A Survey on Integrated Compiler for Online Examination System

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Abstract— **Online examination or e-exam has become important these days because of the rapid evolution in the Internet and Education. Online examination system is more efficient than face-to-face examination. It is more economically enduring because we do not need to print and store papers. Also we do not have to invigilate and monitor the students to prevent cheating. Thus, it is time saving and reduces human labour. With this study, we have proposed an efficient online examination system to conduct subject quizzes and lab exams online, for all educational institutes and provide a set of real time questions for training in placement related programming, for students. The proposed system comprises an integrated compiler for the students to test their coding abilities.**

IndexTerms— **MEAN stack, integrated central compiler, java virtual machine (JVM), java native interface (JNI), privacy, security, graph mining.**

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I. INTRODUCTION

The traditional approach to measure a person's level of knowledge in a subject has been the examination. An education should be committed to progress. It should increase student engagement with the course material, increase student learning, accountability for completion of assigned readings and the amount of in-class time available for discussion in comparison to the typical lecture format. Examinations play a significant role in showcasing how the students are taught and what the students understand and thus leaves an impact on both learning and teaching.

Considering this, it is seen that computer based examinations are more feasible and thus, are mainly used to overcome the traditional approach of examination which is not flexible, time overriding and also results in wastage of paper. We have taken the advantage of conducting online exams in our college, so that the students of our college can enjoy the flexibility as well as maximize their learning through collaboration [1] [2].

Organizations and institutions will have a centralized database of questions, from which the tests will be prepared and the internet will be used as a media for disseminating and conducting tests thus maintaining a uniform pattern for all the examinees throughout the organization.

II. ONLINE EXAM

Over time, a lot of changes have come in the universities' examination systems. The manual examination system was meant for times when there were fewer students and courses. However, at present, with the increase in the gross enrolment ratio in higher education, the examination system has to bear an increased load and leading towards inefficiencies. Currently, online examination has been used everywhere in the world due to mass enrolment ratio. The traditional approach of paper – pen examination is prone to errors, greater time consumption, and valuable natural resources being wasted [3].

The main objectives of automation of examination systems are to minimize human intervention, reduce expenditures, bring efficiency, enhance productivity, optimal utilization of resources, better supervising of examination activities to take quick decisions, timely availability of information/services for stakeholders, integration of isolated but related databases, bring transparency, minimize data redundancy, role-based access to users, improvise public image and reduce psychological pressure[4] [5]

There are existing web based examinations developed with Java Web technologies that provides the functions, including question bank management and online test. Also the integration of client-side programming and server-side programming techniques were used and analyzed [6]. From the survey, we have proposed a system, an online examination that is different from the existing ones which includes an integrated centralized compiler and making use of efficient software, MEAN (MongoDB, ExpressJS, AngularJS, Node.js) stack.

Online examinations are one of the methods that can overcome the problems faced by the traditional paper-pen examination approach. Figure 1 explains how online examination maintains integrity and confidentiality of a person and avoids plagiarism.
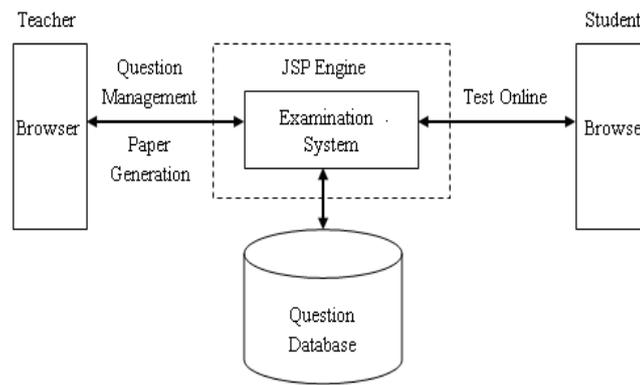
Fig.1 Architecture of an online examination system

Taking into account the examination course content, you can easily add, remove, and update questions in the database as per the convenience. The database will consist of various set of questions as per the difficulty level. The paper can be produced from the database by extracting the questions [7].

The examination being online, students can log in anytime into the campus network and test themselves and improve their coding abilities. A figure 2 show how online examination approach has various benefits, such as it is time saving, saves resources, paper, allows questions to be easily updated into the database and to avoid paper leaks. Answers can be written quickly in a manner that is advantageous for the reuse of data, which grant an easy access to a growing universe of reusable software components [8] [9] [10].
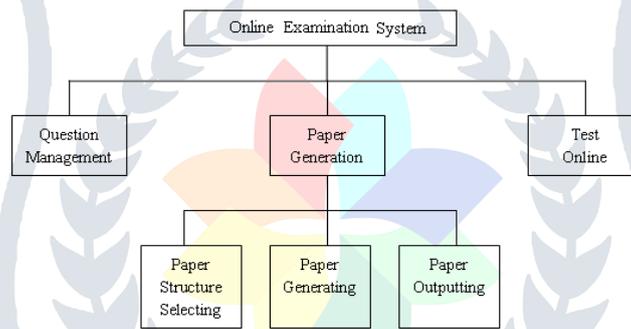

Fig.2 Function module diagram of online examination system

III. MEAN STACK

MongoDB, Express.js, AngularJS, Node.js together is called MEAN. Figure 3 shows the architecture of mean.
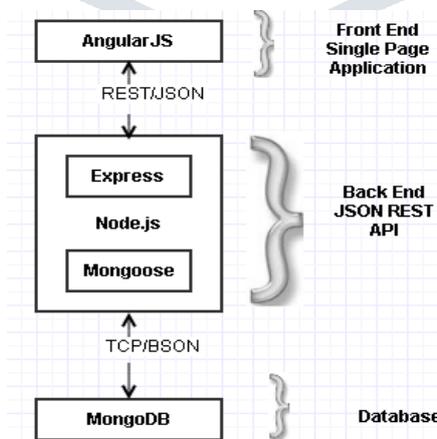

Fig.3 MEAN Architecture

The survey focusses on the usage of MEAN. MEAN stack helps in fast and easy use of heavy applications. It is very fast in performing important operations like create, read, update and delete (CRUD). The target behind using MEAN is that, it is very efficient to prototype. Express is a malleable Node.js application framework that gives robust set of features for web applications. It is a very friendly, flexible and JavaScript full stack.

In this survey we discuss the usage of new technologies which are highly efficient. The usage of MongoDB makes it highly scalable since it is leading NoSQL database and thus, more agile [11] [12] and stores huge data. NoSQL (Not Only SQL) is being used as they handle unstructured data such as documents, multimedia, e-mail and social media effectively in order to have an interactive platform [13].

The model is very powerful in terms of client/server computing and is very strong technology for the storage of structured data [14]. The volume of data in colleges grow regardless of the size because there is a need to store data of all varieties like examination question banks for lab exams, quiz and placement related test cases, graphical statistics and other information [15].

Mongo database is used in order to store student information, examination related questions, stores the marks obtained by the students and all the related data thus supporting increasing data volume and number of users of this repository [16]. For the effective functioning of MongoDB there is express.js. This helps us in building the web servers with node, easier and maintainable. Request router provided by Express.js is an easy to use router that helps in management and other HTTP building blocks.

For an efficient interaction of the client we make use of AngularJS which is a feature that is apt for the client side framework. Sturdy web applications can be developed by using this. It also helps us in structuring the client side operations i.e. interaction of students with the server by answering the lab, quiz and placement related exams. In the server side we have Node.js. Node is highly successful in terms of development and adoption by both enthusiasts and large organizations [17]. Node.js platform is event based and uses just one main thread for its event loop. Since the application is written in JavaScript which is a dynamic programming language, it helps in expanding the objects and functions [18]. Table 1 shows the comparison between MEAN and LAMP (Linux, Apache, MySQL, Perl/PHP/Python).

Table 1 Comparative study between MEAN and LAMP

	LAMP	MEAN
OPERATING SYSTEM	Linux OS	Any OS
WEBSERVER	Apache	NodeJS is event driven and non-blocking.
DATABASE	MySQL- has limited resources	MongoDB- Stores huge amount of data(NoSQL)
LANGUAGE	Perl/PHP/Python	Express.js and AngularJS: AngularJS is framework to create one-page dynamic apps and it runs on the client side whereas the other languages in the traditional LAMP stack would run on the backend. Think about AngularJS as a great and dynamic extension to HTML

IV. INTEGRATED CENTRALIZED COMPILER

As java byte code is more efficient and is expected to run efficiently on multiple environments. Using a single integrated java compiler to compile different language code to the user who works in different language environment will reduce the time and space complexity [19]. The tool used for converting different language code to byte code is taken care by java native interface, whereas java virtual machine will convert the byte code to machine dependent language [20].

Java compiler compiles the program and generates the class files which contains a portable code called as java byte code which is independent of all the platforms [21] [22]. Integrating a single java compiler on the server would be more efficient for the dynamic environment [23].

Java virtual machine creates a virtual layer on top of operating system (abstract computer). Once the class loader, loads the class file, JVM (Java Virtual Machine) creates machine dependent language that can be executed by the processor [24] [25]. The class file comprises of all the instruction set which is designed to be interpreted by JVM which also reduces the hardware dependences by allowing the code to run on all platforms [26].

Java native interface is the framework used for converting other language code into native language. JNI (Java Native Interface) enables the java code running on the environment (JVM) to be called by the other libraries and methods written in languages such as C and C++. JNI will be useful when entire code cannot be written in java, the parts or methods which are implemented in other language can call the code running on JVM. The native method can also create java objects to perform its tasks [27].

Java compiler is being used as an integrated centralized compiler which acts as a reliable common compiler for java and other languages such as C and C++.The java compiler will convert the java code into byte code which is an independent form and works on the basis of write once and run anywhere. Using one common centralized compiler space and time complexity will be minimized. The conversion of programs written in other languages to byte code, is taken care by java native interface, which converts other language code into native form and then it is converted into byte code. Byte code is converted into machine dependent language by

java virtual machine. The centralized compiler is installed in a main server which will be having a set of IP (Internet Protocol) addresses of user (client) computers connected to it [28].

The user can request access to server through undergoing set of security protocols such as authentication. The server side runs on the Node.js platform and the data communication is enabled by the framework ExpressJS and is sent in .json format file, once the data is in the server side integrated java compiler starts compiling, the results are calculated according to the test cases passed and sent to the client using requested IP address.

V. SECURITY IN THE ONLINE EXAMINATION SYSTEM

Privacy and security are the most important factors in e-learning, especially online examination systems. We propose a system that provides security to improvise online examination systems by utilizing technologies such as biometric authentication, internet-firewall, cryptography, network protocol and object oriented paradigms. In addition, we propose a framework for conducting online exams through insecure internet backbone.

The traditional way of identifying the students is checking the student ID card, driving license, resident card or passport. The online process and security of the online examination system helps with eliminating cheating. The survey implies the usage of biometrics which supports the security control, authentication, integrity of online examination and e-monitoring of students using finger prints and cameras, to prevent cheating and substitution of the original student.

The two problems faced are personal identity and unauthorized interference of other users in the network used by clients. The solutions for this are:

1) Challenge of personal authentication:
In order to solve the problem of authentication theft, with the knowledge gained from the survey, the security measures that are to be used are: student logs in with his/her USN, the photograph of the student taken from the students database will be displayed on the screen, and the teacher invigilating should check the photograph shown on the screen and compare it with the student's face to check and see if it is the student with the corresponding USN who is sitting to give the online exam.

The study helps to incorporate biometric scan devices like special cameras for dual purpose of identifying and controlling of the activities inside the examination hall and finger print recognizing devices for confirming the identity of the students.

2) Unauthorized intrusion of other users within the network using other users:
From the survey we concluded that, a domain with the set of students' user id, allocated by the university domain should be created and each instructor will add all the students' user ids. The students who logs in from different IP's cannot use the allocated domain and thus the system is secure.

The online format is considerably superior to paper-and-pencil examinations. From the survey, the above mentioned challenges can be solved by introducing the following security systems.

1. Using biometrics, we overcome the traditional way of checking the ID cards of the students after they start the exam. Biometrics will help to identify the student as he/she enters the exam hall.

2. The IP address can be checked:

   i.   Making use of online signature or student photo and fingerprint
   ii. Making use of online cameras in order to identify the students answering the test, which is more useful than the traditional method of checking the identity cards. [29].

Another aspect of security in online examination system that the paper considers is to protect a student's test scores from being tampered with others. In order to do this, the test scores after being obtained should be encrypted using an encryption algorithm, with a secret key that is known to the student and the faculty, who evaluates the student's test paper. [30]

VI. DATA ANALYSIS USING GRAPH MINING TECHNIQUES

Graph mining has become very popular in pattern recognition and machine learning. An important aspect of graph mining is frequent pattern mining (FPM). This is used to discover patterns that represent conceptually the relations among discrete entities in a graph. But developing algorithms that find all frequently occurring sub graph patterns in a large graph is very challenging.

There are two types of graph mining techniques, based on the style of finding the frequent pattern:

1. Pattern Growth Technique

In this technique, frequent pattern identification is done without using candidate generation. There are two steps in this technique:

1) A compact data structure called the FP-tree is built.
2) Frequent item sets are extracted directly from the FP-tree.

2. Apriori Based Technique

In this technique a 'generate and test' approach is used, i.e., the candidate item sets are generated and tested to see if they are frequent. There are two drawbacks of using the Apriori approach to graph mining:

1) Generation of candidate item sets is expensive
2) Subset checking and multiple database scanning is expensive.

Hence pattern growth technique is preferred over apriori-based technique for graph mining to find the frequent patterns in the graph. [31] [32].

VII. CONCLUSION

The survey helps in integrating a compiler for conducting online examinations. Based on the analysis and the survey made the best technology to implement the online examination system is MEAN stack.

The survey also focuses on describing the integrated compiler used for the compilation and execution. Security is highly prioritized. The paper also gives detailed explanation about how the security is maintained using appropriate technologies.

With this study, we have proposed an efficient online examination system to conduct subject quizzes and lab exams online, for all educational institutes and provide a set of real time questions for training in placement related programming, for students. The proposed system comprises an integrated compiler for the students to test their coding abilities.

VIII. ACKNOWLEDGMENT

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