Implementation of Enhanced E-Learning in Cloud Environment using MVC Architecture

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Abstract: Education is a necessary human virtue and essential for society. The effective way of teaching gives the quality of education. Information Technology plays a significant role in field of education by providing the advance learning techniques such as E-Learning and M-Learning. The advent of computers with sophisticated software has made it possible to solve many complex problems very fast and at a lower cost. The Cloud Computing environment rises swiftly as a natural platform to provide support to E-Learning systems. The Model-View-Controller design pattern is cited as the architectural basis for many web development frameworks. The MVC architecture is the key in providing an efficient web development framework. This paper aims to develop a web application framework for e-leaning in cloud environment by implementing MVC architecture and to display the progress of the enrolled users in E-Learning courses and projects to meet the effective requirements.

I. INTRODUCTION

A. e-Learning

The term e-learning is electronic learning which is a new education concept by using the Internet technology, it deliveries the digital content, provides a learner-orient environment for the tutors and learners which is most frequently used to refer to computer-based training which incorporates technologies that support interactivity beyond that which would be provided by a single computer. It is also referred to as computer based training, internet-based learning, web-based training, and online learning. An online educational service or e-learning service is a website which teaches and helps students improve knowledge in certain subjects. These are normally used by to let students learn from home and complete online homework. The advantages of e-learning are flexibility, mobile nature, avoids travel, cost effective, immediate and unrestricted, can be tailored to different needs, gives personalized training experience, updated immediately, eco-friendly and global. Potential challenges of e-learning are motivation, less face-to-face interaction, access to technology and requires self-discipline. Importance of e-learning in developing countries is, that it reduces costs traditionally associated with education (such as for classrooms and educational material) and enhance the potentiality of the countries finance.

B. Cloud Computing

According to NIST cloud computing means - "cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction. This Cloud model is composed of five essential characteristics, three service models, and four Deployment models." Cloud computing is the widely used modern technology in this computerized era. Cloud is a metaphor to describe web as a space where computing has been preinstalled and exist as a service; data, operating systems, applications, storage and processing power exist on the web ready to be shared. To users, cloud computing is a Pay-per-Use-On-Demand mode that can conveniently access shared IT resources through the Internet. Where the IT resources include network, server, storage, application, service and so on and they can be deployed with much quick and easy manner and least management and also interactions with service providers. The benefits of moving to cloud storage are flexibility, disaster recovery, unlimited storage, easy access of information, quick deployment, automatic software updates, increased collaboration, always available, work from anywhere, security, competitiveness and environment friendly.

C. Model-View-Controller (MVC) Architecture

Model–View–Controller (MVC) is a software architectural pattern for implementing user interfaces on computers. The Model-View-Controller (MVC) design pattern is cited as the basis for the architecture of several web application frameworks, such as ASP.Net, Rails, and Struts. The MVC design pattern decouples three major interconnected components model, view and controller allowing for efficient code reuse and parallel development. It divides a given application into three in order to separate internal representations of information from the ways that information is presented to and accepted from the user. The model layer is to represent the data. The View layer is to provide an end user presentation view. The Controller layer is used to control the model along with the view. The primary benefit of the MVC design pattern is separation of concerns and the resulting

modularity. The design isolates user interface presentation from user input handling, and isolates both of these from application state and transaction processing. This makes it possible to modify or replace one component without needing to modify or even understand the others. The advantages of MVC is simultaneous development, high cohesion, low coupling, ease modification and multiple views for a model.

II. LITERAYURE SURVEY

A. *Migrating Web Applications to Cloud-based MVC Framework*

According to the paper "Migrating web applications to Clouds with cloud-based MVC framework" by Jyhjong Lin, Lendy Chaoyu Lin, Shiche Huang in 2016 [1], the steps of a migration method that employs a cloud-based extension of the MVC framework is as follows. Initially, web application architecture identification which is to identify the current working architecture and find the profile data (use data and action data). Cloud-based application architecture identification is to identify the cloud requirements based on the cloud versions. This step is achieved by imposing MVC framework on the architecture of cloud environments. Candidate clouds identification is the step to identify the candidate cloud service models to use. The service models are SaaS, PaaS and IaaS. Clouds selection is to select the cloud to be migrated based on the QoS features. Finally, clouds migration plan is to specify the plan about the activities such as deploying the architectural components on the selected clouds, deploying the interaction mechanisms among the components, refactoring the deployed components to satisfy the QoS requirements.

B. *MVC Web Architecture*

From the paper "The MVC-web design pattern" by Ralph F.Grove and Eray Ozkan [2], the MVC design pattern decomposes functionality into three major components as follows. The model component encapsulates the domain specific structure and functionality of the application. This essentially includes the state of the application and operations that can change state. The model also maintains dependencies of view and controller components, which it notifies in the event of changes in state. The MVC-Web model component is responsible for maintaining the application state. Its responsibilities are data persistence, transaction processing, external interface and query handling. The view component presents information to the user through a graphical user interface. There may be multiple views of different types operating within the application, presenting different views to multiple users. The MVC-Web view component presents a user interface, including data presentation and input devices. Its responsibilities are information retrieval and display, to interact and present user input and client-side dynamic behaviour. The controller component responds to user actions via the user interface. It is responsible for passing transactions to the model for execution. Controllers exist in a one-to-one correspondence with views. The responsibilities of MVC-Web controller are front controller, action handlers and control flow.

C. *Cloud Computing in Educational Organizations*

Using the paper "Effective use of Cloud computing in educational organizations" by R.Meganathan and P.Jeyanthi in October 2016 [3], the impact of cloud computing in educational field is high. The major benefits of cloud computing for the academic institutions and their students are cost saving (outsourcing the services save the cost of hosting the service-in-house), flexibility (helps in beginning with small scale services and then gradually extending the services to rapid development), extended availability (as cloud is hosted with out-house company through internet, the downtime will be less due to due to superior skills and services available to the cloud providers) and end user satisfaction by providing availability to access the applications anywhere at any time without any restrictions along with frequent updates and provision to use latest tools and features. Gives high benefit to use the applications without purchasing, installing or keep these applications on their computers and comfortable with the data without worrying regarding backup or data loss. The challenges and barriers to implement cloud computing are data security like threats and attacks, bandwidth and acceptance of the management and decision makers in educational institutes to shift from traditional services into cloud services.

D. *Cloud Computing and e-Learning*

The paper "An overview of Cloud computing for e-learning with its key benefits" by Mansi Bosamia and Atul Patel in March 2016 [4], provides the benefits of using cloud computing for e-learning. The advantages of e-learning using cloud environment to the Learner, Tutor and Institute are easy and quick accessibility available to anyone 24/7, reduce time and cost, modular, wide participation, accommodating different learning styles and levels, a positive impact on learners, tutors, as well as the educational system as a whole, effective technologies use many evidence-based strategies and proof of completion and certification, essential elements of training initiatives, can be automated. Benefits to the Learner are learning anywhere with access to a computer and Internet connection, it reduces the cost and time of travelling, self paced learning with their own speed, student motivation and confidence that refresher or quick reference materials are available, easy-to-access course materials, students may have the option to select learning materials that meets their level of knowledge and interest, re-useable learning materials, enables to complete their course conveniently at off-hours from home, take online course and take the online exams, submit their assignments or projects to their tutors from anywhere. Benefits to the Tutors are reduced overall cost by reduction of time spent in travelling, lodging and food, teaching times reduced, easy to distribute the course materials, conducting online tests, quiz, homework, projects and assignments distribution and evaluation is possible at any time, to get the immediate feedback of learner, trackable results of learner.

According to the paper "Review paper on E-learning using cloud computing" by Prof.Poonam R.Maskare and Prof.Sarika R.Sulke in May 2014 [5], the e-learning cloud architecture is divided into the following layers. Infrastructure layer composed of information infrastructure and teaching resources. Information infrastructure contains Internet/Intranet, system software, information management system and some common software, hardware and teaching resources is accumulated mainly in traditional teaching model and distributed in different departments and domain. It is located in the lowest level of cloud service middleware. It is a dynamic and scalable physical host pool. Software resource layer is composed by operating system and middleware and offers a unified interface for e-learning developers. Resource management layer is the key to achieve loose coupling of software resources and hardware resources. On-demand free flow is achieved by virtualization and scheduling strategy. Service layer has three levels of services as, SaaS (Software as a service), Paas (Platform as a service), IaaS (Infrastructure as a service). Application layer is the specific application of integration the teaching resources in the cloud computing model, including interactive courses and sharing the teaching resources. This layer mainly consists of

content production, educational objectives, content delivery technology, assessment and management components.

III. EXISTING SYSTEM

The existing approaches for the implementation of the system of e-learning is done mostly in the local system environment. Only certain implementations are done using the cloud environment. Though usage of cloud is more effective, implementation is seen very rarely. Likewise e-learning is not mostly implemented using modular architecture approaches. Modular approaches like MVC architecture helps in providing modularity to the application and helps in giving different views. The present system of e-learning is implemented either in the cloud environment or using MVC architecture and not using both the techniques.

The existing system at present implements e-learning using local server environment and not in cloud environment. The implementation is also not done with the modularity concepts such as model, view and controller layers. Also the present system comprises of the various e-learning courses and projects. These courses and projects can be enrolled by the students of various institutions and their progress are maintained. These courses and projects along with the student details are maintained in the traditional manner and are implemented in the local server.

IV. PROPOSED SYSTEM

The proposed system aims to overcome the shortcomings of the existing system. This aims in implementing e-learning with both the latest techniques of cloud computing and the MVC architecture. This helps in designing and developing a web application framework for the recent implementation of e-learning.

The main goal of this system is to migrate the existing system web application framework for e-learning, in the cloud environment for the advantages like low cost, scalability, ease of access and security. The application follows the MVC architecture to enhance the implementation. This framework implements the details of the e-learning courses and projects along with the details of the students in the MVC architecture so that all the layers are not tightly dependent on each other. The application also uses techniques to ensure secure usage. This application provides a report of the students enrolled in online learning courses and projects. By using this application, the faculty members can view an academic report of the enrolled students in courses and projects to know the exact performance of their students.

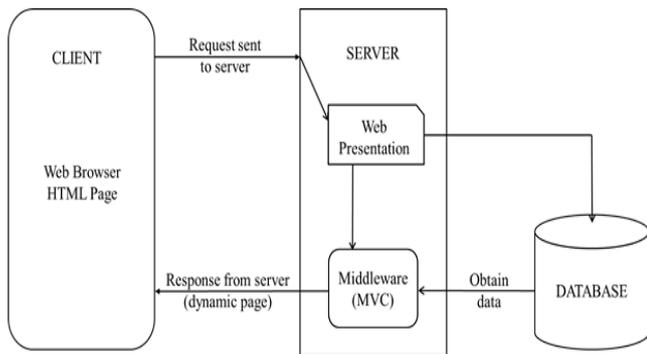The proposed system architecture is explained below.

Figure 1. The Architecture of the proposed system.

The client is the user of the college. The user login to the application and sends a request to the server. The request sent is to view the student academic report based on the college and department. The contents are stored in Cloud environment in the Model-view-controller architecture. Based on the information from the user, the request is sent to fetch the record. The record is fetched from database and displayed in various views in the presentation layer based on the user criteria.

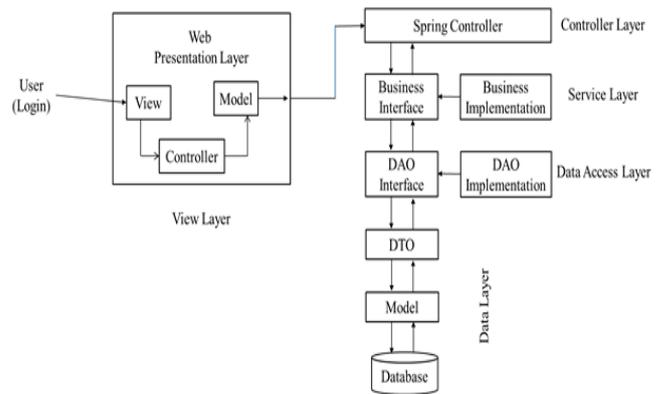The MVC architecture is as follows.

Figure 2. MVC Architecture layers of the proposed system.

The layers are View layer to provide various presentation views based on the users, Controller layer to control the model to be displayed to a particular view, Business (Service) layer to implement the business logic, Data access layer to access the data from the database, Data transform layer to provide an interface wrapper over the original data, model layer to store the raw data in the database. The data from the database is accessed using model layer and controlled through controller layer to display in the View layer.

V. IMPLEMENTATION

The implementation of the application is done in the following manner using MySQL for database, Spring and Hibernate (Using Java) for middleware and Angular JS for front end view layer.

The modules are User and student details, Course details and Project details. User and student details module maintains the details of the users and students. It also maintains the details of the all the faculty members of the college along with student details. This module also provides a dependent relationship with the students and the courses or projects based on their enrollment. Course details module is the module which is responsible in maintaining the details of the courses along with the course activities and contents. Project details module is the module which is responsible in maintaining the project details along with the activities to be completed for a project.

The layers implemented are Model layer (Pogo Classes and DTO Classes), DAO layer (Interface and implementation), Business (Service) layer (Interface and implementation), Controller layer and View layer. The Model layer deals with the Hibernate connections with the database. The DAO layer has the interface and its implementation to access the database. The Business layer is the service layer which has the interface and implementation for the business logic. The Controller layer is the layer which is responsible to control the implemented methods along with the presentation view layer. The view layer is the presentation layer which is responsible to display the application in the browser in the user friendly manner.

VI. RESULTS

The Dashboard page is used to display the overall top students list based on the completion of projects and courses and top trending courses and projects based on the enrollment of the students of the department of the user signed in.
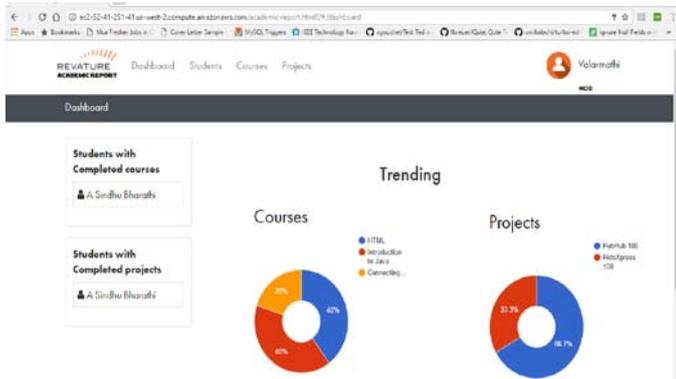

Figure 3.   Dashboard page.

The Students page is used to display the overall students list along with the courses and projects completed and currently doing list for each student based on the department of the user signed in.

Figure 4.   Students' page.

The Student Profile page is used to display the details of the individual student. It also helps in viewing the details of the courses and projects enrolled by that student. This page also displays the information about the percentage of completion of the courses and projects which is currently done by the student. It also displays the details of courses and projects completed by that student. The courses and projects details can also be viewed in this page.

Figure 5.   Student's Profile page.

VII. CONCLUSION

The paper aims in developing the web application framework for effective E-Learning using MVC architecture in the cloud environment. This application provides a user-friendly environment to the users to know about the academic performance of the students enrolled in the courses and projects. This also provides different views based on the users using the application. The web application is the effective framework to implement e-learning using the recent technologies.

VIII. FUTURE WORKS

As future enhancements, this system aims in providing academic report based on ranking among the enrolled students and their active participation in the completion of the projects and courses. It also aims to overcome any other short comings faced by the public users.

IX. ACKNOWLEDGMENT

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