

## Using CBT System For The Conduct of GST Examinations in Adamawa State University (ADSU)

Sarjiyus, O.

Department of Computer Science, Adamawa State University, P.M.B. 25, Mubi Nigeria.

Corresponding Author: Sarjiyus, O.

**ABSTRACT:** Paper and pencil test (PPT) or paper based examination systems seem to be the commonly used method for students' assessment in institutions of higher learning in Nigeria. However, this method of examination is characterized by so many challenges. These challenges include high cost of printing papers, shortage of manpower, examination malpractice, and human errors during marking, omission of students result, inadequate examination venues and invigilators. To address these challenges, there has been a shift from paper based to computer based testing (CBT) systems, taking advantage of the ever expanding ICT capabilities across the globe. Nigeria has taken a leap and has adopted the use of computer based testing (CBT) systems. However, these systems are limited to only admission and screening examinations. Essentially, this study proposes the use of computer based testing (CBT) as a method not only for admission processes but also to be extended to regular semester examinations, with emphasis to courses having large students population such as GST in Adamawa State University (ADSU). A prototype application system has been developed using VB.Net and MySQL as the database.

**Keywords:** Examination, ADSU, ICT, Nigeria, computer Based Testing.

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### I. INTRODUCTION

Information and Communication Technology (ICT) has become, within a very short time, one of the basic building blocks of modern society. Many countries now regard understanding it and mastering its basic skills and concepts as very crucial in education. This is because it adds value to the processes of learning and to the organization and administration of learning institutions. It encompasses different types of technologies, which are utilized for capturing, processing and transmitting data and information, using computer facilities. It is an umbrella term that includes communication devices or application, encompassing radio, television, cellular phones, computers, network, hardware and software, satellite systems and so on, as well as the various services and applications associated with them [10]. Thus, ICT focuses specifically on the application of these new technologies in an educational context and environment, and serves as a tool for supporting the various components of education. Such components include, among others, teaching and learning, resources management (human, material, financial resources) and admission and examination processes also known as learning assessment. One specific form of ICT for assessment is the Computer-Based Testing (CBT), also known as Computer-Based Assessment or e-assessment/testing. It is a method of administering tests in which the responses are electronically recorded, assessed, or both. It is commonly available for several admissions tests throughout the developed countries. according to [2], computer based examination is a method of accessing students using a computer as an alternative to paper delivery, storing of response, marking of response and providing a report of results of the examination. Computer-based tests offer several benefits over traditional paper-and-pencil or paper-based tests. Technology based assessment provide opportunities to measure complex form of knowledge and reasoning that is not possible to engage and assess through traditional methods [2]. In Nigeria, employers now conduct aptitude test for job seekers through electronic means; the universities and other tertiary institutions are registering and conducting electronic examination for their students through the internet and other electronic and networking gadgets. Similarly, different examination bodies in the country such as West Africa Examination Council (WAEC), National Examinations Council (NECO), National Business and Technical Examination Board (NABTEB), and National Teachers Institute (NTI), among others register their students through electronic means [8]. Computer and related technologies provide powerful tools

to meet the new challenges of designing and implementing assessments methods that go beyond the conventional practices and facilitate to record a broader repertoire of cognitive skills and knowledge [6].

The paper and pen (manual) method of writing examination, which has been in existence for decades, may not be appealing for use because of the problems usually experienced including examination venue capacity constraints, lack of comfort for examination candidates, delay in the release of results, examination malpractices, cost implication of printing examination materials and human error. This brings about the need for automation of the examination system [14]. However, the computer based examination system in Nigeria tends to focus more on assessment to admit or screen students for entrance into Nigerian institutions [8]. Also the country is still yet to fully implement the computer based examination system in all aspect of the examination process by moving beyond admissions exams [15]. In this study, we propose the use of computer based system as a method for assessing course examinations. A prototype scalable software system has been developed using Vb.Net and MySQL, as the database.

## II. REVIEW OF RELATED LITERATURE

There have been a number of researches focusing on the development of automated examination systems and electronic learning information systems. [12] Developed a novel online examination system based on a Browser/Server framework which carries out automatic grading for objective questions in computer related topics such as programming, Microsoft Windows operating systems and Microsoft Office applications. It was successfully applied to the distance evaluation of basic operating skills of students offering computer science in some Universities. [4] presented a web-based educational assessment system by applying Bloom's taxonomy to evaluate student learning outcomes and teacher instructional practices in real time. The system performance is rather encouraging with experimentation in science and mathematics courses of two local high schools [5] developed an online website for tutoring and e-examination of economic courses. This novel software tool was used for online examination and tutorial application of the syllabus of economic courses so as to ensure that students study all the concepts of economics. So, the proposed software is structured from two major modules: The first one was an online website to review and make self-test for all materials of economic course. The second part is an online examination using a large database bank of questions through it the level of students can be evaluated immediately and some statistical evaluations can be obtained. The developed software offers the following features:

1. Instructors could add any further questions to maximize the size of the bank of questions.
2. Different examinations for each student with randomly selected questions from the question banks can be done.
3. Different reports for the instructors, students, classes etc. can be obtained.
4. Several students can take their exams simultaneously without any problem inside and outside their campus.

The proposed software has been designed to work based on the client server architecture. [1] proposed a model for electronic examination in Nigeria which enforces all applicants to be subjected to online entrance examination as a way of curbing the irregularities as in the Joint Admissions Matriculation Board (JAMB) examinations. This model was designed and tested in Covenant University, one of the private universities in Nigeria. Findings revealed that the system has the potential to eliminate some of the problems that are associated with the traditional methods of examination such as impersonation and other forms of examination malpractices. [9] Developed a web application where tests in multiple choice formats could be taken online and graded immediately. The web application relies solely on Microsoft developed technologies. It runs on the Microsoft.net framework, uses the ASP.NET web server, C# as the intermediate language, ADO.NET to interact with the relational database and Microsoft SQL server as the relational database. [7]. developed an online examination system that carry out the examination and automatic grading for students examinations. The system facilitates conducting examinations, collection of answers, automatically marking the submissions and production of reports for the test. It supports many kinds of questions. It was used via Internet and also suitable for both local and remote examination. The system could help lecturers, instructors, teachers and others who are willing to create new examinations or edit existing ones as well as students participating in the examinations. The system was built using various open source technologies such as PHP, HTML and MySQL database engine. An automatic grading module was developed to incorporate different examination and question types. The system was tested in the Mansoura university quality assurance center. The test proved the validity of using this kind of web based systems for evaluating students in the institutions with high rate of students. The limitations of the above systems are enormous: these systems are domain / application area-specific, so cannot fit into all deployment area needs; not well secured in terms of data security and integrity; do not present a generalized model for adoption by any user willing to migrate to the *e*-examination platform; most of the systems are stand-

alone applications that only run on distributed networks and thus access is limited to the networked geographical domain. However, in this paper, these limitations are well addressed.

### III. THODOLOGY

Qualitative data collection was done in Adamawa State university (ADSU) where data was collected using the interview method with staff and students of the university in the month of July august 2015. The choice of ADSU for the purpose of this research was due to the reality on ground (due to the ever increasing student population in GST) on the need to embrace the CBT method. The authors observed that the current examination process used by ASDU GST unit is the traditional paper based method. Findings after careful analysis shows clearly that majority of the staff and students find the examination process as time consuming and prone to all forms of examination misconduct. Hence, the choice of a new system to automate the existing exam processes and address the aforementioned setbacks. Six departments that have been engaging the PPT or paper based examination (for GST) were selected for this study in ADSU; where twenty five (25) students (18 males, 7 females) were selected from each department for the interview and questionnaire purpose. Also eight (8) lecturers were selected from each department for interview on their students' performance in the GST courses. Three (3) departments were selected from each faculty in ADSU, which include Computer Science, Physic, Biology, Economics, Public Administration, Accounting, Fisheries, Crop Science, and Agric. Extension.

#### 3.1 Interviews and Questionnaire

The interview was conducted for the students who have been used to the PPT or paper based examination method. The questionnaire were also distributed to both students and staff members whose students have for long been evaluated using PPT. The questionnaire consisted of four (4) essay questions and 20 scaled items concerning the examinees' acceptance of the CBT method and its usability. A scale from 1 (total disagreement) is to 5 (total agreement) was used. The main aim of the research is to determine the acceptability or otherwise of the existing PPT system of examining students' in GST courses in ADSU and come up with a new design (CBT or e-examination) based on the deficiency of the existing system. The result of the interview is analyzed in the table below:

Students				Lecturer		
Department	Good/ Accept (26)	Fair/ Rejection (26)	Indifference (26)	Good/ Accept (8)	Fair/ Rejection (8)	Indifference (8)
Comp/sci.	8	18	-	1	7	-
Physics	13	13	-	3	5	-
Geography	8	16	2	2	5	1
Economics	8	17	1	3	3	2
Public Admin	8	18	-	2	6	-
Accountancy	6	20	-	1	7	-
Fishery	4	20	2	2	6	-
Crop Science	4	16	6	2	5	1
Agric. Extension	8	16	2	3	5	-
<b>Total</b>	<b>67</b>	<b>154</b>	<b>13</b>	<b>19</b>	<b>49</b>	<b>4</b>

**Table 1:** The Questionnaire.

#### 3.2 Analysis of the Interview Result

From the table above, it has been discovered that out of the 234 students interviewed, 67 students accept that the present PPT examinations method for GST courses is good enough. 154 students reject the use of the existing system and are demanding for a change to e-exams, while only 13 students show indifference to the interview. Also, out of 72 lecturers interviewed, 19 are comfortable with the existing PPT system while 49 saw the need for the e-exam system. Only four (4) lecturers did not respond to the questions. It can therefore be deduced from table 1 above that majority of the students and staff have preference for e-exams to the manual PPT or paper based methods of conducting GST examination in ADSU.

From the above;

1. Acceptance/good implies that the existing PPT or paper based method is accepted
2. Rejection/fair implies that the existing PPT or paper based method is not accepted.

### **Challenges of the Existing System**

The mode of student's assessment in ADSU is the traditional PPT method. In this method, students are assessed using paper based method on cognitive ability. This method of assessment has imposed serious limitation. E-examination can be used to assess cognitive and practical abilities. Cognitive skills are assessed using e-testing software; practical skills are assessed using e-portfolios or simulation software [3].

At present, the traditional paper based or PPT method used in ADSU for assessing students in GST and other large courses is characterized by different forms of examination malpractices such as bringing in unauthorized material, writing on currency notes and exam cards, spying of other candidates work in examination hall, substitution of answer booklet sheets and change of examination scores or grades. Others include impersonation, leakage of questions to students before the examination, body writing or tattoo in which students especially females write on hidden parts of their bodies.[13] Corroborated this by identifying the PPT with so many problems such as; Tedious processes as the examination is characterized by a large number of students and marked manually. Other challenges include subjective scoring and possible manipulation of results and late release of results among others.

## **IV. THE PROPOSED SYSTEM**

The university can choose to use Internet or use intranet set up within the university environment the intranet can be set up in e-exams centers containing 50 to 250 computers system and a server.

### **Architecture of the Proposed System**

A three tier architecture comprising the presentation tier, the logic tier and the database tier. The presentation tier offers the interface to the user, the logic tier serve as the middleware that is responsible for processing the user's requests/queries, while the database tier serves as the repository of a pool of thousands of questions. It also consists of other modules for authentication (using user name/registration number and password) and results computation.

### **Method of Preparing Questions**

The first and most important step in preparing the e-examination questions is to ask the course lecturer to submit the questions to the administrator at the center via the faculty exam officer at most a week before the commencement of the actual examination.

The second step involves the administrator entering the pool of questions into the database. Finally, the timing for the examination is set.

### **Development Life Cycle of the New CBT System**

The waterfall model was adopted in the design methodology of this research, and the model views the process of software development in five steps. In this choice, all activities in each step will be completed before crossing to the other. The following steps are involved in the waterfall model.

1. Requirement analysis and definition.
2. System and software design.
3. Implementation and testing
4. Systems testing
5. Maintenance

**Requirement Analysis and Definition:** In this step the user (in this case, students and lecturers) of the system were consulted to elicit certain information concerning the new system in a bid to establish concrete goals, requirements and services that the end user expects from the system. This involved proper definition of the nature and scope of the problem. The problem upon which this project is based is the design and implementation of a computer based tests (CBT) system that is completely devoid of the setbacks posed by the existing PPT or paper based method of writing GST examination.

**System and Software Design:** The requirement specifications from the first step above were studied and a system design was prepared to aid in specifying hardware and software requirements and also help to define the overall system architecture.

This includes the use of Data flow Diagrams (DFD), activity diagram and UML Use Cases Diagram.

**Implementation and Testing:** This phase involves the actual development of the system. It is in this phase that the graphical user interface (GUI) is designed and the model is implemented using Vb.Net and the database was designed using MySQL server.

**System Testing:** This is the phase in which every unit of the program is tested and integrated to function as a complete system and to ensure that it works in accordance with the required user specification.

**Maintenance:** This phase is the final stage of development where all the necessary maintenance activities were carried out in an effort to see that the software continues to be operational even in an event that a new development emerges in future.

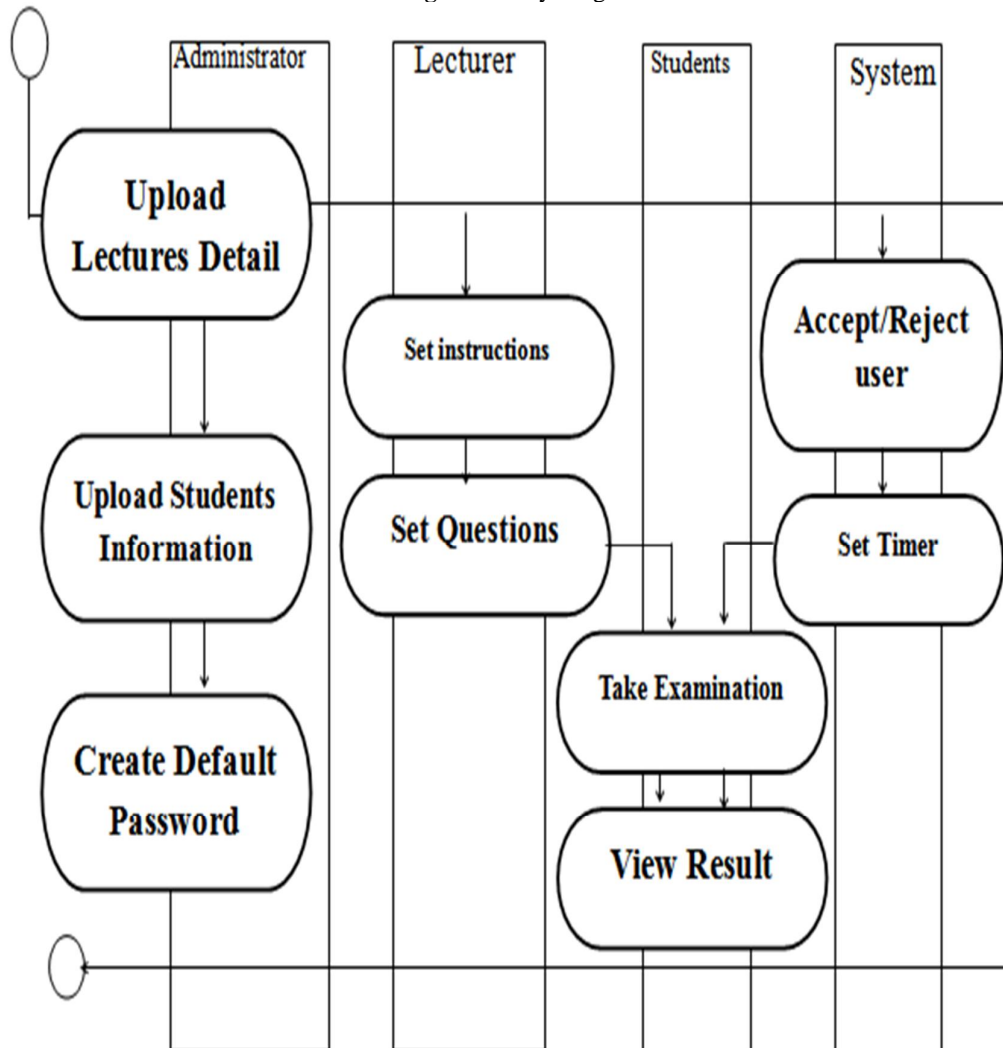
**Designing the CBT System**

The design of the system has been carried out using the activity diagram, Data flow diagram (DFD), UML use cases and entity relationship (E-R) diagram. All in an effort to capture the basic functionalities of the CBT system.

**Activity Diagram for the CBT system**

Essentially, an activity diagram is a graphical representation of the workflows depicting stepwise activities and actions which support choice, interaction and concurrency in the unified modeling language (UML). Activity diagram can be used for describing the operational step by step workflows of the basic functionalities in a system. Essentially, an activity diagram shows the overall flows of control in a system.

Fig 1: Activity Diagram



**Data flow diagram (DFD) for the system**

Data base flow diagram (DFD) uses very limited number of primitive symbols to represent functions performed by a system and the data flow among the functions. Starting with a set of high-level functions that a system performs, a DFD model hierarchy represents various sub-functions. The DFD shown in fig. below displays the relationship among the functionalities in the CBT system, the entity STUDENT can take examination or view result after he or she has gained access to the system (valid registration). The entity, LECTURER can upload examination in the CBT database using any preferred format, set the exam question instruction and configure the correct options or set of options for the question. The entity ADMINISTRATOR has the responsibility of inserting students, lecturer ansetting the default password for the users of the system. The entity, SERVER is responsible for authenticating the users of the system and provides the timing functionality for the examination. The system is designed to log off upon expiration duration for the exams.

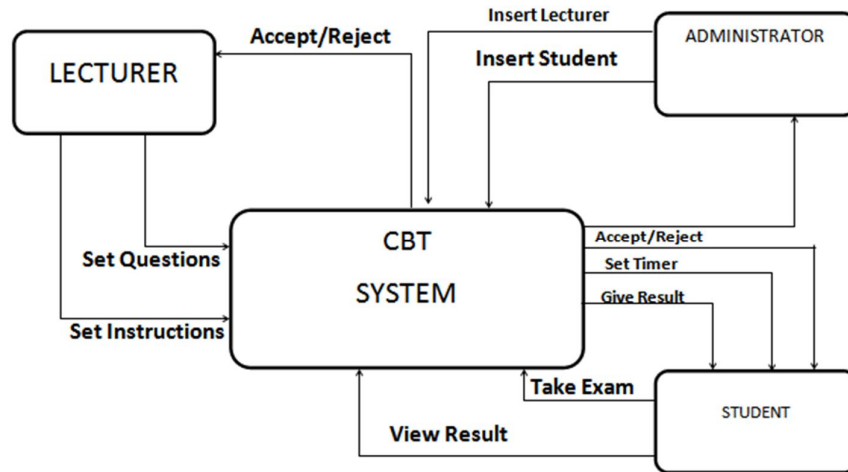


Fig 2: Dataflow Diagram

**UML Use Case Diagram for the CBT**

The use case diagrams for each entity in the system are shown in the figures below. It includes the use case diagram for the administrator, lecturer, server and student. The ADMINISTRATOR's use case is presented in Fig. 3 and it shows the activities that are required of the administrator including the upload of lecturer's details, upload of student details, creation of default password, creating new user, creation of a new course/modifying existing courses among others.

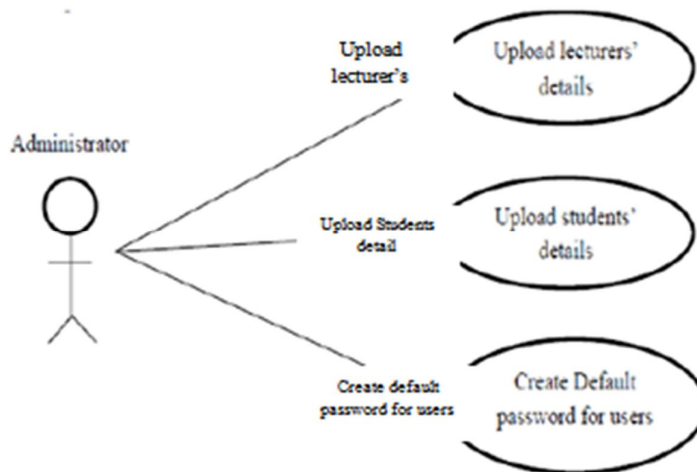


Fig 3: UML Use Case Diagram for CBT

The use case diagram for the entity, LECTURER is given below in Fig. 4. It depicts the process of setting examination instructions, insertion of questions in the database, insertion of options as well as specifying the correct answers to the questions.

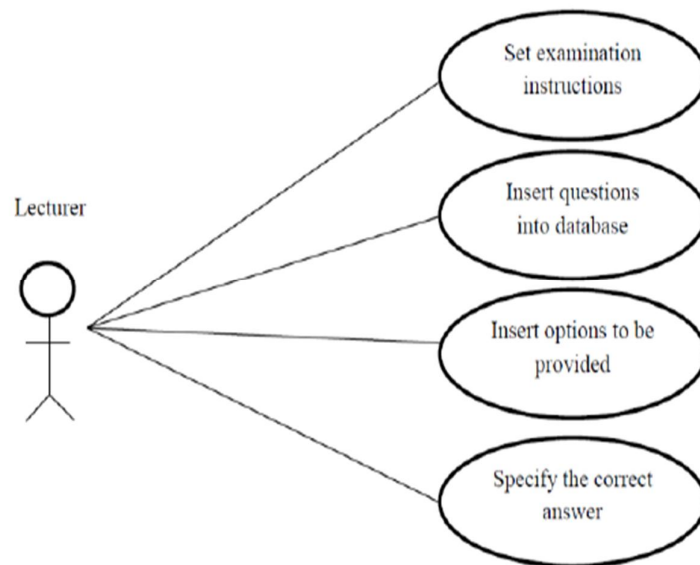


Fig 4; UML Use Case Diagram For Lecturer

The server is saddled with the responsibility of authenticating users of the system as well as producing timer functions for the exams. The use case is given in Fig. 5 below.

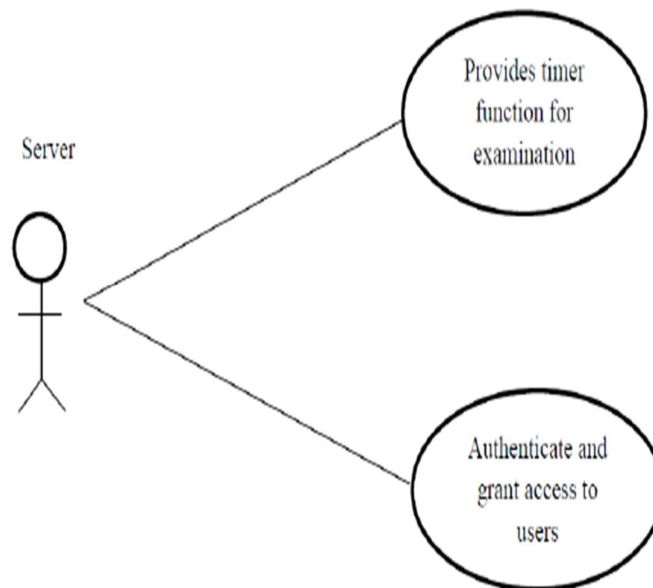


Fig 5: UML Diagram for Server

The use case diagram for the STUDENT shows that the student writes exams and views the result. Fig. 6 shows the use case diagram for the student.

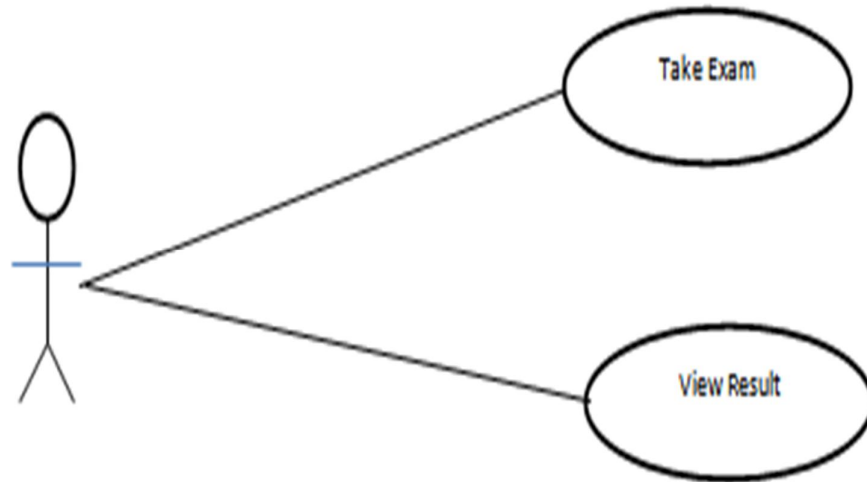


Fig 6: UML Use Case Diagram For Student

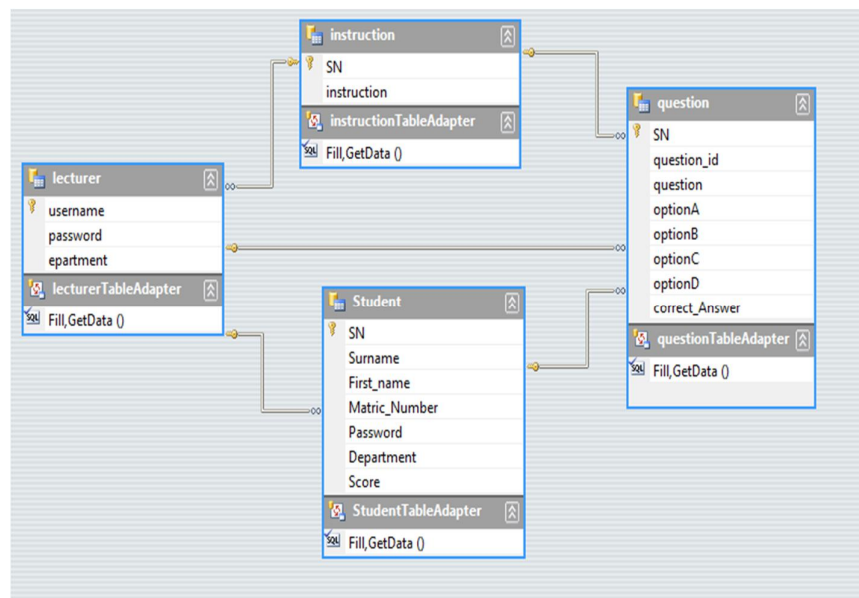


Fig 7: Entity Relationship diagram for the developed CBT system

**Programming Tools used for thenew System.**

- i. My SQL Server 5.6.19.0(2)
- iii. Vb.Net 2013

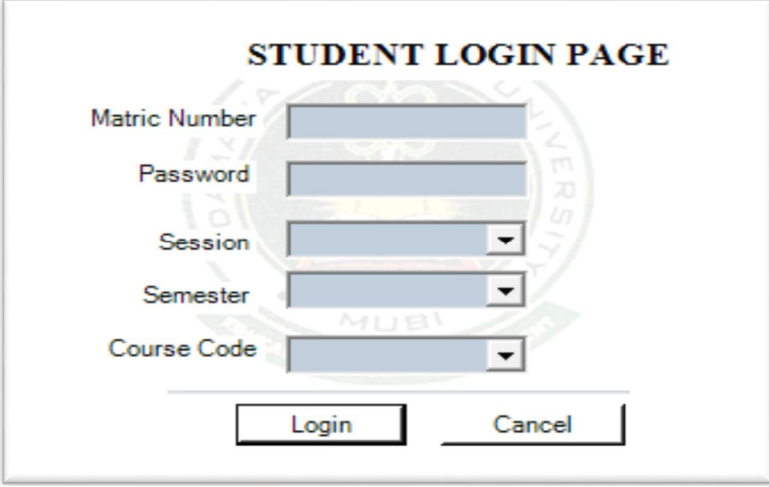
**III. RESULT AND DISCUSSION**

The Computer Based Testing (CBT) system is made at (b) functional pages which include the students` login page, admin login page, question page, admin login page, question page, the result summary page, question upload and configuration page as well as the students` result page.

**3.1 Student Login Page**



This is the default page otherwise known as the homepage of the system which automatically loads after the URL has been requested by a web browser on the client/user system. This environment contains the login section for the student to provide his/her details for authentication into the system. This page is shown in Fig. 8. The page also provides a link to the lecturer's login section.



**STUDENT LOGIN PAGE**

Matric Number

Password

Session

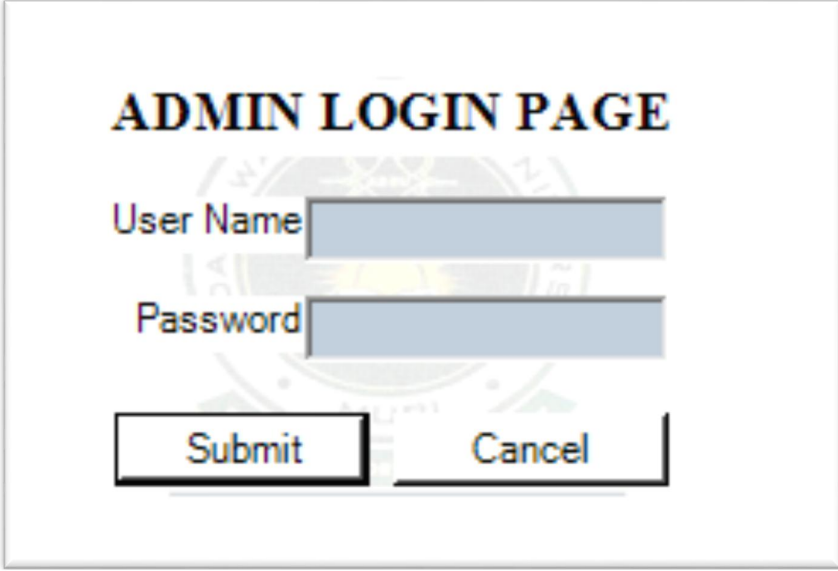
Semester

Course Code

Fig. 8: Student Login Page

#### Admin Login Page

The admin login environment is shown in Fig. 9, it is used by the lecturer to access the system so as to carry out operations such as setting questions, viewing result summary report to generate a complete loss of student's grade after the exams. The lecturer logs in with a pre-assigned and re-modified username and password.



**ADMIN LOGIN PAGE**

User Name

Password

Fig. 9: Admin Login Page

#### Question Page

This page is used to serve the exam questions to the student. The question page on load fetches questions from the database randomly and serves it to the student this page help initiates a countdown timer that is used to manage the duration of the exams. The question page is shown in Fig. 10.

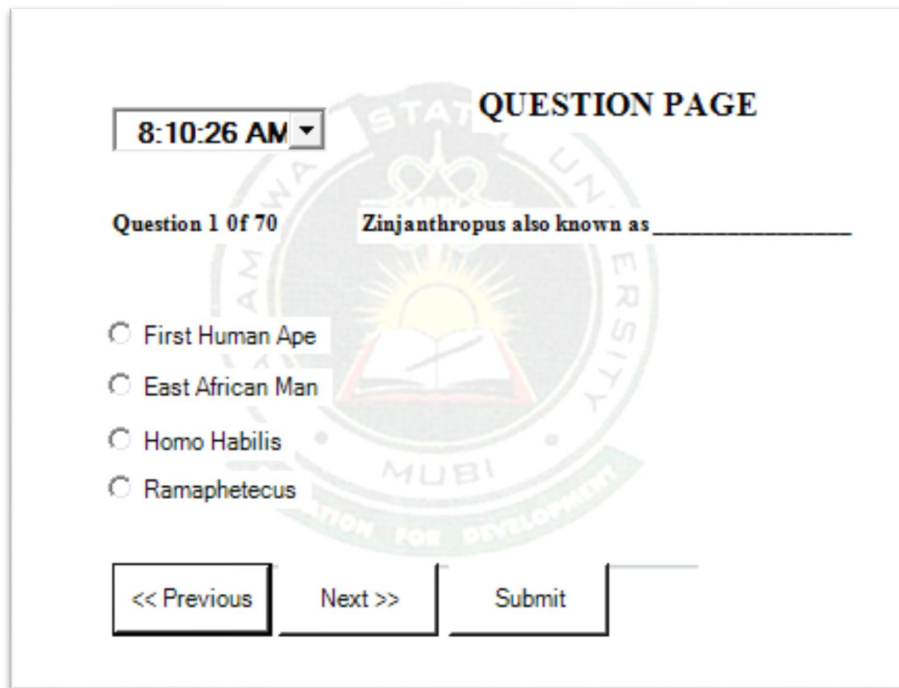


Fig. 10: Question Page

**Student Result Page**

This module is used to display the result of the student for the examination taken. The result is determined based on the number of options provided by the students which matches the correct option given by the lecturer. The students` grade is also displayed automatically. This page is shown in Fig 11.

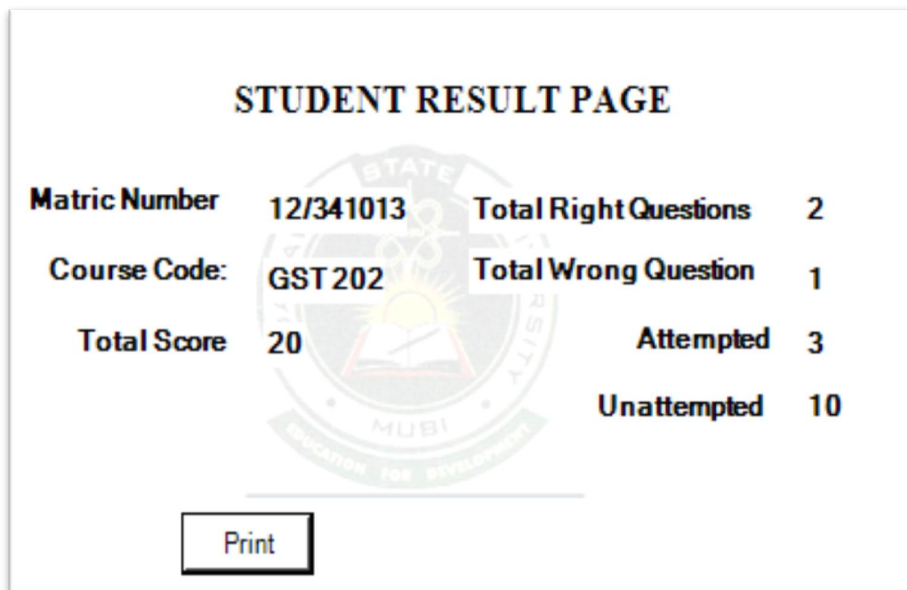


Fig.11: Student Result Page

**Question Upload and Configuration Page**

This module is mainly used by the lecturer to input his/her questions into the database and to specify the answer to the question. The module is shown in Fig. 12 below.

### QUESTION UPLOAD PAGE

Session

Semester

Course Code

Total Question

Score Per Question

Test Time Hour

use Typed Question

Course Code

Fig. 12: Questions Upload Page

**Result Summary Page**

This is a module used for displaying the resulting all students who have written the examination. It is shown in Fig. 13.

### RESULT SUMMARY PAGE

Session

Semester

Course Code

	MATRIC	SCORE	ATTEPTED QUESTION	UNATTEMPTED QUESTION	TOTAL RIGHT OPTION	TOTAL WRONG OPTION
▶	11/341002	40	5	5	4	1
	11/341004	20	7	3	2	5
	11/341005	50	9	1	5	4
	11/341006	60	10	0	6	4
	12/341001	30	6	4	3	3
*						

Fig. 13: Result Summary Page

#### IV. CONCLUSION

In this research, a Computer Based Testing (CBT) system is developed and proposed for adoption in Adamawa State University (ADSU) to be used for all list examination. The information system is an online examination system that delivers questions set by lecturers and generate report of the result of students who sat for the exam as well as the overall examination result summary abased on the user's request. Shortcomings such as examination malpractices, low capacity exam venues, inadequate invigilators, inadequate examination materials, omission of students results and human errors during marking and or grading process will be completely eliminated as a result of the adoption of the CBT system. The cost of conducting a mass driven examination will be reduced to the nearest minimum as these will be no need to print questions or answer booklets as it used to be. It should however, be of note that future research should accommodate essay based questions an opposed to only the multiple choke and structure question formats which the CBT method currently accommodates.

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#### About the Author

Sarjiyus Omega is Lecturer with the Adamawa state University (ADSU), Mubi Nigeria. He holds a Bachelor of Science (B.Sc) and a Master of Science degree (M.Sc) in computer science from Adamawa state university. He is a member of the Nigerian computer society (NCS). His primary area of interest includes computer network and security.