TestLEAD: Engineering a Modern CBT Application

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Abstract— The rapid advancement of Information and Communication Technologies(ICT) in teaching and learning has shifted the paradigm from paper-pencil-based to computer-based system of examinations. Early research on CBT almost exclusively focused on theoretical issues such as improving measurement efficiency by achieving adequate levels of test score reliability using as few items as possible. However, it was soon evident that practical issues — such as ensuring content representation, making sure all examinees have sufficient time to complete the test, implementation of new item types, and controlling the degree to which items were exposed to examinees — needed to be addressed, too. TestLEAD CBT is a modern engineered computer based testing software with interesting features added to the above mentioned features like - improved test evaluation precision and efficiency, immediate scoring, self proctoring, integrated data management system, flexible scheduling, bulk question authoring, easy access and speed etc. Although, there are different mode of question presentation, TestLEAD CBT is limited to multiple-choice questions hence, the need for a future extension to incorporate other mode of questioning.

Keywords— Test, Computer, CBT, ICT, TestLEAD.

I. INTRODUCTION

It is generally recognized that examinations determine the extent to which educational objectives have been achieved as well as the extent to which educational institutions have served the needs of community and society. The rapid advancement of Information and Communication Technologies(ICT) in teaching and learning has shifted the paradigm [5] from paper-pencil-based to computer-based system of examinations which are usually termed as Computer Assisted Testing, Computerized Assessment, Computer Based Testing (CBT), Computer Aided Assessment (CAA), Computer Based Assessment (CBA), Online Assessment, E-Assessment and Web-Based assessment [1] [3] and many others.

Computer – based examinations are the form of assessment in which the computer is an integral part of question papers' delivery, response storage, marking of response or reporting of results from a test or exercise [6].

This paper seeks to describe a modern CBT application (TestLEAD CBT), designed to fully incorporate the benefits of computer based testing over the paper-based testing. TestLEAD CBT is a modern engineered computer based testing software with interesting features like improved test evaluation precision and efficiency, immediate scoring, self proctoring, integrated data management system, flexible scheduling, bulk question authoring, easy access and speed etc.

The rest of this paper is structured as follows: the next section describes the TestLEAD CBT architecture in terms of block diagrams and the interrelationships between the components. Also, the interaction and dataflow among the component modules are described at top level. Immediately after that, is a section that describes the modules and other key components that makes up the TestLEAD CBT. The data model structure is discussed next, then the usage of the application and finally a proposed future extension was made.

II. ARCHITECTURE OF TESTLEAD

The block diagrams and the interrelationships between the components that make up the Computer Based Testing (CBT) Software application architecture is illustrated in fig 1.0 below. The block diagram represents a bottom-up layered structure and usage of the CBT software. At the lower level of the block diagram: The admin can edit, delete and create new candidate type, Manage Centers, Venue and Systems i.e. create new centers, attach venues to the center and register computers in a venue.

Next, on top of the first layer is the question authoring layer that enables the admin to enter questions into the software's question bank either singly or by uploading them in bulk. This part of the software also allows the admin to edit existing questions, change the topic name attached to a question and even change the difficulty levels of each individual question in the question bank.

Test Configuration, describes the next layer immediately after the question authoring layer. This module allows a test/exam to be initiated-which is similar to fixing the test date, time duration for which the test can be taken for a day, test code and category, session, starting mode (whether On Login or On Start Time), number of versions of test, question display mode (whether all or one by one), question administration (i.e. linear or random), option administration (i.e. linear or random) and subject selection specification. After the test/exam is initiated, then questions will be composed for the test through the test composition module. During test composition, question will be selected from the pool of question in the question bank for that particular test.
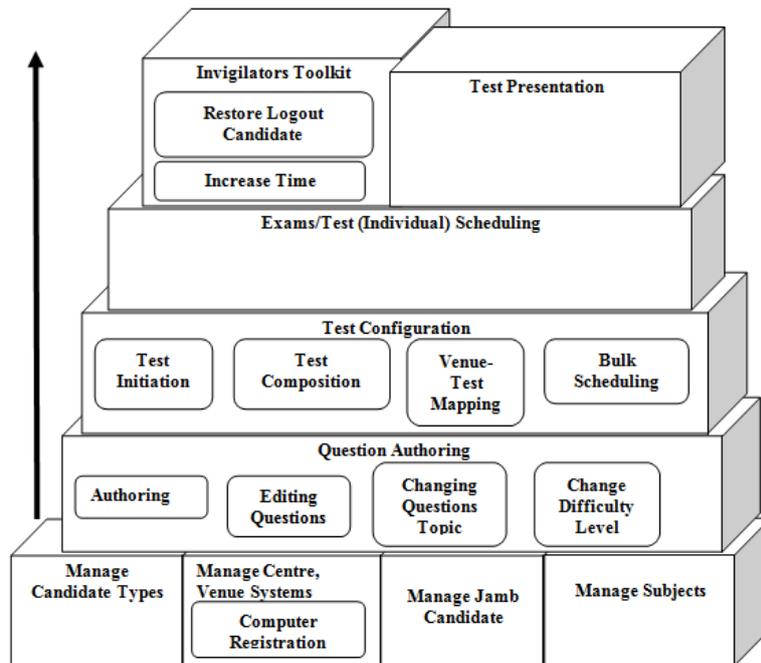
Fig. 1 Block Diagram of the TestLEAD CBT Software Module

When questions have been composed for a test then there will be need to map venues to this test through the venue-test module. Students can be scheduled also through the bulk upload candidate scheduling module provided in the configuration layer.

Individual candidate can also schedule for an exam through the scheduling layer above the configuration layer in fig. 1 above. This module allows candidate profile and candidate's choice of center to be collected and hence automatically scheduled for the test/exam with batch, date and time allocation.

At the top most layer of the block diagram describes the presentation of the test/exam to the students' on the exams date as soon as the student is logged in or on start time of the examination. In event that a student is logged out due to technical hitches, the invigilators toolkit can be used to restore the candidate/ student and also increase the candidate's time when the need arise. Also, the report module enables the admin to view reports on already taken test/exam.
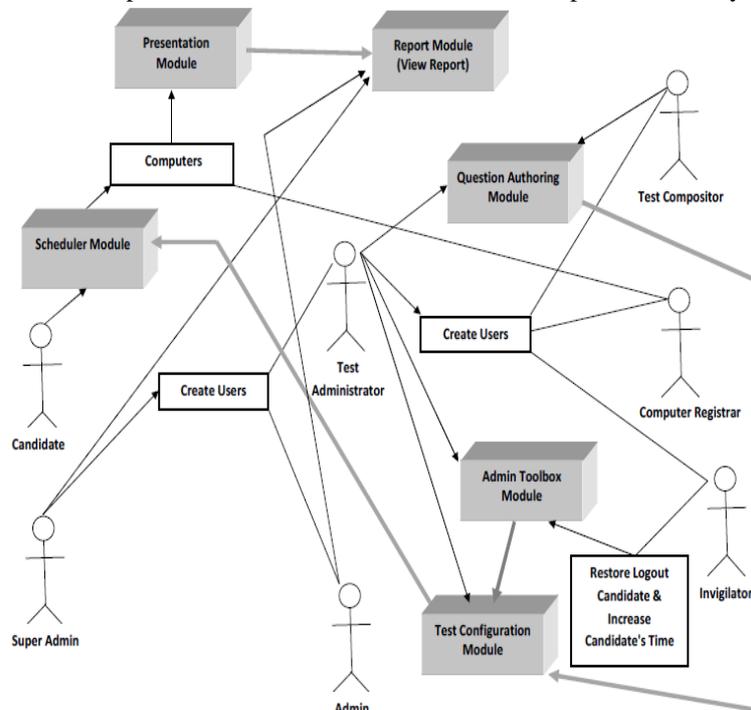

Fig. 2 TestLEAD CBT Architecture/ Users Interaction

III. TESTLEAD'S MODULES

A. Scheduling
Two forms of scheduling were assumed (i.e. individual & bulk upload of candidates id). The architecture below describe the individual scheduling process.
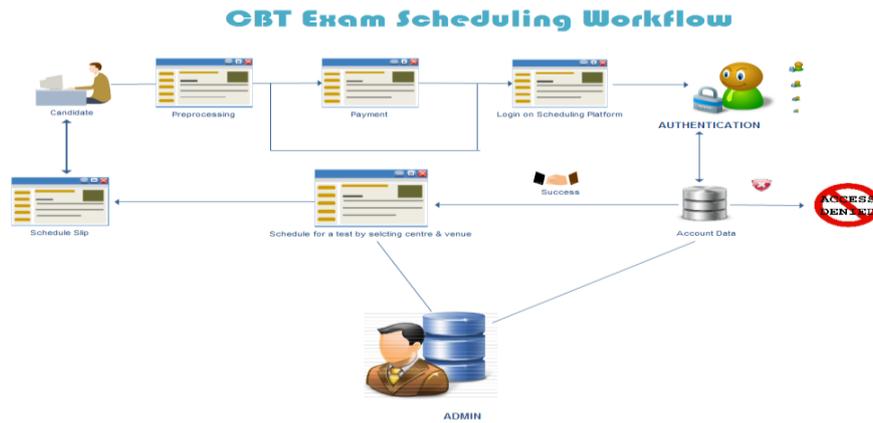
Fig. 3 Architecture of the Scheduling Module

B. Configuration

The configuration module as described above is use for necessary settings that must be made before the test can be taken.

C. Authoring

This module was designed on the assumption that questions can be authored in one of two ways. Authoring question one-at-a-time and bulk upload modes. Other interesting features of this module include editing, preview before upload, changing of topics and difficulty levels of questions etc. The module has its design architecture as shown below.
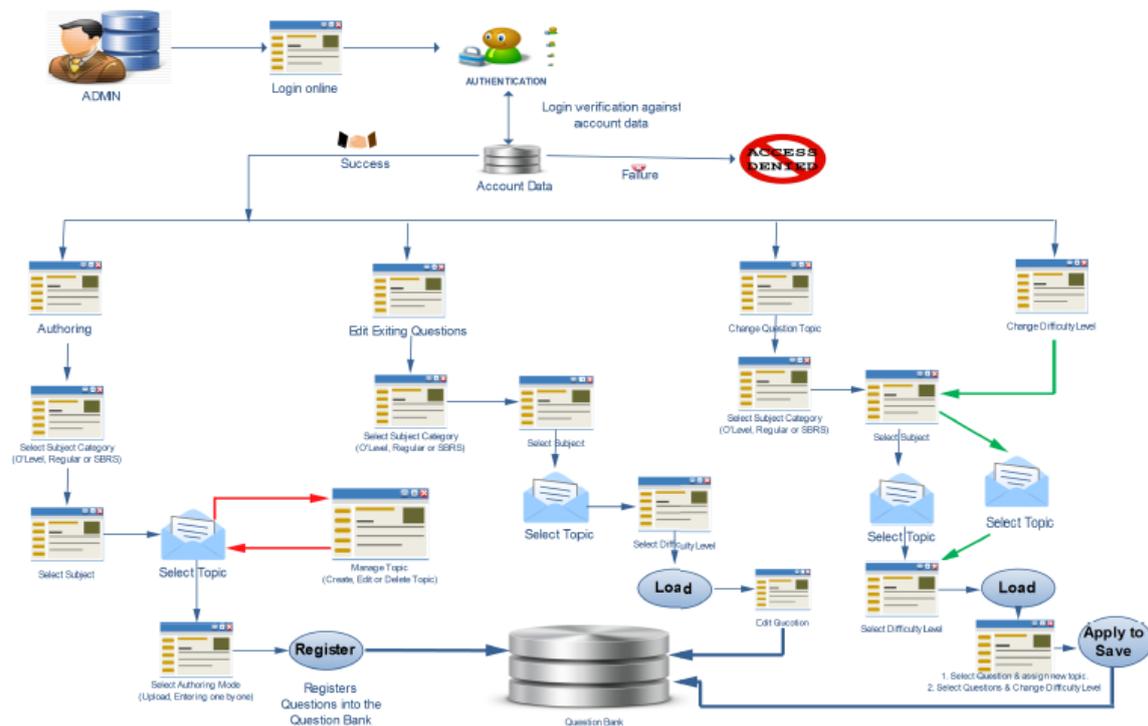

Fig. 4 Architecture of the Question Authoring Module

D. Presentation

This describes the test presentation to the candidates. It was designed on the assumption that question presentation can be linearly or Randomly presented to examinees. Other features include navigation control to enable examinees navigate to any question of their choice, preservation of presentation to each examinee for reference purpose etc.

E. Reporting

This module was designed to make flexible report viewing pattern of an already taken examination.   Interesting features of this include; viewing percentage of examinees that answered a particular question correctly, score range views, some sophisticated filters to determine what views you want etc.

F. Security Considerations

security was not left out. Each computer that will be use with TestLEAD CBT must have its MAC Address registered and store in its database. Instructor validation of examinee is also provided to avoid impersonation, invigilators toolkit to manage technical problems like power outage and other fail-safe mechanisms.

IV. USING TESTLEAD

The application covers any form of test/exam that can be taken in a typical class settings in any institution in the world. Test/exam can be configured for any course by a test administrator. Currently, the application has been deployed on abu.edu.ng/cbt and has been tested for different courses taken in the Ahmadu Bello University, Zaria Nigeria with a very large class capacity ranging from eight thousand to ten thousand students.

The application is intended to be put into use for entrance examination, continuous assessment test and semester/ sectional based examination.

V. CONCLUSIONS

We presented a modern engineered CBT application (i.e. TestLEAD CBT) putting into consideration metrics that covers a high percentage of what is required of a computer based testing application.

The application stands out to contribute in enhancing the measurement of constructs or skills that cannot be fully or appropriately captured by paper-based tests, improve measurement by increasing the precision or efficiency of the measurement process and finally will make test administration more convenient for examinees, test sponsors, or both.

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