

Computer-based Software Model for Examination Monitoring and Assessment System in Academic Environment

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ABSTRACT

This work describes the design and implementation of a computer-based examination system in cases when exam malpractice has become rampant. This report gives an application with a centralized database that can quickly locate students' details for an online assessment. Furthermore, it helps provide a workspace for mathematical calculations to be carried out. The application is a web-based application developed using several programming languages like HTML, CSS, JavaScript and PHP. The application assists in the immediate grading of students and the real-time processing of results for students.

Keywords

Computer-Based, Software, Monitoring, Examination, Academic, Environment, Calculations

1. INTRODUCTION

Examining a student's ability and understanding of a particular discipline that has been initially taught is the most widely accepted method [1]. In general, examination is used to assess the extent to which educational objectives have been met, as well as the extent to which educational institutions have contributed to the shaping of a specific environment. As a result, educators must explore and investigate alternative methods of assessing a student using a different medium in order to provide assistance to the student. On the other hand, technology has arrived and, in a positive way, has altered various aspects of people's lives, assisting humans in efficiency and accuracy. For several years, there has also been a recent increase in interest in the development and use of computer-based tests in educational assessment, particularly in different countries [2]. When compared to traditional paper-based tests (PBT), computer-based tests (CBT) have numerous significant advantages, including efficiency and immediate scoring. Furthermore, because of advanced technological capabilities, computer-based tests allow for more genuine assessments [3]. However, there are a few disadvantages to administering CBT, including (1) the need for more adequate facilities. (2) test security, and (3) backup procedures in the event of a technological failure. Exam malpractice has become too poor and boring for students in the modern era, as assumed by certain individuals, and even firms in Nigeria still go by the old fashion way of writing exams, which is Paper Based Test (PBT), and the rate at which Examination malpractice has sky rocketed in many Nigeria institutions is alarming, leading to a continuous degrading in the standard and good quality of education in the country. The purpose of a computer-based test is to determine whether or not the examinee has knowledge of the subject being tested, not whether or not the student is computer literate. [4],[5]. According to [6], HTML provides a cross-platform solution for displaying webpages on a variety of

devices such as Smart TVs, tablets, PCs, smartphones, billboards, and wristwatches. HTML5 elements are being used on a growing number of websites. Furthermore, HTML establishes new input types for unraveling web page design with built-in support for CSS and JS, which favors superior input control and validations [7]. Many assistive technological devices can include text-to-speech software as well as sophisticated technologies such as refreshable puff technology, which allows people who are unable to use a mouse or speech-to-text technology to send signals to a computer via a straw device using air pressure by sipping and puffing [8]. As a result, the first use of a computer for testing was to allow test developers to save different test documents in similar word processing software [9]. With the adoption of the Computer-Based Test (CBT) as a testing mode by the Joint Admissions and Matriculation Board around 2013, item banking became critical in test administration (JAMB). UTME and its council began the development of over 1000 test items in approximately 23 subjects that were tested by UTME from which it can withdraw items for use at a specific time. Many individuals, businesses, and organizations believe that the cost of implementing and even designing a computer-based assessment will be less expensive than the old-fashioned paper and pencil test [10]. The development of an efficient, affordable, and user-friendly software is what makes this study unique. The main goal, however, is to create and implement an online computer-based test system that will provide a different workspace or work sheet where students can solve mathematical calculations.

2. MATERIALS AND METHODS

This proposed system was designed and developed using an iterative process, which will allow the system to deliver faster and respond to change more effectively. Agile software development is a software engineering methodology. Many procedures are carried out in this process in order for a software to be fully developed. These procedures include developing [11], delivering, and testing higher-quality software at a low cost and in a short amount of time. Figure 1 depicts a flow diagram of how agile-developed software products function.

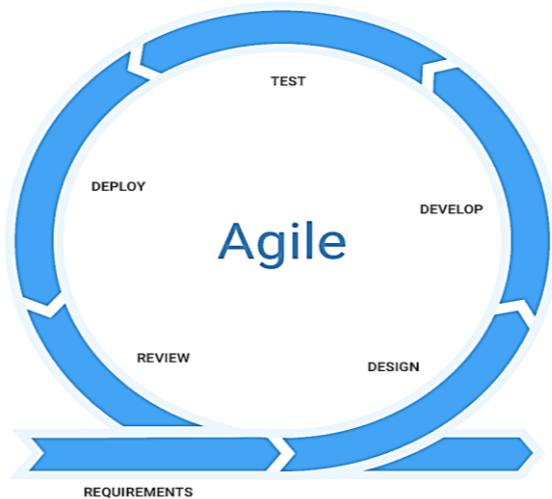


Fig 1: The software development life cycle (Agile model)

2.1 Database Structure of Proposed Model

The database was designed using a relational database model, and a relational database server was used to organize the database for this software (MYSQL). This database contained field names such as student id, student exams id, course name, lecturer, and so on. This data is entered by students or lecturers and is managed by the administrator from the back end.

In Fig 2, after filling out and submitting registration information, the individual would receive a code (Email code). With this code, students can gain access to the system and use the platform for either downloading materials or taking assessments. However, if the student is not new to the application, he/she is required to enter his/her email and password after authentication to determine if the student was granted login privileges. If the authentication is found to be false, the student must restart the entire process; however, if the authentication is found to be true, the student can carry out his/her CBT assessment from any location.

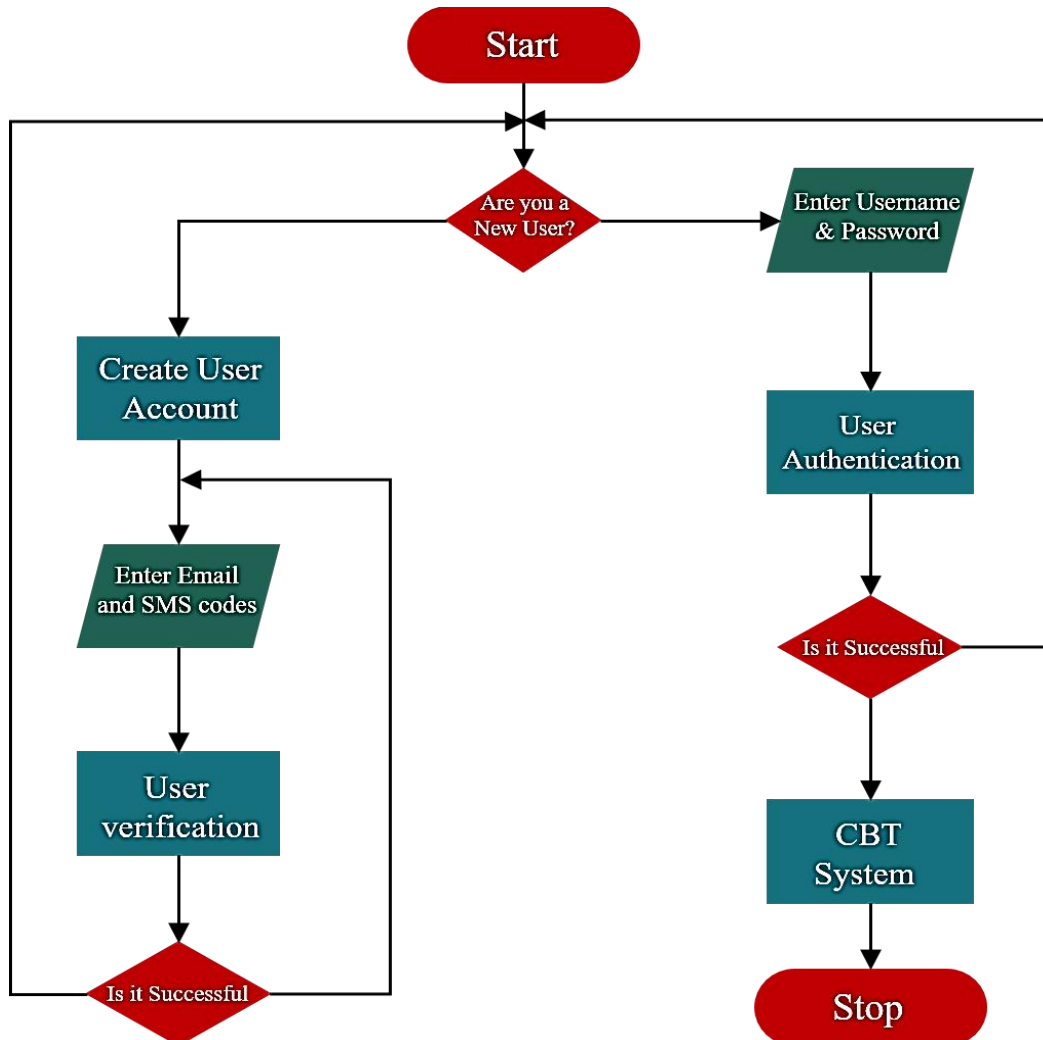


Fig 2: Program Flow Chart of the Proposed System

2.2 Diagram of Proposed System

The use case pays more attention to how the system behaves from an external and superior standpoint. The use case is created during requirement gathering and is refined and corrected as it is reviewed (by stakeholders) during analysis.

Figure 3.5 also depicts a set of use cases, relationships, and actors. It is important to note that these actors are external bodies or individuals who interact with the proposed system, such as administrators and users, customers, and so on, or a central database-like system.

2.3 Architecture of Proposed System

The system architectural design is three-tiered, as illustrated in Fig 4. The presentation tier is designed in HTML, while the middle tier connects the presentation tier and data tier; the

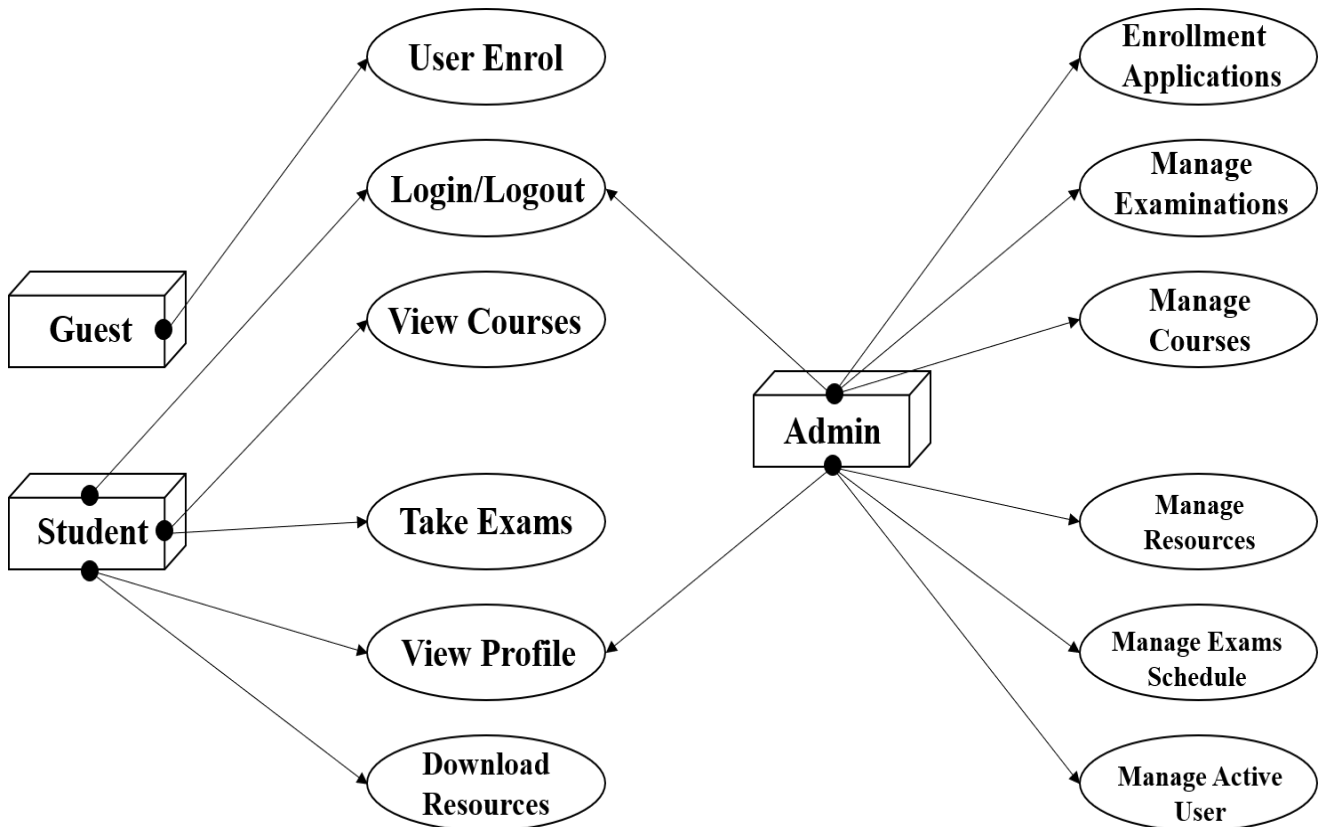


Fig 3: Diagram of the Proposed System

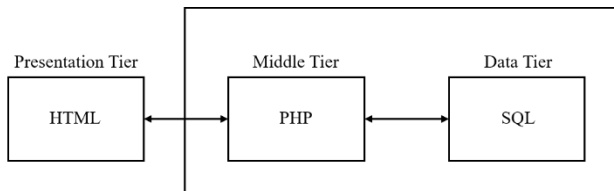


Fig 4. Architecture of Proposed System

3. Results and Discussions

3.1 Software Requirement

- **HTML5:** Hyper Text Mark-up Language is a front-end browser language for building the skeletal framework of all web application.
- **CSS3:** Cascading Style Sheet is a front-end styling tool for styling the web page, it is used to beautify and give structure to the elements of HTML.
- **JavaScript:** a front end that enables users interact with the web page.
- **PHP:** Hypertext Preprocessor (PHP) is a sever side language responsible for data manipulation between the web page and the database, that is, it stored data into the database, it reads data from the database, it updated and deletes data from the database among others.
- **JQuery:** A JavaScript library that makes it easier to use JavaScript.
- **AJAX:** Asynchronous JavaScript and XML (AJAX) enables quick interplay with the server without loading the web page.

middle tier is unique and is also known as the application tier because it is designed in PHP and runs only on the server, not to mention that the data tier is also the part of the system that is responsible for storing data, which is the database.

3.2 Proposed Programming Language

XAMPP is an acronym for cross-platform, Apache, MySQL, PHP and Perl, this software connects the user interface with the database while the application is being developed on a local machine.

Table 1. Hardware Requirements for the Proposed System

Component	Minimum	Recommended
Processor	1.9 gighertz (GHz) x86-bit or 64-bit dual core processor with SSE2 instruction set	3.3 gighertz (GHz) or faster 64-bit dual core processor with SSE2 instruction set
Memory	2GB RAM	4GB RAM
Display	Super VGA with a resolution of 1024 x 768	Super VGA with a resolution of 1024 x 768

3.3 Development Environment

The IDE is Sublime Text, and the PHP framework is Code Igniter, which is used to execute the client side and web service area of this web application. The sublime text editor is a well-known IDE for creating small and robust applications all over the world. It is well-known for its ease of integration with programming technologies such as HTML, CSS, JavaScript,

and PHP. It is quick and has an auto complete integration that makes coding a breeze.

Code igniter is a PHP framework for creating large and robust applications such as social media and CBT applications. It integrates databases and other technologies required for development quickly and seamlessly; it includes a small wizard within the system for easy integration and creation of CSS documents, as well as properly structuring HTML documents.

The framework includes features such as project visualization, code highlighting, syntax correction, and others. The Hypertext Pre-Processor (PHP) was chosen as the scripting language for this application primarily because (1) it integrates well with the MySQL database, (2) it includes an XML Parser, (3) it does not consume excessive server resources during page rendering, and (4) it has simple syntax flow support..

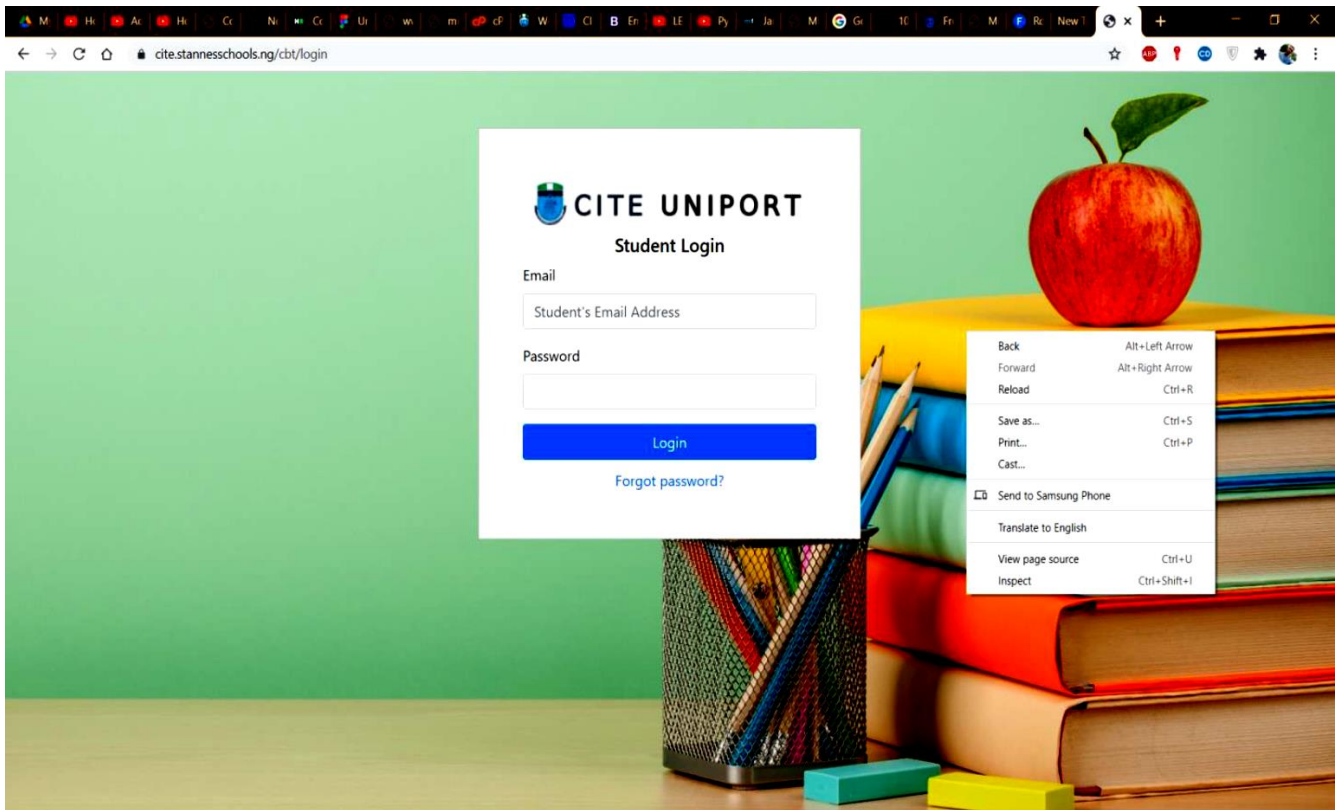


Fig 5: Accessing the Chrome Web Developer Tool

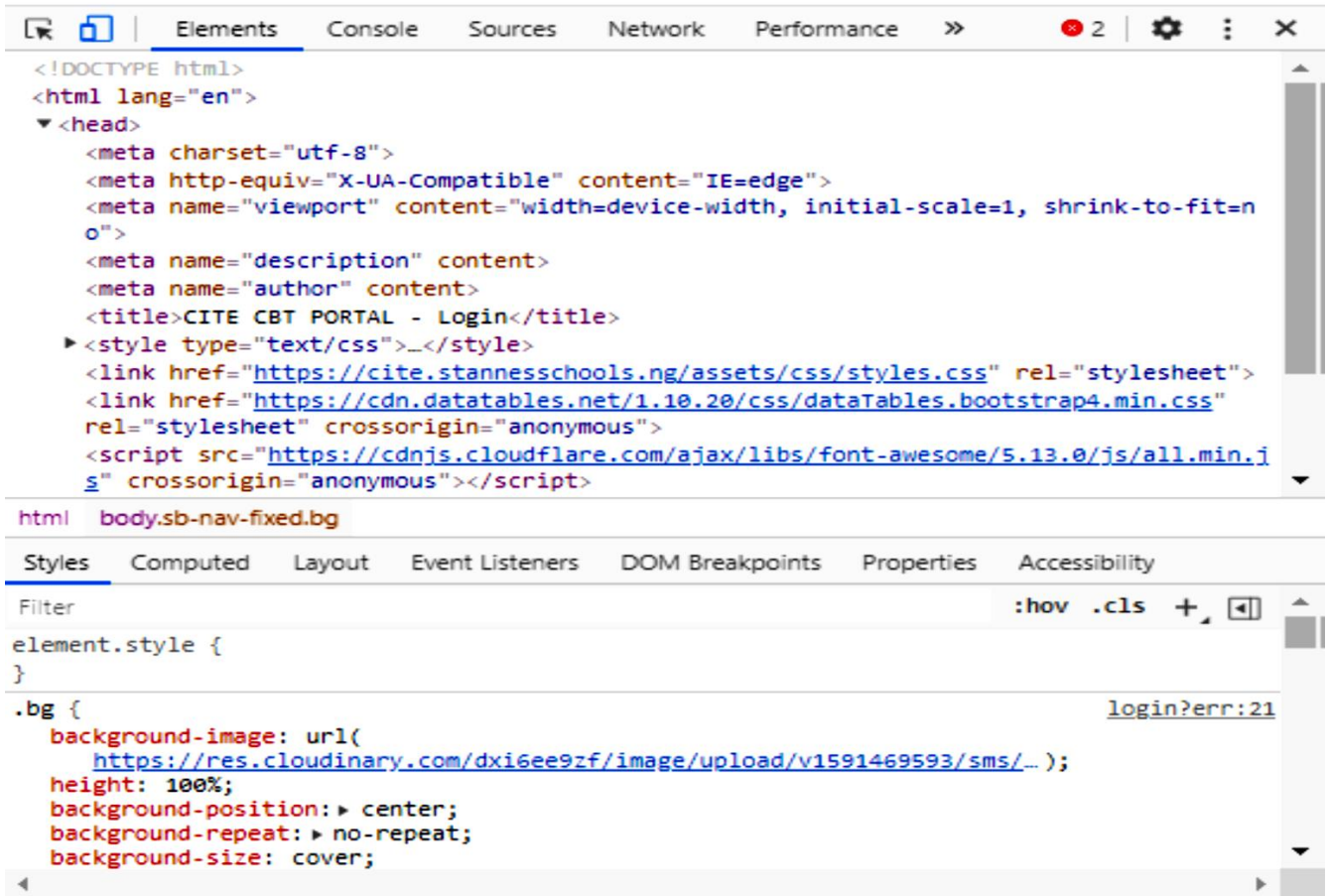


Fig 6: Chrome Web Developer Debugging Technique for CSS

The styles, image sizes, scripts, and so on are displayed using Chrome DevTools. The system can be debugged in order to identify the errors on the page. Furthermore, the styles can be toggled on or off, or changed entirely to see what effect it has on your website.

3.3.1 Implementation

The layer for presentation, which is the user interface, is always designed in the program architecture using HTML, while the application layer is designed using PHP, which runs on the server, and the data layer is designed using MySQL server. The computer has the XAMPP control panel and the MySQL database installed.

3.3.2 Testing protocol

To test the codes, the unit testing approach was chosen. The test procedure that was chosen is as follows: (1) the module interface is tested to ensure that information flows properly into and out of the program; unit under test (2) the local data structure is examined to ensure that data stored temporarily maintained its integrity throughout all steps in an algorithm's execution (3) every statement, including error handling paths, is tested simultaneously.

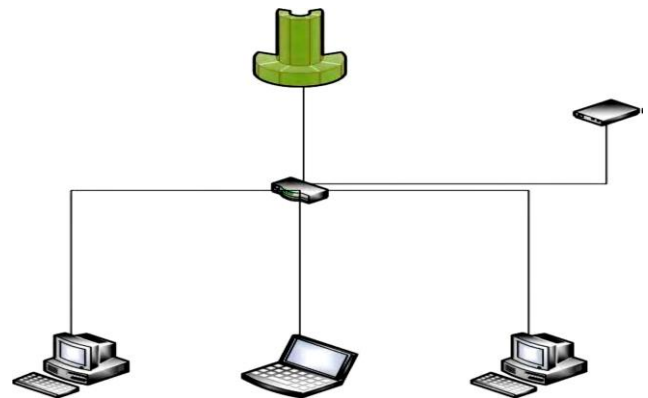


Fig 7: Implementation Architecture

3.3.3 Output

Fig 8 illustrates the landing page of the proposed CBT application; this is the first page an administrator sees after entering his or her credentials to manage the portal where students can take tests and download materials.

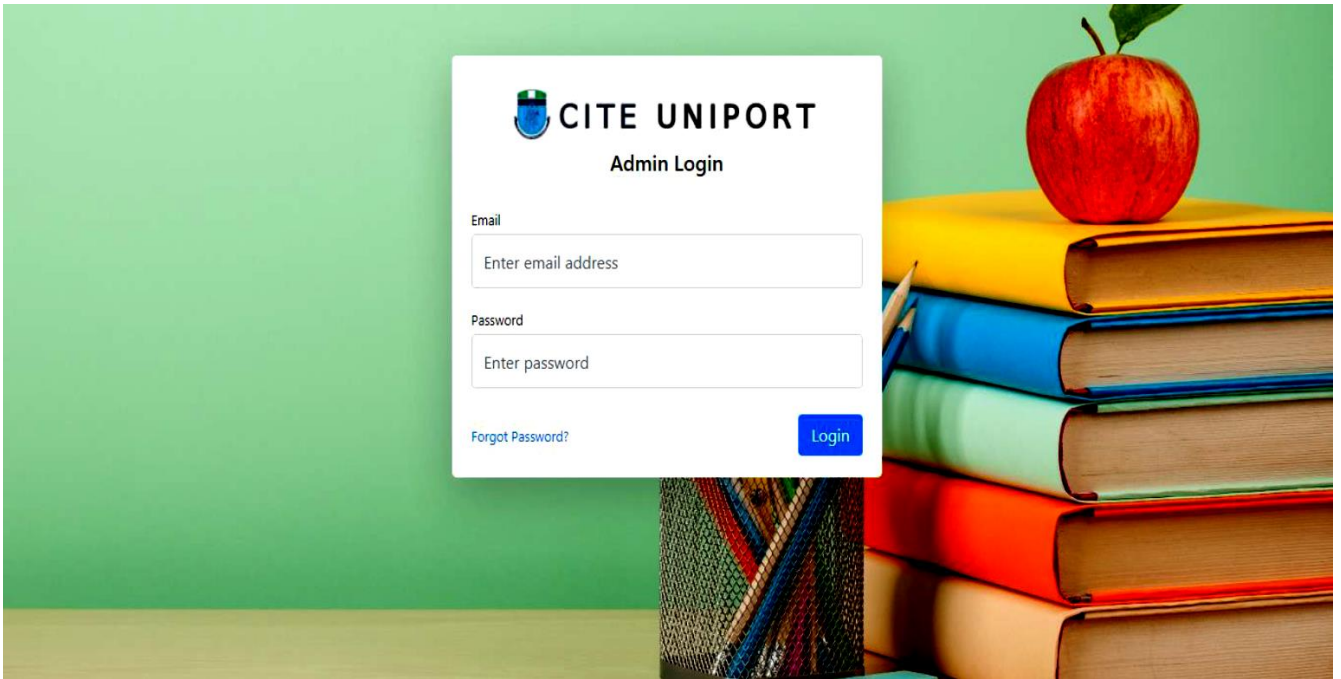


Fig 8: Landing Page for Admin

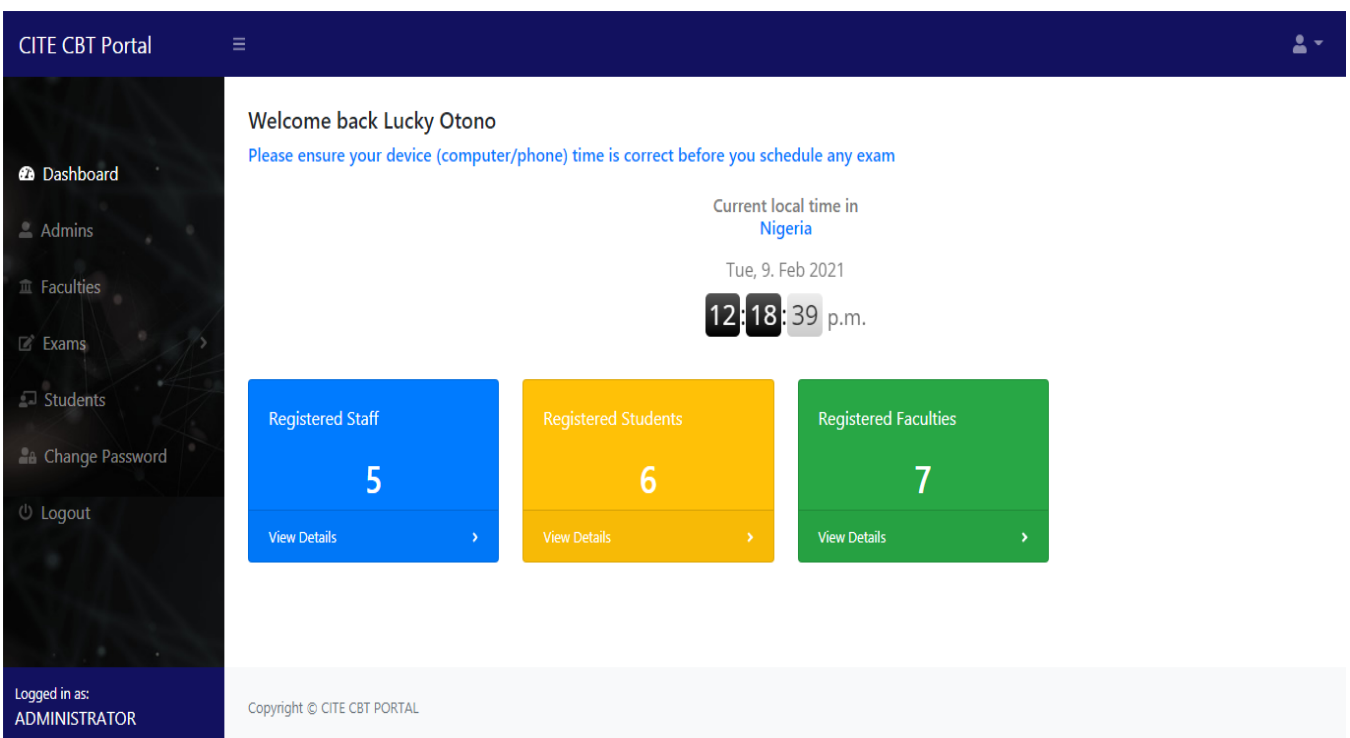


Fig 9: Dashboard for Admin

Fig 9 depicts the administrator's dashboard, where the admin can choose to sign out or continue administering tests to users. This is a critical page because an administrator cannot navigate the application without it.

Departments in Science faculty

+ New Department
< Back to Faculties

Show entries
Search:

SN	DEPARTMENT NAME	ACTION
1	Physics	Edit Department Manage Levels
2	computer science	Edit Department Manage Levels

Showing 1 to 2 of 2 entries

Previous
1
Next

Fig10: Dashboard for adding student's faculty

1	Agriculture	Mechanical	Year 2	Engineering thermodynamics	50 Minutes	Exam is Not Scheduled	Schedule now	View and Edit Submissions
2	Science	Physics	Year 1	Fundamentals of Physics	30 Minutes	Exam is Not Scheduled	Schedule now	View and Edit Submissions
3	Agriculture	Mechanical	Year 4	mechanical engineering	0 Minutes	Exam is Not Scheduled	Schedule now	View and Edit Submissions
4	Engineering	master	Year 1	Fundamentals of Physics	30 Minutes	Exam is Not Scheduled	Schedule now	View and Edit Submissions
5	Engineering	chemistry Department	Year 1	Physics	60 Minutes	Sat 6th Feb 2021 - 7:58 PM	Reschedule	View and Edit Submissions

Fig 11: Table for scheduled exams

Fig 11 depicts registered exams that students can access based on the time appointed or scheduled by their instructors; exams can be rescheduled for a different date, such as the time for the appointed exams. The number of students who completed and submitted the assessment can also be viewed, and their scores can be obtained.

Exam Question for computer science fundamental of Computer literacy

The screenshot displays a user interface for creating exam questions. At the top, there are two input fields: 'Exam Duration in minutes' with the value '33' and 'Exam Instructions' with the text 'do not use any material for this exams'. Below this, a section for 'Question 1' is shown. It includes a 'Question Type' dropdown menu set to 'Objective', a 'Marks Obtainable' input field with the value '5', and a text area containing the question 'what is computer based test application used for'. To the right of the text area is a blue 'Add Image' button and a red 'X' button. Below the question, there is a list of categories: 'Exams' (checked), 'Movies', and 'Disco', each with a checkbox and a red 'X' button.

Fig 12: Platform for creating questions

In Fig. 12, the administrator has the right to establish exams for the students, which can be objective, subjective, or theoretical, and marks that can be obtained during the exams can then be added. Images can also be added to the questions based on what the tutors think his students should know.

The CBT application has made it simple for tutors to eliminate exam malpractice; he is looking to assess students, which is nearly inaccurate when using the old method of administering assessments (PBT). The data collected from students is used to either increase or decrease their CGPA. The computer-based test application is primarily designed for students [12], but it is also used by other skilled users for various types of assessment, such as human resource management (HRO) for conducting job interviews [13]. However, due to the recent increase in exam malpractice, the web administrator now employs a Robotic timer, which is used to double the time spent outside of either the CBT application or Google where mathematical calculations are performed. Other existing CBT applications are excellent, but the majority of them are slow and complicated for most users; they are also difficult for new administrators to locate a specific data from the database. This is why a proposed system is needed, one that can address the shortcomings of the current system. Application of an improved algorithm that includes objective, subjective, and theoretical components, in accordance with the works of [15]. This is in contrast to the existing system, which employs only objective techniques. It is also worth noting that, based on the architecture design, the proposed system has additional features not found in the existing system. Features such as the addition of Google sheet and Google document are important [16] to assist students in calculating and solving mathematical equations, which improves the application's user friendliness and navigation.

4. CONCLUSION

This research presents the development of a computer-based test software, many authentication schemes have been explored for the mode authentication, because the goal of the system was to develop a model with enhanced security features to avoid

exam malpractice; and also, an application that provides a different work space or work sheet where mathematical calculations can be solved. This system was built with Hypertext Preprocessor, Hypertext Markup Languages (html), Cascading Style Sheets (CSS), JavaScript, and My Structured Query Language as the database backend. This ensures that the application is neither cheap nor robust, and that it can run on a variety of platforms. The system has the potential to drastically reduce examination malpractice because applicants are properly authenticated online in real-time prior to taking the examination, and the integrity of the results could also be improved because applicants have access to immediate result checking. As a result, in the current era of distance education, which includes online learning, which has been prompted by the adoption of ICT, the Examination has the overall advantage of being simple or easy to administer, and also has the ability to provide students with instant results, easy verification, absences of paper work, and long-time tangled in marking examination scripts, which in some cases are open to errors and misplacement of some scripts due to the large volume of scripts that has to be marked and accessed. The system will also save the instructor from going through the pains of grading a specific student, and the quick access to results will encourage serious distance education systems.

5. REFERENCES

- [1] Olatoye, R. A. (2009). Influence of computer anxiety and knowledge on computer utilization of senior secondary school students. *Electronic Journal of Research in Education Psychology*, 7(19), 1269-1288.
- [2] Azimi, M. (2018). The relationship between anxiety and test-taking C-test and cloze-test. *MOJES: Malaysian Online Journal of Educational Sciences*, 4(1), 30-42.
- [3] Gilbert, L., Whitelock, D., & Gale, V. (2011). Synthesis report on assessment and feedback with technology enhancement.
- [4] Huff, K. L., & Sireci, S. G. (2001). Validity issues in computer-based testing. *Educational Measurement:*

Issues and Practice, 20(3), 16-25.

- [5] Leichsenring, F., & Steinert, C. (2017). Is cognitive behavioral therapy the gold standard for psychotherapy?: The need for plurality in treatment and research. *Jama*, 318(14), 1323-1324.
- [6] Ratha, A. K., Sahu, S., & Meher, P. (2018). HTML5 in web development: a new approach. *International Research Journal of Engineering and Technology (IRJET)*, 5(3), 551-554.
- [7] Garas, S., & Hassan, M. (2018). Student performance on computer-based tests versus paper-based tests in introductory financial accounting: UAE evidence. *Academy of Accounting and Financial Studies Journal*, 22(2), 1-14.
- [8] Thurlow, M., Lazarus, S. S., Albus, D., & Hodgson, J. (2010). Computer-Based Testing: Practices and Considerations. Synthesis Report 78. *National Center on Educational Outcomes, University of Minnesota*.
- [9] Weiss, D. J. (2013). Item banking, test development, and test delivery.
- [10] Newton, C., Acres, K., & Bruce, C. (2013). A comparison of computerized and paper-based language tests with adults with aphasia.
- [11] He, Q., & Tymms, P. (2004). The development of a computer assisted design, analysis and testing system for analysing students' performance.
- [12] Cantillon, P., Irish, B., & Sales, D. (2004). Using computers for assessment in medicine. *Bmj*, 329(7466), 606-609.
- [13] Retnawati, H. (2015). The Comparison of Accuracy Scores on the Paper and Pencil Testing vs. Computer-Based Testing. *Turkish Online Journal of Educational Technology-TOJET*, 14(4), 135-142.
- [14] Khoshima, H., & Toroujeni, S. M. H. (2017). Computer-Based Testing: Score Equivalence and Testing Administration Mode Preference in a Comparative Evaluation Study. *International Journal of Emerging Technologies in Learning*, 12(10).
- [15] Odeh, A. H. (2019). Analytical and Comparison Study of Main Web Programming Languages–ASP and PHP. *TEM Journal*, 8(4), 1517-1522.