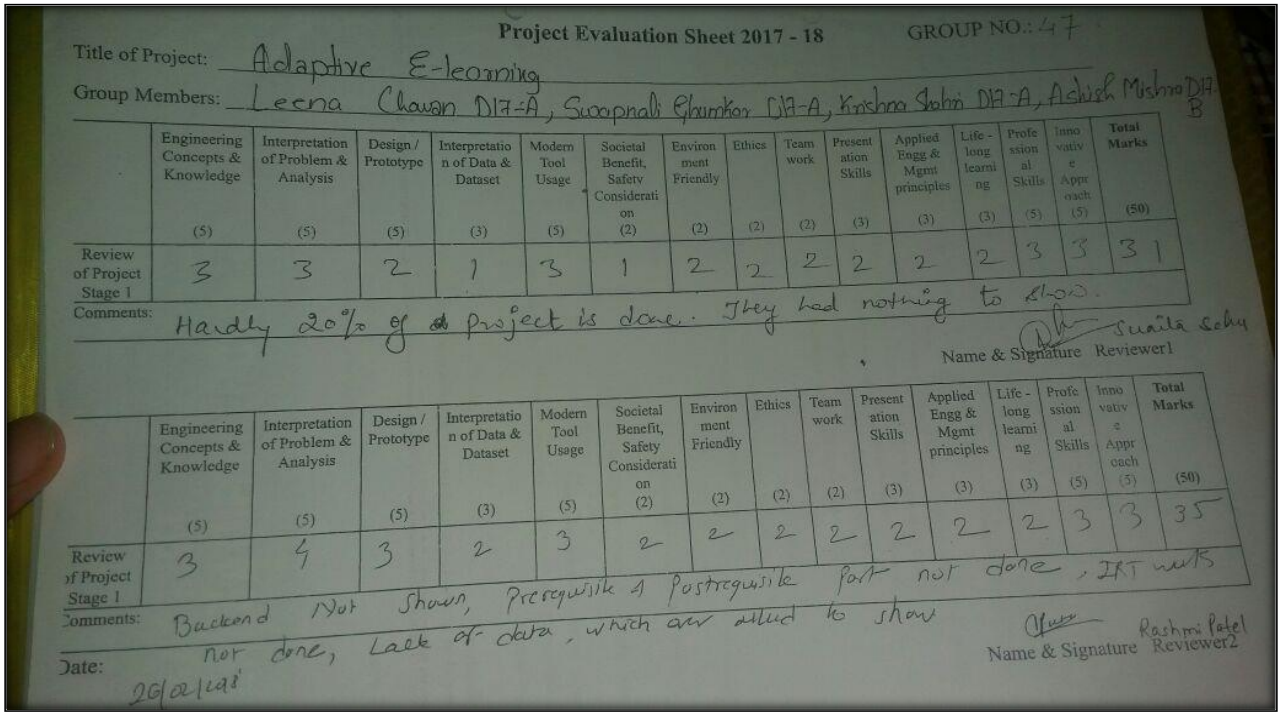
Review Sheet

Review 1



Project Evaluation Sheet 2017 - 18 GROUP NO.: 47

Title of Project: Adaptive E-learning

Group Members: Leena Chavan D17-A, Swapnali Ghumkar D17-A, Krishna Shahi D17-A, Ashish Mishra D17-B

	Engineering Concepts & Knowledge (5)	Interpretation of Problem & Analysis (5)	Design / Prototype (5)	Interpretation of Data & Dataset (3)	Modern Tool Usage (5)	Societal Benefit, Safety Consideration (2)	Environment Friendly (2)	Ethics (2)	Team work (2)	Presentation Skills (3)	Applied Engg & Mgmt principles (3)	Life-long learning (3)	Professional Skills (5)	Innovative Approach (5)	Total Marks (50)
Review of Project Stage 1	3	3	2	1	3	1	2	2	2	2	2	2	3	3	31

Comments: Hardly 20% of project is done. They had nothing to show.

Name & Signature Reviewer1 Sunita Sahu

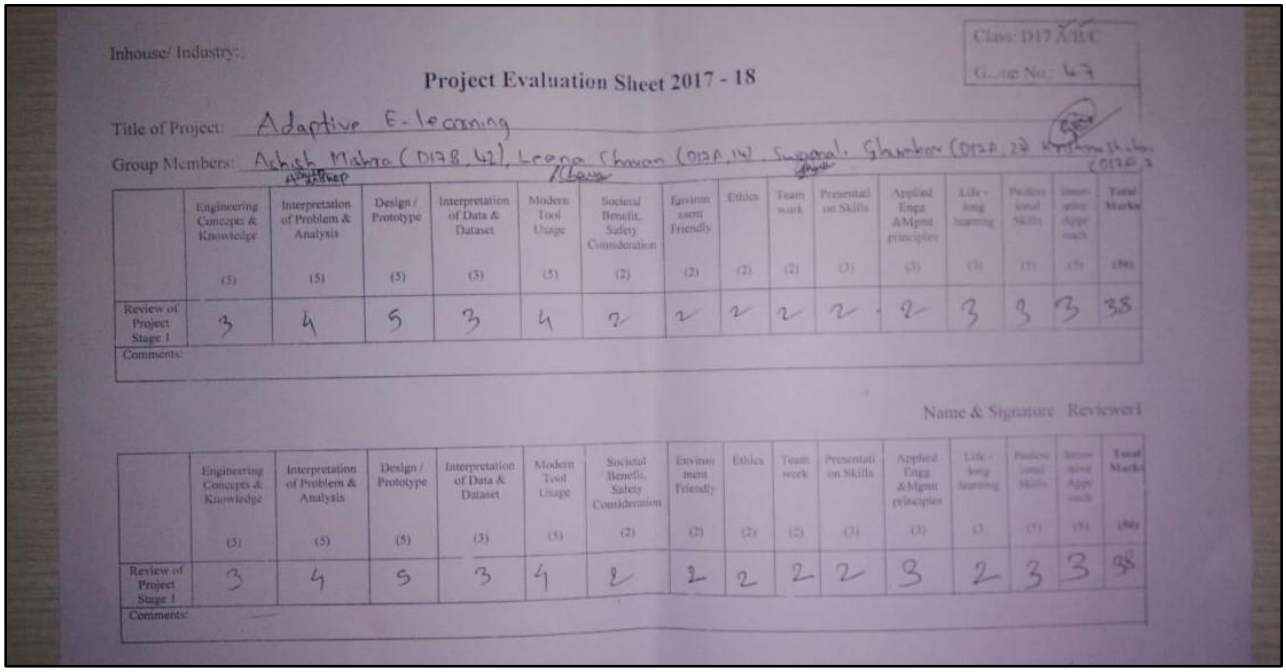
	Engineering Concepts & Knowledge (5)	Interpretation of Problem & Analysis (5)	Design / Prototype (5)	Interpretation of Data & Dataset (3)	Modern Tool Usage (5)	Societal Benefit, Safety Consideration (2)	Environment Friendly (2)	Ethics (2)	Team work (2)	Presentation Skills (3)	Applied Engg & Mgmt principles (3)	Life-long learning (3)	Professional Skills (5)	Innovative Approach (5)	Total Marks (50)
Review of Project Stage 1	3	4	3	2	3	2	2	2	2	2	2	2	3	3	35

Comments: Backend Not Shown, Prerequisite & Postrequisite part not done, IRT work not done, Lack of data, which are allied to show

Date: 26/02/18

Name & Signature Reviewer2 Rashmi Patel

Review 2



Inhouse/ Industry:

Class: D17 A/B/C

Group No.: 47

Project Evaluation Sheet 2017 - 18

Title of Project: Adaptive E-learning

Group Members: Ashish Mishra (D17B, 42), Leena Chavan (D17A, 14), Swapnali Ghumkar (D17A, 23)

	Engineering Concepts & Knowledge (5)	Interpretation of Problem & Analysis (5)	Design / Prototype (5)	Interpretation of Data & Dataset (3)	Modern Tool Usage (5)	Societal Benefit, Safety Consideration (2)	Environment Friendly (2)	Ethics (2)	Team work (2)	Presentation Skills (3)	Applied Engg & Mgmt principles (3)	Life-long learning (3)	Professional Skills (5)	Innovative Approach (5)	Total Marks (50)
Review of Project Stage 1	3	4	5	3	4	2	2	2	2	2	2	3	3	3	35

Comments:

Name & Signature Reviewer1

	Engineering Concepts & Knowledge (5)	Interpretation of Problem & Analysis (5)	Design / Prototype (5)	Interpretation of Data & Dataset (3)	Modern Tool Usage (5)	Societal Benefit, Safety Consideration (2)	Environment Friendly (2)	Ethics (2)	Team work (2)	Presentation Skills (3)	Applied Engg & Mgmt principles (3)	Life-long learning (3)	Professional Skills (5)	Innovative Approach (5)	Total Marks (50)
Review of Project Stage 1	3	4	5	3	4	2	2	2	2	2	3	2	3	3	38

Comments:

International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: SJIF: 5.995
Available Online at www.journalijcar.org
Volume 7; Issue 2(H); February 2018; Page No. 10130-10133
DOI: http://dx.doi.org/10.24327/ijcar.2018.10133.1703

Research Article

ADAPTIVE E-LEARNING SYSTEM

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VESIT Mumbai, India

A R T I C L E I N F O

Article History:
Received 14th November, 2017
Received in revised form 13th December, 2017
Accepted 10th January, 2018
Published online 28th February, 2018

Key words:
ACO, IRT, adaptive, learning style, Learning objects, feedback, test.

A B S T R A C T

Adaptive learning is a kind of learning environment which provides individual learning. It can customize the learning style according to the individual's personality and characteristics. Adaptive E-learning, refers to a training concept in which technology is introduced step by step in all aspects of the business of training. One of the key factors in such systems is the correct and continuous identification of the user learning style, such as to provide the most appropriate content presentation to each individual user. This system is capable of recommending learning content of potential interest to a user and also the likely Web browsing action on the current item using a novel similarity measure approach. The system is able to deliver the learning objects composing a course either by following the organization defined in the course's manifesto, or by dynamically choosing the sequence in which the learning objects that compose a lesson should be delivered. The latter sequencing is done on the basis of the learner responses to tests.

INTRODUCTION

E-learning and distance education via the Internet is a means of current and promising teaching. However, it suffers from defects mainly related to the relative absence of the teacher and, therefore, the difficulty of adapting teaching to the level and behavior of the learner. Paper-based exams and traditional exams are often based on the Classical Test Theory which centers around statistical characteristics like reliability, validity and distinction and so of. But there is still shortcomings for CTT — it neglects the relationship between candidates' scores and difficulty of questions, i.e. the difficulty relative to the candidates. While, the Item Response Theory can stabilize questions' parameters freeing from the influence of tested samples. So, compared with CTT, IRT has the following advantages:

1. More accurate estimation for questions' parameters.
2. Comprehensive revolution to equivalence to tests.
3. Definitions for such integrated quality index as information and function to be a more scientific criterion for selecting questions.
4. More suitable for adaptive testing system.

If a system can correctly extract a user's intention from his/her Web-browsing behavior, when coupled with the user's personal preference, making good personalized recommendation is possible. User's evaluation feedback and browsing behavior are monitored to provide recommendation.

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LITERATURE SURVEY

There are various papers on this particular domain of Adaptive e-learning. Each having a different concept or methodology to help the user to learn better. For providing a better solution, we have referred few well-known papers and extracted concepts that could help us create the proposed solution.

F. Trif, C. Lemnaru and R. Potolea in one their paper titled "Identifying the User Typology for Adaptive E-learning Systems", have come across 4 main types of learning types namely,

Type I – Meaning Directed Style

Type II – Reproduction-Directed Style Type Iii – Application-Directed Style Type Iv – Undirected Style

In this paper we came across intermediate attributes of learning that is:

1. Study activities -these include processing strategies and regulation strategies.
2. Study motives and study moves-these include Learning orientations and mental models of knowledge.

In this paper, K-means clustering is used to understand the relativity between different learning types. The learning activities are grouped into clusters and then the clusters are mapped with the learning types. Though the paper talks about different learning types and activities, but only gives the learning style suggested by one of the expert. There are many experts who have different ways to estimate the learning style. Here, clustering is used to know the user's category. Others

methods can give better results than clustering like DBSCAN or DB SCALE. [1]

Kosuke Takano and Kin Fun Li in the paper titled "An Adaptive e-Learning Recommender Based on User's Web-Browsing Behavior", have talked about feedback mechanism to understand the learners browsing behavior. [2]

In this paper, there are two types of feedback from the user, which helps in the detection of influential browsing behavior.

- Explicit Feedback: In explicit feedback, a user evaluates an item on the recommended list, by navigating to the linked page or giving it a score according to his/her preference. The recommender then associates the specific item with certain influential browsing behaviors.
- Implicit Feedback: In implicit feedback, our system suggests influential Web-browsing behaviors associated with a user's preferred item on the Web browser. This suggestion can be disabled if a user does not want to have it shown on the browser. If a user takes the suggested Web – browsing action, the system regards the content is associated with the user's frequent browsing behaviors. We call the browsing action taken as suggested, user's implicit feedback.
- Hybrid: Combination of both Implicit and Explicit. Typical web browsing behaviors include-
- web pages browsed.
- Terms on web pages selected by mouse click.
- Terms on webpages copied on clipboard.
- Keywords searched within the webpages
- Web pages saved.
- Web pages printed.
- Webpages bookmarked.

The author gives a better understanding about the different web browsing behavior and also how to capture them to help the recommender. Each browsing activity can be assigned a particular weight depending on its use by the user, this can help to understand the user better. The recommender architecture and browser action provider architecture can be understood well by referring to fig 4.2.2 of the paper.

Deng Shaoling, in the paper titled "Using learning styles to Implementing Personalized e-learning System", introduces us to different Elements of Learning Object like. [3]:

- Visual: Instance to pictures or photographs, tables, graphs and flowcharts.
- Aural: Video recordings (visual and aural).
- Verbal: Video & Audio recordings, discussions and conversations
- Physical: Learning by doing
- Social: Group work (activity) or Group studies.
- Solitary: Work Individually. Logical: Graphs and flowcharts.

This paper gives an insight about the different elements, but after researching we can say that a learning object cannot consist of all the elements. These elements can guide us to know the preference of the user's browsing behavior. Tailored courses are easy to create if we know the user's preference, behavior and intention. For creating a tailored course background knowledge about the user is very important.

Rafael Morales and Ana Silvia Agüera, in the paper titled "Dynamic Sequencing of Learning Objects", have introduced two types of dynamic sequencing of learning objects[6].

1. Traditional Sequencing
2. Socratic Sequencing

The working of traditional and Socratic sequencing can be better understood by referring tofig 4.6.1 and 4.6.2 from the paper.

This paper helps us understand the sequencing of learning objects and the similar concept can be implemented on Elements of Learning object. This sequencing can be done with the help of the Bayesian predictor which totally depends on the history of use. Changing the sequence after every test is not worth and hence the system should wait and understand the behavior of the user for some iteration. The browsing behavior can be of a large help in such a case.

Manju Bhaskar, Minu M Das, Dr. T. Chithralekha, and Dr. S. Siva satya, in the paper titled "Genetic Algorithm Based Adaptive Learning Scheme Generation for Context Aware E-Learning", introduces the following [4]:

- The Psychology of the Learner
- The Intention of the Learner
- Relation between Psychology of the Learner and
- Different abstractions of Learning Object

The paper gives us a clear understanding about the various abstractions of learning object and how they are related to the psychology and intention of the user. This knowledge helps us to bring about the adaptive nature. This abstraction may or may not hold true for each type of person. This can be used as a reference.

The relation between psychology of the learner and different abstractions of learning objects and the relation between the intention of the learner and different abstractions of the learning objects can be understood by referring to fig 4.4.1 and 4.4.2 in this paper

Xiaoping Li, Zhenghong Wang, Xiaobing Wu, Yingxiang Li and Hong Jian Dong, in the paper titled "The Design of Adaptive Test Paper Composition Algorithm Based on the Item Response Theory", talked about Classical Test Theory and Item Response Theory. The biggest advantage of Item Response Theory is that the estimations of item parameters have nothing to do with the sample being tested. It speculates the candidate's' ability through characteristic function of the question, combining the answer of the candidates. The characteristic function can be divided into one-parameter, two-parameter and three-parameter by the number of parameters in the Item Response Logistic model [5]

In this paper the main four problems are discussed:

- Entry Level
- Item Selection
- Ability Estimate
- Termination

This paper related to the difficulty of the question and distinction of the question are also important factors. The guessing coefficient is also taken into consideration which

helps the system to understand the seriousness of the test given by the user.

Existing System

DOOR: DOOR Digital Open Object Repository is an Open Source piece of software for creating learning objects repositories. [7]. With DOOR you can store digital content in the form of learning objects (LO), i.e., content + metadata, in a tree-shape catalog. You can then search for LOs, retrieve them and include them in your courses or instructional units.

DOOR is compliant with international metadata standards, and implements the IMS Metadata 1.2.1 and Content Package 1.1.3 specifications. DOOR is also fully integrated with Moodle, and Open Source LMS. The DOOR-Moodle plug-in allows Moodle teachers to browse more repositories seamlessly from a single Moodle course, and then select and import LOs with their metadata.The system can be well understood by referring fig 5.1,5.2 and 5.3. [7]

Proposed System

In our proposed system, the flow of the system as shown in Fig.1 is explained as follows:

1. Learner registers himself into the system.
2. The next step the learner is presented with is a questionnaire, so that the system can understand the learner.
3. The abstraction of learning object (LO) is known with the help of step 2.
4. Learner then browses for what he needs and selects the LO.
5. Learner is provided with the abstraction with the help of data collected in step 2.
6. Learning Style Analysis takes place for the learner as he starts with the selected LO.
7. All the data for the particular learner is recorded for his profile.
8. Now when the learner finishes with the LO, he has to go through a test and a feedback session. The test is based on the LO that he studied and the feedback is about the system.

The test results obtained are used for two important criteria:

a. To understand where the LO and the learner lacked in attaining the objectives.
b. To understand the Learner's Ability.

9. The next LO is selected by the system by taking both the criteria into consideration.

10. The selected LO is recommended to the learner.
11. Now the data of the browsing behavior of the learner is given to the ACO recommender to generate a sequence of the elements of LO that suits the learner's behavior.
12. The predicted sequence is stored for the user in his profile and produced at the time when the learner selects the next LO recommended by the system.

The learner here is being evaluated with the help of both the algorithms. We test the sequencing of the learning object and also the prediction of the next learning object. So we can say that the learner experiences both IRT and ACO. As IRT is based only on the last iteration or feedback, we tend to use ACO instead of IRT as the algorithm will help to decide the sequence not on the basis of only last iteration or feedback but on the basis of the history throughout and as the algorithm also helps in staying in sync with the latest changes in the behavior of the user, we have a change to incorporate all the aspects of behavioral styles of the user. So as IRT that is replaced to ACO is used in the sequencing of elements inside the learning object and the prediction of the next learning object is done, taking into consideration both Pre – Requisite and Post – Requisite of the upcoming LO (Learning Object).

Fig 1 Proposed System Flow

CONCLUSION

The above proposed system is adaptive in nature and will help improve the learning experience of the user. The adaptive nature is introduced because of the two main algorithm that are differentiated below.

Item Response Theory	Ant colony optimization
Input to the system is the result of the test or feedback given by the learner in the last iteration.	A history of actual fact is given as the input to the system.
It is not time consuming as it only depends on test result of last iteration and so the computation is less	It is time consuming as it depends on the history of facts and so it needs heavy computation.
Learner's ability is taken into consideration.	Learners ability is not taken into consideration but it can be calculated but after many iterations
Precision less than ACO	More precision as the data is collected over time.
Termination of IRT if the results or the feedback are positive.	Termination of ACO takes place when the input to the system becomes stagnant.

Future Scope

Future holds a lot for this particular domain. Learning techniques and methodologies have been evolving throughout ages. Many new upcoming technologies can help make the learning process better. IoT and Augmented Reality can play a very crucial part in enhancing the experience of learning. So this will make the process of learning more interactive. The learning objects can be enhanced and made more rich further making the system better.

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How to cite this article:

Arun M N (2018) 'Adaptive E-Learning System', *International Journal of Current Advanced Research,* 07(2), pp. 10130-10133. DOI: http://dx.doi.org/10.24327/ijcar.2018.10133.1703

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