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Online Examination System with Adaptive Tests and Learning Structure Analysis for Performance Enhancement using MVC Architecture

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Abstract: Today internet has flourished exponentially and is doing wondrous modifications in the daily living of the common man. It has incredibly revolutionized the way education is being offered to majority of people. Our online examination system application which provides a user friendly, multi featured and absolutely flexible platform for the smooth functioning of online exams. It is being designed using PHP using MVC architecture and MySQL consisting of six modules. All of these modules greatly contribute to online learning, online examinations and finally exam evaluation. It also helps in doing detailed analysis of a student learning structures by using Markov chain. It supports the computerized adaptive test pattern and also consists of functionalities like random question generation, group and test wise analysis of student performance, setting of difficulty level and text-to-speech for visually challenged people. Our system integrates Markov chain with the adaptive test. It is highly reliable, user friendly, flexible and cost-effective.

Keywords: *PHP, Mysql, MVC Architecture, Markov Chain*

I. INTRODUCTION

Examination is a part of the rigorous learning process that happens to be one of the most crucial elements in the assessment of an individual. It gives stimulus to our train of thoughts, help us to think under pressure and to analyze one's own capabilities. E-learning has gained lot of impetus over time and has soon become the most accepted and convenient form of learning. It reduces the time involved, assures learning from any part of the world at any time and thus increases the flexibility of learning. Online examinations smooth the process of E-learning as well as manual learning and play a major role in the analysis of an individual's performance. Although the traditional method of examination is still into use and will never lose its importance, online examinations are an added advantage that provides multitude of functionalities that will ease the entire process thus reducing the monotonous work load and our online examination application makes it even more reliable and easy by integrating multiple functionalities in one single web application. Our online examination application comprises of different modules which efficiently manage the entire online examination process like admin module, student module, content management module, examination management module, examination evaluation module and security module.

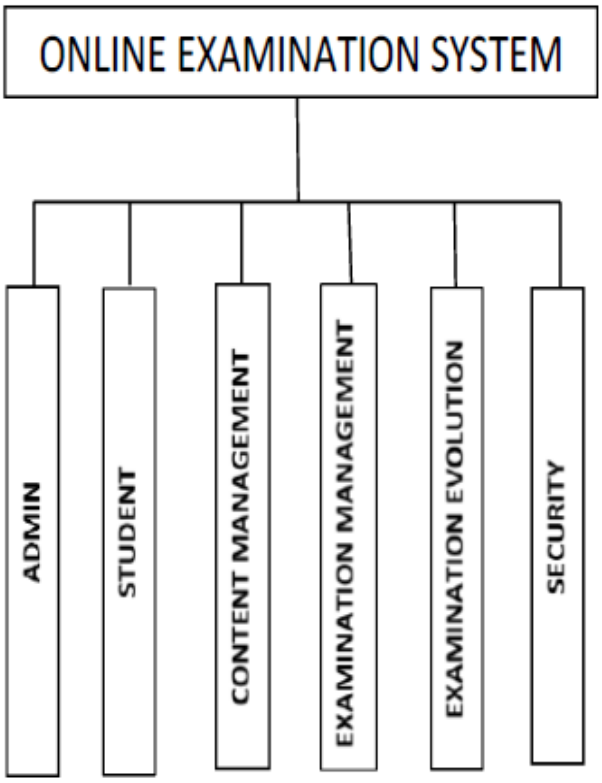

Figure 1: Online Examination System Modules

All of these modules are integrated using the MVC architecture.

MVC Architecture:

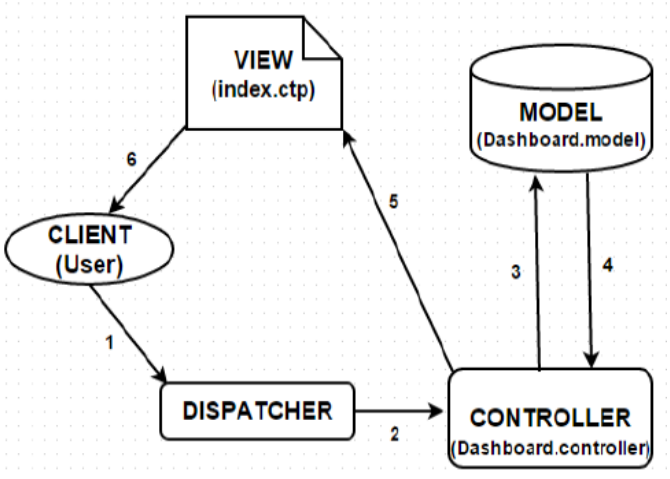

Figure 2: MVC Architecture

Model, View and Controller often known as MVC is the architectural pattern built with an idea to keep the data that is to presented, separate from the methods that interact with it. The input is taken by the controller through the dispatcher which then passes it to the model for processing and further sends it to the view to display the output. This system facilitates the development of modular systems thus allowing the developers to add, delete and update different functionalities quickly.

Model:

Model has absolutely no knowledge of what happens to the data when it is sent to the view or the controller. It just acts as a bridge, a communicator between the view and the controller without calling or seeking any response from either of them. Its main purpose is to process the data into its permanent storage and prepare it in order to send it to the view or controller. Model never questions anything that is been sent to it for processing however it accepts all requests. Model is the crucial component of the MVC architecture as it connects the controller and the view without which the output wouldn't be produced.

View:

View is the part of the system where the HTML file is generated and displayed. There is no direct relationship between the View and the Controller without the Model in between them.

Controller:

The controller interacts with the user accepts requests from it and constantly updates the model about the incoming inputs. Without the inputs from the user the controller cannot perform any function. The controller is connected to only one model and one view thus creating a one way flow of data within the system.

A. Problem Background

Online examination is gaining immense demand lately since the time online learning or E-learning has been introduced. However the major challenge in designing the online examination system is the user-friendliness. Another important factor is to make online examinations customizable so that the admin or the instructor can customize tests whenever required as per his/her own needs. Our application focuses on enabling multi-featured customization functionalities. The more the customization features the more flexible, scalable, reliable and user friendly it becomes.

B. Problem Statement

The online examination system provides registration of students pre exam, allows the admin to customize the exam as per his own needs, enables the user to give the exam and analyze his/her own performance on the basis of various factors, compare his performance with the other people in the group and thus develop a civilized learning pattern based on the observations.

C. Research Objective

The main objective of our project is to provide a multi-featured web application that can customize exam as per our wish and this will also help us to automate our own college training process for aptitude and placements. The system should also make several analysis of the student's performance, depending on which conclusions and patterns of student intellect can be examined and further advice the student's for enhancement in their weak areas accordingly. Various reports and evaluations of student performance should be available online. Our web application should have a large data support which can manage huge chunks of data without deteriorating the overall performance. Our system should provide security mechanisms for authorizing the users and granting privileges to the admin. It should be able to keep a track of all the exams given by the person and thus allow him/her to make comparisons with his/her own as well as others performance.

D. Scope of Study

The scope of the project is to implement text-to-speech for visually challenged people and also to design a computer adaptive test (CAT) so as to drive to certain evaluations based on the student's intellectual level.

II. LITERATURE REVIEW

Existing System

There are many existing online examination systems presenting different features. The paper on "Design & Development of online examination & evaluation system" is based on browser-server structure using JSP & SQL server and contain different basic modules. It is majorly divided into two sub systems namely examination and evaluation. [1] "Interactive Online Training and Placement system" includes an additional alumni module and follows a more structured approach and students can upload their CV's for placement purpose. [2]. A paper on "Online examination system supporting user-defined question type" uses a composite design pattern for implementation which defines hierarchical structure. The most important feature of this system is user defined question types which supports reading comprehension questions & psychometric questions. [3]. "Design of examination system on basic .NET technology" implements an algorithm for random selection of questions and sets difficulty co-efficient using a formula and expert grading. [4]. "Novel web-based online examination system for CS education" also uses a browser-server structure and is based on DCOM technology and MS SQL server. It supports two question types objective questions and operating questions. It uses auto grading feature by fuzzy matching for objective and operating questions. For security, all data transmission is done using a bit stream format after encoding. [5]. "Design & implementation of online examination system based on J2EE" uses Dreamweaver in the front end and uses a J2EE middle tier architecture.

Security mechanisms include MD5 for password and WEB-INF directory to protect system resource. [6]. "PHP +My SQL based online examination system with power failure handling & Dropbox capability" implements session management and power failure handling. It also includes a dropbox capability to avoid rigidness and saves time. For security it uses jQuery validator client side and server side PHP functions, MD5 for password protection and custom developed CAPTCHA & apache server to replace original URL. [7].The paper on "Using Learning Analytics Technologies to Find Learning Structures from Online Examination System" creates knowledge points and analyzes the next state depending upon the previous step. It finds the students from any learning structures while answering the online examination system and from those learning structures it analyzes the weak points of students and supports and helps them in improving the weak areas. Markov supports six different answer types and their definitions namely: true, false, true-true, true-false, false-true and false-false. [8]. "Estimation of an Examinee's Ability in the Web-Based Computerized Adaptive Testing Program IRT-CAT" allows immediate estimation of ability of student after termination of test and it consists of components like management system of the examination, system for parametric estimation according to the response received, system for estimation of student's ability and system for re-evaluation.

Apart from these online examination systems and training and placement modules, we have also reviewed some of the currently working online websites, software applications & analysis like AMCAT, a4academics.com, ClassMarker, ExamBuilder.com, TAP, mettl.com, Exam2win.com, 4test.com, Lofoya.com and Eklavya.com. AMCAT implements a computer adaptive test and consists of compulsory and optional modules. The website a4academics.com has no proper segmentation of questions in sections but it discusses answer to each question in great detail. ClassMarker.com uses multi-lingual student interface and allows us to create custom tests and exams online. It also allows optional selling of quizzes and puzzles. ExamBuilder.com implements many ways to schedule students for exam and allows 3 ways for student registration like bulk, auto retake and manual and also generates a gap analysis report. TimesPro aptitude test is mostly used for banking courses and includes questions on general aptitude and psychometric evaluation. The website mettl.com includes a pre-built test and has advance remote proctoring mechanisms to prevent cheating such as web cam proctoring, browser tolerance, IP restriction and private test limits. Exam2win.com is a timed test with negative marking per question and has a feature to pass the question in case the correct answer to the question is not known. Lofoya.com has timer for each question this helps in keeping track of time while practicing and has important formulas enlisted for each section with a scientific calculator. 4test.com is only for practice and it is not time based. However Eklavya.com can assign time for each question independently and can analyze the rank of students and it is only for private users.

III. SALIENT FEATURES

Our web based online examination application is a combination of six modules which include Admin module, Student module, Content Management module, Examination module, Exam evaluation module and Security module. Admin module concentrates mainly on the functionalities and privileges assigned to the administrator who controls the flow of the entire examination system. Student management focuses on the functionalities of student and gives certain analysis of the student performance. Content Management module manages the questions of each exam and also deals with managing the subjects. Examination management module implements the online examination function. Examination evaluation module is responsible for generating the score report. Security module includes password hashing.

A. Admin Module

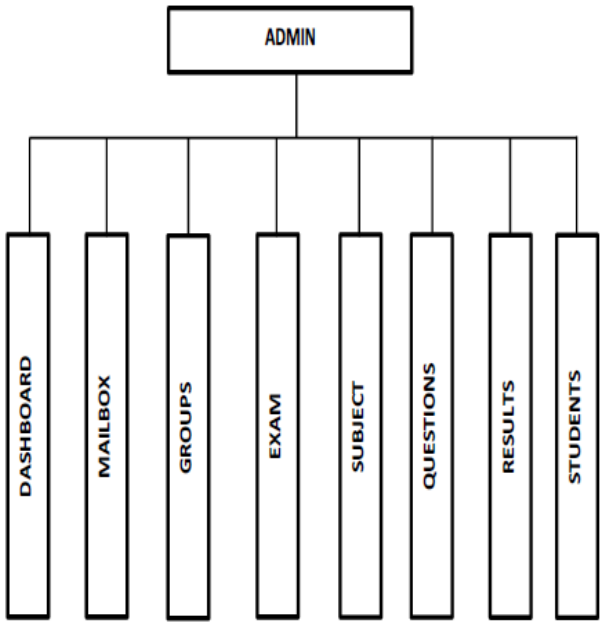

Figure 3: Admin Module

This module includes a dashboard which gives the status of the students in every group in terms of active, pending and suspended. It can make groups of students giving same test. It can also create a new subject and add exam questions related to that subject and assign that exam to a particular group. Admin can add a new exam, set its duration, specify whether it will be a practice exam or final exam and also state the time period between which the exam will be active. Admin can view the results of a particular student based on his name and the group to which he belongs. This application avails admin to add and remove students from any group at any point of time. Admin can enroll students manually also and can give the admin rights to some other individual who will in turn be responsible in

the management and control of the entire examination application.

B. Student Module

The student module interface reflects the functionalities enabled by the admin and the way a particular exam will appear to the student. There is a student dashboard that gives a fair record of the number of exams given, total points earned till date, position secured in the exam amongst the others and the best performance of the student. It also displays a performance graph that gives a graph based performance record of the student. Leaderboard gives the record of the points earned by each individual who has attempted the test. The student gets brief information of the exams scheduled for the day.

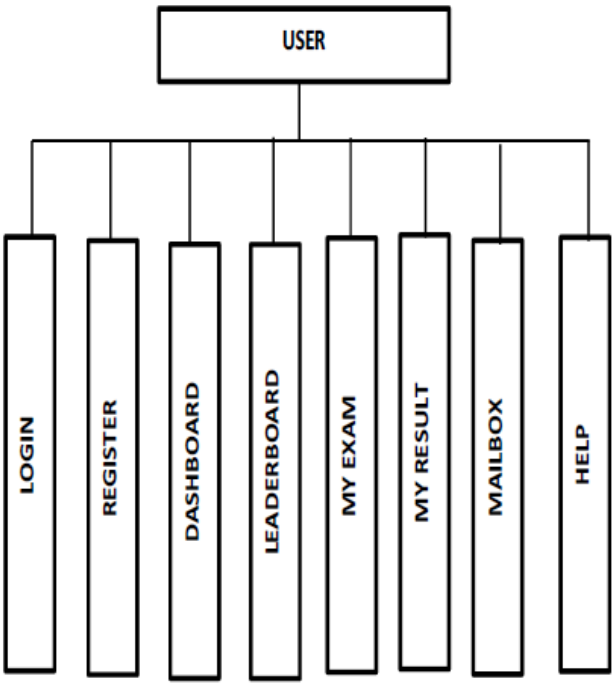

Figure 4: Student Module

C. Content Management Module

The content management module plays a crucial role in managing multitude of questions in the database and also the subjects with which those questions are associated. Management of questions deals with adding a new question manually and importing or exporting a file containing a question bank. Our applications supports visual questions, fill in the blanks questions, true/false, subjective, multi choice, match the columns, psychometric questions and essay-based questions. While adding a question the admin or instructor is allowed to select the type of the question to which the question most closely relates to, add the number of options that can be visible to the user and also add a correct answer for each question. The admin can enable/disable the negative marking function, provide a hint to each question if needed and also assign marks for each question separately and set difficulty level for it. The admin can also assign different questions for different groups of students. The admin can add, delete or edit the subject list and also assign a subject with its related questions to any group of students.

D. Examination Management Module

With respect to the admin side this module deals with assigning exam name, setting the duration of exam, passing percentage of exam, stating the exam mode that is a practice session or the actual exam and also states the instructions that need to be followed during the examination. For practice sessions it states the time period through which that practice test would be available. Further it also deals with enabling/disabling features like negative marking, paid exam, instant results, displaying answer sheet post exam, random questions and random options. There is also a feature to set the maximum attempt count exceeding which the user will lose access to that examination. With respect to the user side, this module rolls through the normal examination in which the user is allowed to give exam, save his answers, review questions and finally submit the exam.

E. Exam Evaluation Module

The exam evaluation module generates the result of the exam depending upon the student performance. The admin can waive rights to display the result exam-wise or student-wise. Accordingly the student can view his scorecard and analyze his own performance and can implement modifications to his preparation.

F. Security Module

Password hashing is done on each individual record every time a password is set using a mutator/setter method. Cakephp hashes passwords using bcrypt.

CONCLUSION

Our online examination web application provides a multi featured platform that supports a multitude of functionalities all integrated in one single application. It provides a detailed analysis of student performance based on knowledge points or learning analytics in both tabulated and graphical format. It allows the admin to customize the exam according to his own needs and thus reduce the monotonous manual work load.

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