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Implementation of Dual Decision Support System for Students and Teachers using Data Analytics in Online Exam

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Abstract: ***Online Learning platforms are increasing day by day, and most of the people prefer online learning as this platform is very convenient and affordable. In online learning education, learning content designing plays very important role to improve student performance. Therefore in this project we proposed a data analytics based model to analyze student's exam solving and content accessing behaviors which will help teachers to improve content quality. Student's behavior analysis will also help to find out questions difficulty levels as well as student's grade and performance. We proposed a decision support system in online learning system for tutors/teachers which will help them to improve their learning quality. Along with this the tutors will be able to view student's performance online using Graphical User Interface. In this system, we proposed a personal questions ordering module for students depending upon their historical question solving patterns.***
Index Terms: data analytics based model, decision support system, personal questions ordering module.

I. INTRODUCTION

Online learning is becoming very popular nowadays. But if teacher wants to improve his learning quality it is very important to keep a track on each and every student's performance. But it is very difficult task to do such things manually. Therefore to improve learning quality we proposed a data analytics tool which will automatically track student's performance and show all the analytical reports graphically in easiest way. Learning analytics are often thought of as the distinction between embedded and extracted analytics. On the one hand, embedded analytics refer to cases where the learning technology directly uses data, for example providing exercises to adjust students' performance. On the other hand, extracted learning analytics refer to instances in which data is made available for different actors, such as teachers or students. Teacher dashboards are an often-used example of extracted analytics. It has been proposed that information on dashboards can help teachers to improve their daily teaching practice. Dashboards can be considered a new instrument for teachers. Integrated into adaptive learning technologies, dashboards offer the possibility for teachers to visualize students' performance and progress in real time. This gives teachers additional insights to enable them to adequately respond to students' needs during the learning process. Hence, dashboards provide opportunities for teachers to adapt their pedagogical actions to the needs of individual students. In this project we proposed visual analytics dashboards to show student's exam solving behavior and content access activities. The teacher will be able to view live performance of each and every student using live dashboard. We also proposed personalized question ordering module, in which system will track student's question solving behavior and depending upon the historical data system will predict student's question preferences. System will arrange the order of exam questions according to student's preferred question type.

II. LITERATURE REVIEW

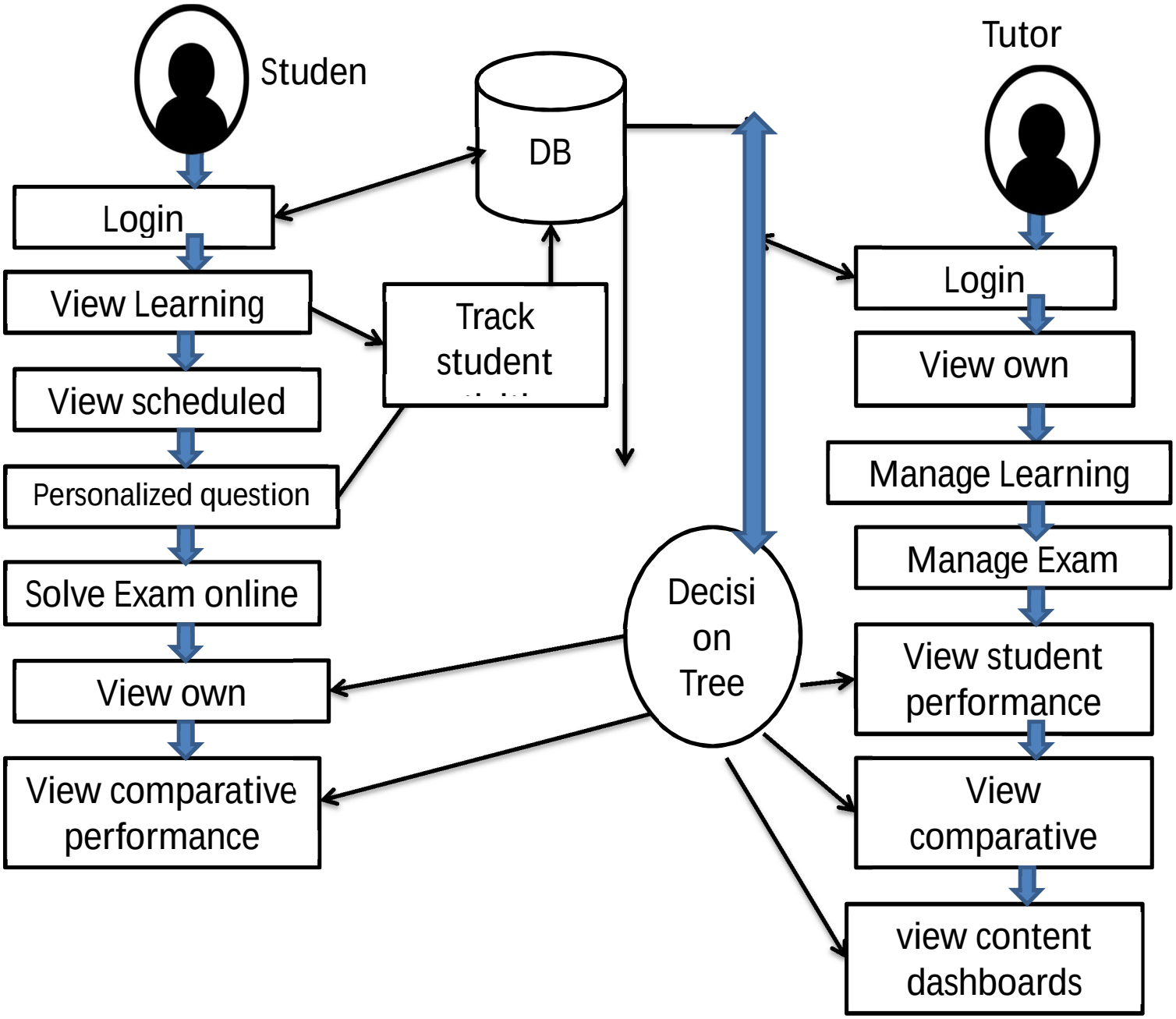
Much research has been conducted on modeling students' problem solving behaviors. They mainly focus on the outer loop, that is how students master the knowledge by solving a series of problems [1,2,3]. For example, Bayesian knowledge tracing was proposed to build procedural models for problem-solving processes [6]. It takes binary variables to model learners' latent knowledge. Each variable represents the understanding/non-understanding of a concept. Since learning concepts are not independent as assumed in Beyesian knowledge tracing, Learning Factor Analysis [4] and Performance Factor Analysis [5] then modeled learners' knowledge states using logistic regression with more learner features. Further, GNN has been applied to model students' performance based peer's data [1]. An increasing amount of research has been done to analyze the inner loop, that is, detailed process for solving a multi-step problem, which is more complicated. Some works use machine learning methods to cluster students' detailed problem-solving behavior. For example, Chris et al. [37] recorded the snapshots of students' code during the programming, and modeled problem-solving process using Hidden Markov Model.

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Visualization techniques have also been widely applied to analyzing students' problem-solving processes. Some studies visualized students' learning processes on solving a set of questions. For example, Xia et al. [9] used a zip-like visualization to facilitate students to plan their personal learning path. Other studies applied visual analytics to students' problem-solving sequences for questions with multiple steps. Hosseini et al. [7] used scatter plots to represent the changes in programming concepts and whether these changes increased or decreased the correctness of the program. Furthermore, Berland et al. [8] used a node-link visualization to track students' program processes and the links between states show the portion of students who made the transition.

A. Proposed System

We proposed an online learning system in which students will be able to do registration and subscribe courses after logged in into the system. Tutor will upload learning content for students and schedule exams. Students can access the learning content anywhere and anytime and Content access activities will be tracked and stored in database to calculate students' preferences. On the other hand, question solving behavior will be tracked in database at the time of online exam to generate live dashboards and calculate student's performance. Working diagram is as shown below



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B. Behavior Tracking

We proposed automatic behavior tracking tool which will track the entire click through activities that the student will do after login. Mainly we will consider two types of behaviors as follows

1) *Exam Solving Behavior:* While solving exam questions system will track student's click events, question solving sequence, no of attempts to solve particular question, time to solve every question etc.
2) *Content Accessing Behavior:* When student access any educational material (documents/videos etc), the access details will be automatically tracked and stored in database

C. Decision Support System

On the basis of collected behavioral data, our proposed system will generate graphical as well as textual reports which will help to take decision regarding education content and question designing. While solving exam, teacher will be able to view live dashboard to analyze student's performance.

D. Live Student Performance Dashboard

Our proposed system will capture real-time data on learner performance, which is displayed in real time to the teachers on dashboards. The system includes three different dash-boards for teachers. The lesson overview dashboard indicates the performance of students on the pre-selected exercises. Teachers can monitor this dash-board to see whether students' answers are correct or incorrect. Green blocks indicate that a student has answered the question correctly. Orange blocks denote that a student eventually answered the question correctly after one or more incorrect attempts. Red blocks indicate that the student did not manage to give a correct answer. Finally grey blocks show that the student has not yet at-tempted the question. As this dashboard is updated continuously while students practice, it also provides information on the pace of the students. The class overview dashboard provides an overview of the performance of the students compared to all other students using the system, indicating to which group each student belongs (10% best students, 20% best students, etc.). Finally the progress dashboard is used when students work on a dative exercises. This dashboard indicates which students are progressing on their learning goals, are stable, or slowing down in their progress.

E. Exam Questions Analysis Dashboard

Using this dashboard tutor will be able to take decision about questions. This dashboard contains exam question details like

1) How many students solved the particular question?
2) How many students solved particular question correctly? And
3) How many students solved particular question incorrectly?
4) How much time do the students spend to solve the question?
5) How many attempts required solving the particular question?

F. Learning Content Popularity

On the basis of content access tracking, system will calculate learning content popularity

G. Personalized Questions Ordering

Depending upon student's preferences, exam questions will be automatically arranged in preferred ordered. Students preferences will be find out with the help of their historical activities.

H. Algorithms

Decision Tree Algorithm

This algorithm will be used to calculate student's performance as well as content popularity. Decision Tree algorithm belongs to the family of supervised learning algorithms. Unlike other supervised learning algorithms, decision tree algorithm can be used for solving **regression and classification problems** too. The general motive of using Decision Tree is to create a training model which can use to predict class or value of target variables by **learning decision rules** inferred from prior data(training data). The understanding level of Decision Trees algorithm is so easy compared with other classification algorithms. The decision tree algorithm tries to solve the problem, by using tree representation. Each **internal node** of the tree corresponds to an attribute, and each **leaf node** corresponds to a class label.

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I. Expected Outcome

1) Student wise live dashboard to analyze performance
2) Comparative performance analysis reports
3) Exam Questions Analysis Reports

J. Development Tools

1) Deployment Platform: Windows
2) Application Server: JBoss AS7/Apache Tomcat/GlassFish
3) Technology : Java EE
4) Development Tools (Serverside): Servlets & JSP,Java Beans
5) MVC framework : Spring Boot
6) Database technologies: MySQL,JDBC
7) Web Development: XML, HTML, DHTML, Javascript,AJAX
8) Development Tool: Eclipse IDE
9) Algorithm : Decision Tree

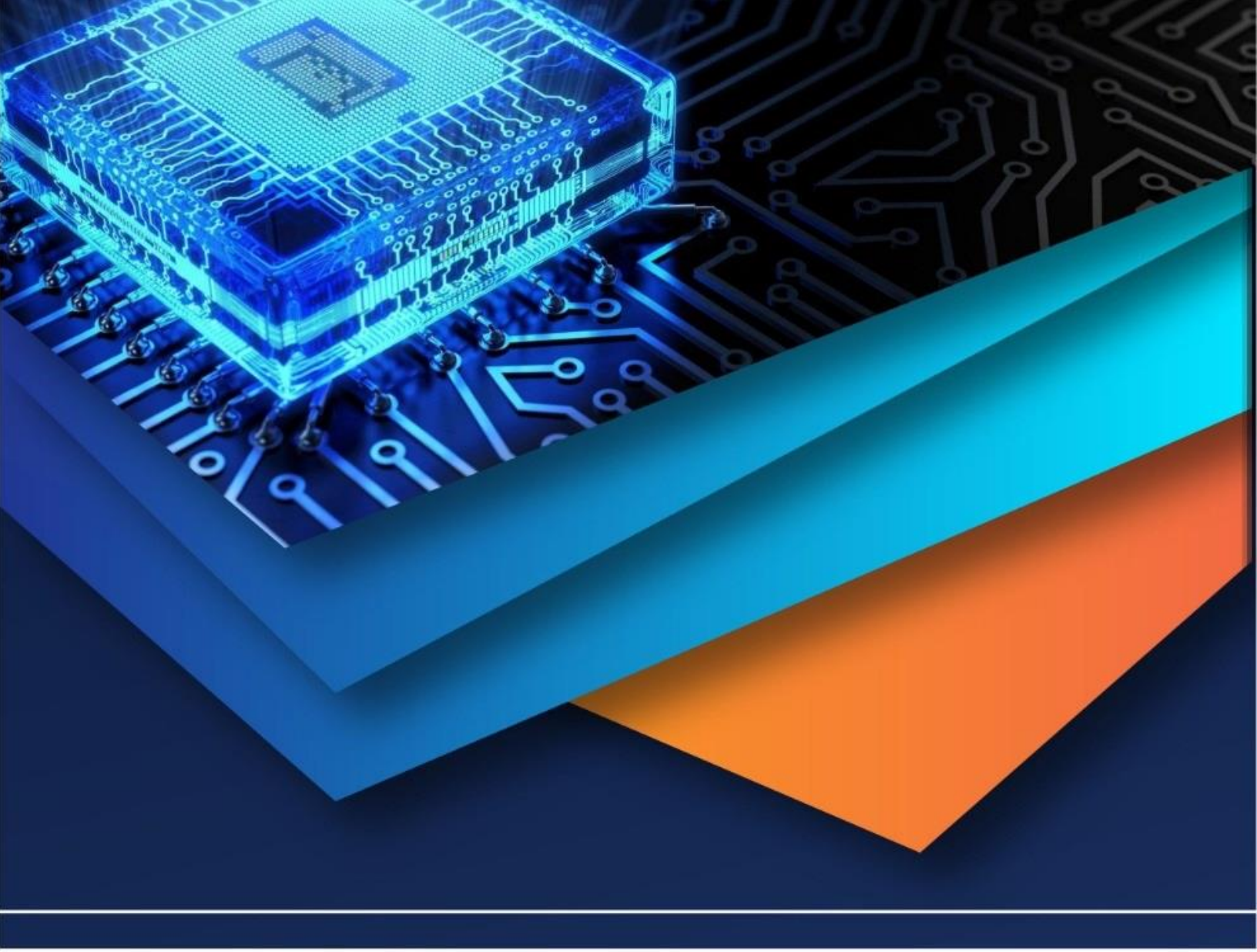
III. CONCLUSION

In this project we proposed a decision support system in online learning environment for tutors/teachers which will help them to improve their learning quality. In proposed system we are applying data analytics on each and every activity of student to develop an intelligent system which will help teachers to improve their teaching quality, questions designing and content quality. Therefore we can conclude that the proposed system will provide complete decision support to tutors and students in various learning aspects.

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