

Design of a Network-Based Test Center for Computer Unit, Michael Okpara University of Agriculture, Umudike

Engr. Dr. Nnochiri U. Ifeoma¹, Engr. Iroegbu Chibuisi²

¹*Department of Computer Science, Michael Okpara University of Agriculture Umudike, Nigeria*

²*Department of Electrical/Electronic Engineering, Michael Okpara University of Agriculture Umudike, Nigeria*

Abstract:Computers are known for their wide range of uses especially in scientific and mathematical fields. However little or no thought has been given to putting them into good and proper use in our immediate academic environment and this is saddening indeed. This research aims to introduce the concept of computer networking and in addition, present a useful application of such a network – the Computer Based Test. The work also tries to outline the benefits of the Computer Based Test over the Paper and Pen or manual test methods. The design of the system is quite simple and easily understood. Its flexibility makes it amenable for future changes and amendment to either incorporate other aspects of intelligence or to be designed for any other school age or class.

Keywords: Computers, Computer Based Test, Academic, Flexibility

I. INTRODUCTION

Computer networking is one of the most exciting and important technological fields of our time. The internet interconnects millions of computers, providing a global communication, storage, and computation infrastructure. Moreover, the internet is currently being integrated with mobile and wireless technology, introducing an impressive array of new applications.

A computer network is a set of computers connected together for the purpose of sharing resources. The most common resource shared today is connection to the Internet. Other shared resources can include a printer or a file server. The Internet itself can also be considered as a computer network.

It is saddening however, that these formidable tools are put to little or no use in our immediate academic environment. This is in a huge contrast to foreign academic environments where advances in computer technology continue to change the lives of both instructors and students.

One of the exciting new ways to use computers in education is in testing. Computer-based tests (CBTs) have been used in second language testing since the early 80's. The rapid change in the mode of administration of tests is very understandable. This is because computers have a number of very desirable functions that considerably ease up the test

creation and assessment task, including item creation and presentation, answer collection and scoring, statistical analysis, and storage, transmission, and the retrieval of information.

Presently, every bit of assignment, classwork and examination in Michael Okpara University of Agriculture, Umudike is done through manual methods or what is widely known as Paper-Based Testing (PBT) or the Paper and Pen Method (PPT). This method of testing is good but has a lot of shortcomings. These include high chances of script misplacement due to the need to handle large amounts of paperwork, the excessive amount of time spent in preparing and grading exams, errors occurring when students fill in wrong identification information on answer scripts and a very high possibility of various types of examination malpractices both before, during and after examinations, posing suspicions on examination integrity. These drawbacks can effectively be taken care of by Computer-Based Tests (CBTs).

This work is directed towards enlightening the general populace of the department on one very good way computers can be utilized in our immediate environment.

II. NETWORKS

A computer network comprises any number of computers that are linked together. A network can be confined to a single building, utilizing data cables as linking devices. Where greater distances are involved, the computers that constitute a network are linked by means of satellite links, telephone lines or fiber optic cables (Meyer and Cilliers, 2002). When computers are linked together, information can be moved between them swiftly and efficiently. The information moves directly between computers rather than through a human intermediary. A network also allows for information to be backed up at a central electronic location. It is difficult to maintain regular back-ups on a number of stand-alone computers and important information can be lost by mistake (Chellis *et al*, 2000).

2.1 Network Classifications

i. Local Area Networks: A local area network (LAN) is a number of computers connected to each other by a cable in a single location such as a single school department or a group of organizations forming one institution (Chellis *et al*, 2000). It is a computer network that interconnects computers within a limited area and has its network equipment and interconnections locally managed (Donahue, 2007). This allows for data transfer and communication such location.

ii. Wide Area Networks: A wide area network (WAN) is a telecommunications network or computer network that extends over a large geographical distance. Wide area networks are often established with leased telecommunication circuits. Business, education and government entities use wide area networks to relay data among staff, students, clients, buyers, and suppliers from various geographical locations. In essence, this mode of telecommunication allows a business to effectively carry out its daily function regardless of location. The Internet may be considered a WAN (Groth *et al*, 2005).

iii. Metropolitan Area Networks: A metropolitan area network (MAN) is a computer network that interconnects users with computer resources in a geographic area or region larger than that covered by even a large local area network (LAN) but smaller than the area covered by a wide area network (WAN) (IEEE Std, 2002). The term is applied to the interconnection of networks in a city into a single larger network (which may then also offer efficient connection to a wide area network). It

is also used to mean the interconnection of several local area networks by bridging them with backbone lines (Laudan, 2001). The latter usage is also sometimes referred to as a campus network.

iv. Campus Area Networks: A campus network, campus area network, corporate area network or CAN is a computer network made up of an interconnection of local area networks (LANs) within a limited geographical area (Wade *et al*, 2005). The networking equipment (switches, routers) and transmission media (optical fiber, copper plant, Cat5 cabling etc.) are almost entirely owned by the campus tenant / owner: an enterprise, university, government etc. (Donahue, 2007).

V. Personal Area Networks: A personal area network (PAN) is a computer network used for data transmission amongst devices such as computers, telephones, tablets and personal digital assistants. PANs can be used for communication amongst the personal devices themselves (interpersonal communication), or for connecting to a higher level network and the Internet (an uplink) where one "master" device takes up the role as internet router.

III. SYSTEM DESIGN

3.1 Operational Structure

The block diagram below shows an operational flow of the different parts of this research.

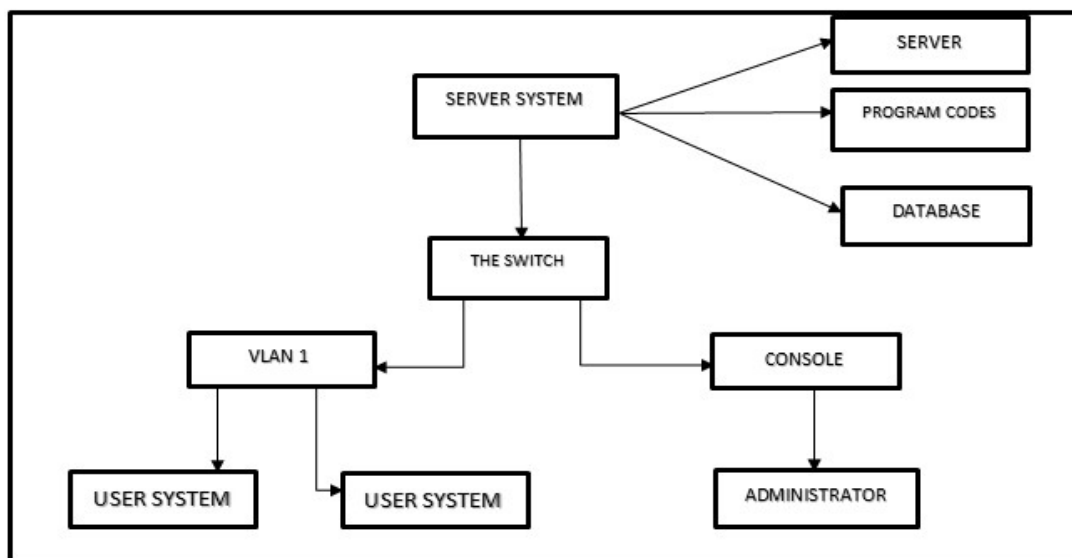


Fig.1: Block diagram showing the research overview

The switch represents the key part of the project and serves the chief role of enabling communication between the different devices on the network according to set configurations.

The switch has a console port from which administrative configurations can be effected. The switch also has a native Virtual Local Area Network (VLAN) ports on which the client systems reside. The server system also resides here. On the server, the database which contains the student data, the

test data and the administrator's profile are embedded. We also installed the Windows Apache MySQL and PHP (WAMP) server software on this system to serve the program files and finally, we placed the test program logic on the www

directory of the server. This represents the basic operational structure of this research.

3.2 The CBT Software Use Case Model

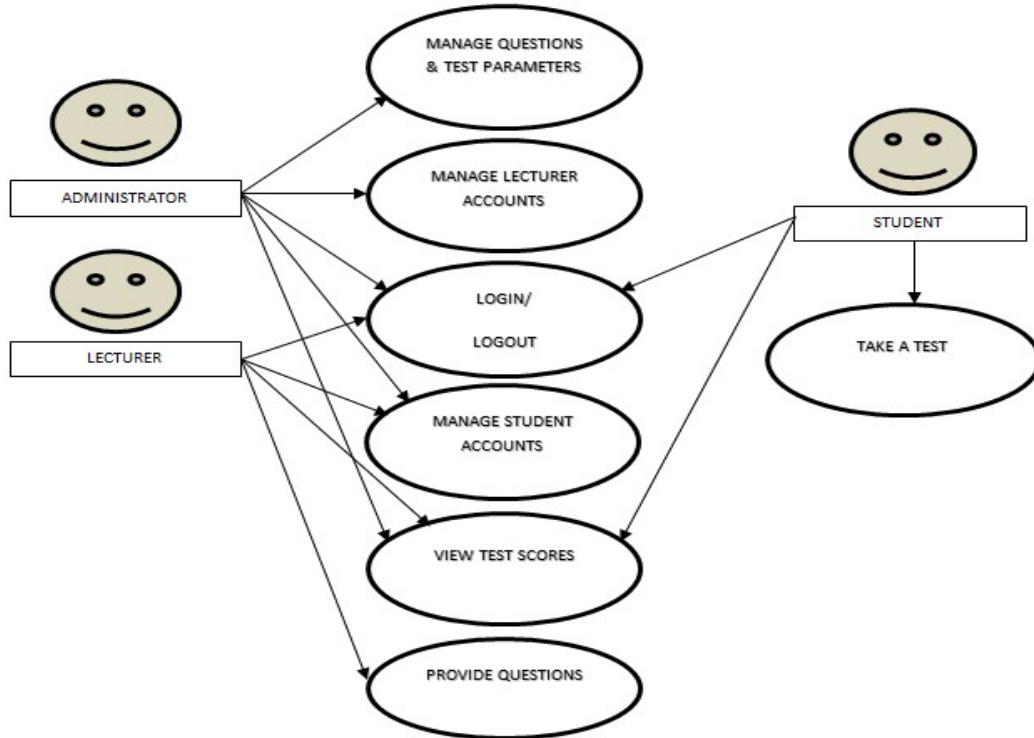


Fig2: CBT software use case model diagram

3.2.1 Manage Accounts

Brief Description

This use case comes in two angles. One is a function of the administrator alone – managing lecturer accounts and the other is a function of both the administrator and the lecturer – managing student accounts. This function describes the ability to perform tasks such as creation, deletion and updating of accounts.

Flow of Events

Basic flow

This use case starts when the administrator/lecturer wishes to create, delete, or update accounts

1. The system requests that the administrator specify the account to be operated on.
2. Once the account is located, one of the sub flows is executed. If the Administrator selected “delete account”, the *delete account* sub flow is executed.

Sub flows

Delete Account

1. The system should be confirmed by the administrator/lecturer.
2. The system removes this account from the database.

Create Account

1. The system should be confirmed by the administration/lecturer.
2. New account is created.

Update Account

1. The system should be confirmed by the administration/lecturer.
2. Account is updated.

Alternative flows: None

Special Requirements: None.

Pre-Conditions: The Administration must logged in.

Post-Conditions: The account must be changed correctly.

Extension Points: None.

LOGIN

Brief Description

This use case describes the ability of a user to gain access to different areas of the program. This case applies to students, lecturers and the administrator.

Flow of Events

Basic Flow

This use case starts when the actor wishes to log into the Online Examination System.

1. The actor enters his/her username and password or registration number in the case of students.
2. The system validates the entered name and password or registration number and logs the actor into the system.

Alternative Flows

Invalid Name/Password/Registration Number

If, in the Basic Flow, the actor enters an invalid name and/or password (or registration number, in the case of the students), the system displays an error message. The actor can choose to either return to the beginning of the Basic Flow or cancel the login, at which point the use case ends.

Special Requirements: None.

Pre-Conditions: The system is not logged in but the login screen displayed.

Post-Conditions: If the use case was successful, the actor is now logged into the system. If not, the system state is unchanged.

Extension Points: None.

LOGOUT

Brief Description

This use case describes the ability of a user to drop access to different areas of the program. This case applies to students, lecturers and the administrator.

Flow of Events

Basic flow

This use case starts when the actor wishes to log out of the program. The actor clicks the “Logout” button. In the case of the student however, the systems logs out automatically on two conditions – time exhaustion or test submission.

Alternative flow: None.

Special Requirements: None.

Pre-Conditions: The system is logged in and has the logout button on the screen/ the test time has exhausted or the student submits the test.

Post-Conditions: If the use case was successful, the actor is now logged out the system. If not, the system state is unchanged.

Extension Points: None.

MANAGE QUESTIONS

Brief Description

This use case describes how the Administrator/lecturer manages questions for the test. This contains options like add, delete and modify questions.

Flow of Events

Basic flow

This use case starts when the Administrator wishes to add, change, and/or delete question in the system.

1. The system requests that the Administrator specify the function he would like to perform (add a question, Update a question, or Delete a question)
2. Once the Administrator provides the requested information, one of the sub flows is executed.

If the Administrator selected —Add a question, the Add a question sub flow is executed.

If the Administrator selected —modify a question, modify a question sub flow is executed.

If the Administrator selected —Delete a question, the Delete a question sub flow is executed.

Add a question

The system requests that the Administrator enter the question, four options and specify the option label bearing the correct answer. Once the Administrator provides the requested information, the system generates and assigns a unique id number to the question. The question is then added to the system.

Modify a question

1. The system requests that the Administrator enter the question id.
2. The Administrator enters the question id. The system retrieves and displays the question information.
3. The Administrator makes the desired changes to the question information. This includes any of the question information specified in the Add a question sub-flow.
4. Once the Administrator updates the necessary information, the system updates the question record.

Delete a question

1. The system requests that the Administrator enter the question id.

2. The Administrator enters the question id. The system retrieves and displays the question information.
3. The system prompts the Administrator to confirm the deletion of the question.
4. The Administrator verifies the deletion.
5. The system deletes the question from the system.

*Alternative Flows**Question Not Found*

If, in the Update a question or Delete a question sub-flows, a question with the specified id number does not exist, the system displays an error message. The Administrator can then enter a different id number or cancel the operation, at which point the use case ends.

Delete Cancelled

If, in the Delete a Question sub-flow, the Administrator decides not to delete the question, the delete is cancelled, and the Basic Flow restarts from the beginning.

Special Requirements: None.

Pre-Conditions: The system is in the manage question state and has the manage question screen displayed.

Post-Conditions: If the use case was successful, questions are added, deleted or modified. If not, the system state is unchanged.

Extension Points: None.

*TAKE A TEST**Brief Description*

This use case describes how a user takes a test using the software.

*Flow of Events**Basic Flow*

This use case starts when the student wants to take a test.

1. The student picks the desired course if it is available.
2. The system returns a new exam of this subject for the student to take.
3. The participation chooses one answer in the multiple choices questions.
4. The participation submits his/her answers thus finishing exam.
5. The system returns a result for his/her answer and return to beginning of exam.

*Alternative Flows**Test Written*

If the student has written the selected test beforehand, the system returns a notification and the student has the option of picking another test or logging out of the system.

Special Requirements: None.

Pre-Conditions: The system is in the exam state and has the exam screen displayed.

Post-Conditions: If the use case was successful, the student takes a test and submits. If not, the system state returns to choosing a subject for exam state.

Extension Points: None.

*CONTRIBUTE QUESTIONS/ANSWERS**Brief description*

This use case allows a lecturer to provide new questions/answers. The provided questions/answers are verified, classified and added to system question bank.

*Flow of Events**Basic flow*

This use case starts when a lecturer wishes to add questions to his course.

1. The system checks if the current user has sufficient right to provide questions/answers. If that user has the right, the system will grant him/her the access to contribute questions.
2. After that, user enters questions and answers into forms.
3. User submits the questions/answers and receives a system message telling him/her that the questions/answers have been added.

Special Requirements: None.

Pre-conditions: User must be logged onto the system.

Post-conditions: If users successfully complete contributing questions/answers then those data are queued for system moderator to verify. Otherwise, the system remains unchanged and all temporary data are not saved.

Extension Points: None.

*VIEW RESULTS**Brief description*

This use case allows a lecturer or administrator to view student results. The student can only view the result for a particular test on completion of the test.

Flow of Events

1. Viewer clicks on "Check Student Results".
2. Viewer provides student registration number.
3. The system pulls all the results that match the specified student registration number.

Special Requirements: Viewer should declare correct student details.

Pre-conditions: User must be logged onto the system

Extension Points: None

Post-conditions: None

3.3. Flow chart for the CBT test program

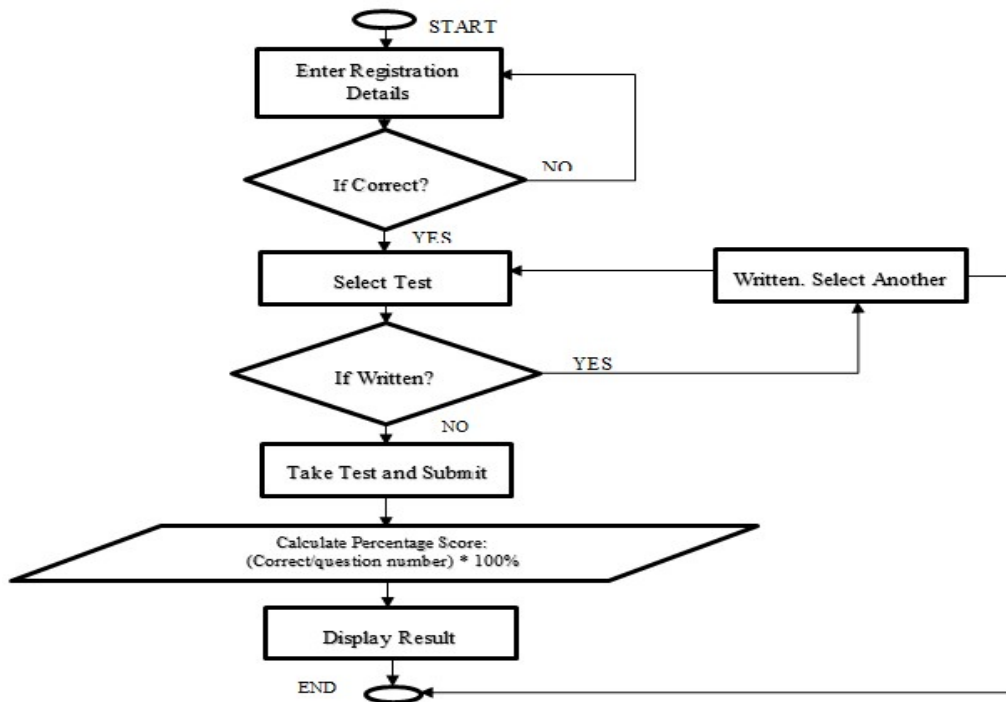


Fig 3: Computer-based test program flow chart

IV. RESULTS AND DISCUSSIONS

VLAN. To confirm this, we use the command DO SHOW VLAN in the switch's CONFIG mode

4.1 The Network

For devices on the network we created to communicate with each other, one criterion is that they should be on the same

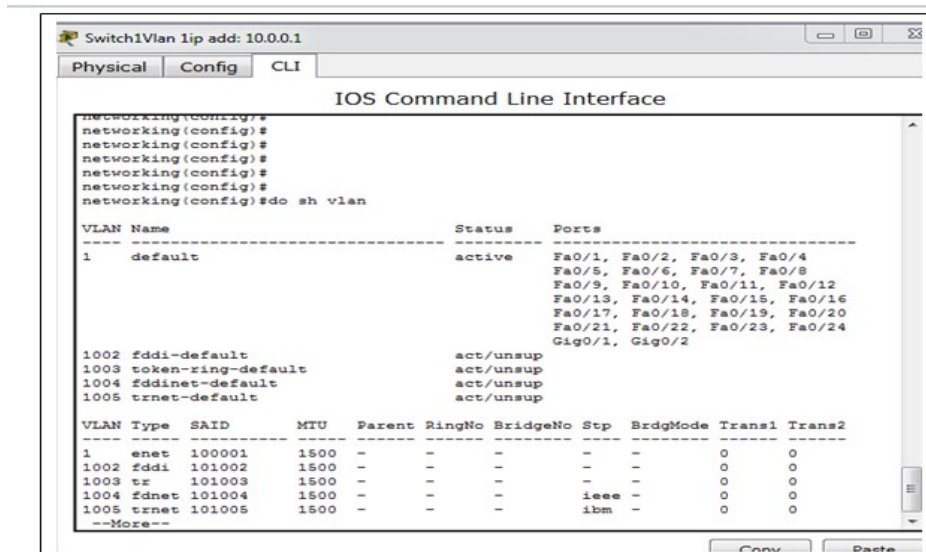


Fig.4: VLAN Confirmation

Another important criteria is that the network we created should also allow the devices connected to it to see each other by means of their IP addresses. This is very necessary for the network's file sharing/serving functionality. To check for this,

we typically PING the systems from the command line interface. The ping syntax is:

PING *IP ADDRESS* (e.g. PING 10.0.0.4)

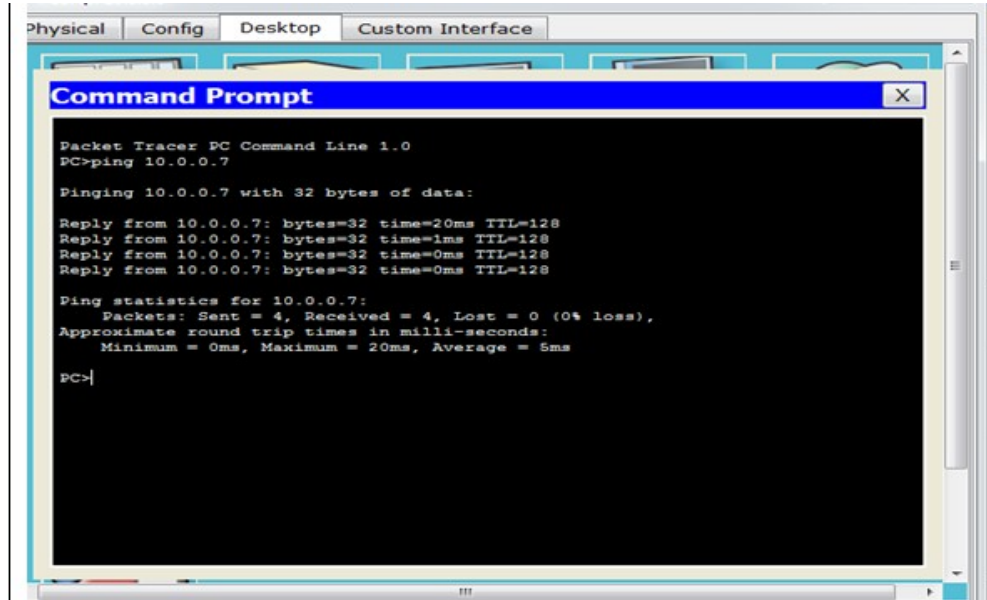


Fig.5: Connectivity check using ping from the command prompt

When the IP address of a system is “pinged” and the system is available on the network, it responds as shown above. In addition to the response, it also gives the total time it took to send a ping and receive a response and the Time to Live (TTL) value of the signal. What basically happens is that the sending system sends an ARP (Address Resolution Protocol) signal into the network. Every system get the alert. If the IP address is not for a system, it drops the packet but if it, that system responds. This basically confirms that there is a free connecting path between the systems.

Another important check done on the network is checking the interface ports to which devices are connected and verifying if such ports are up or down (i.e. electrically connected or disconnected). This test also helps the network administrator verify where devices are connected in the case of a confusion as to where his devices are actually connected. The command used to do this is the *show ip config brief* and the *show running config*.

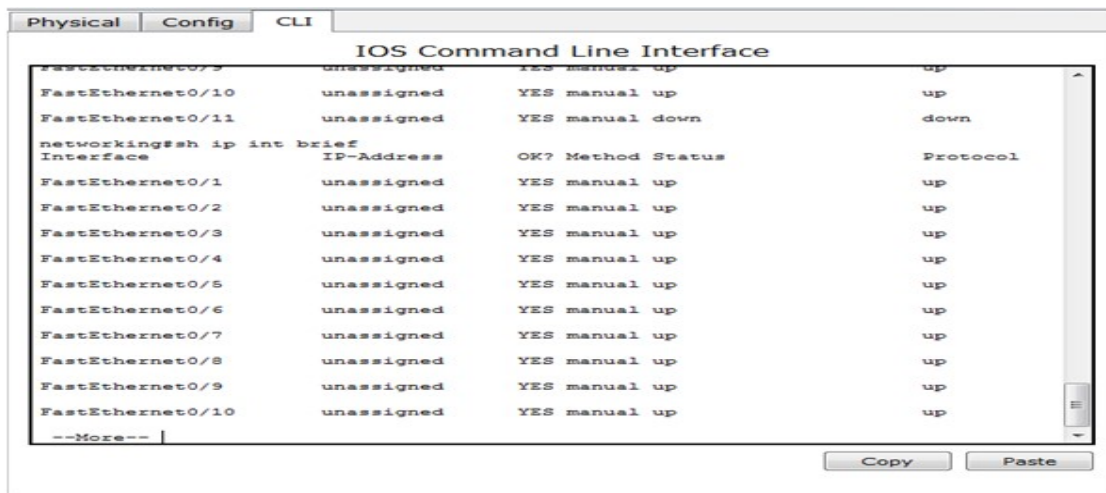


Fig.6: IP Interface

4.2 The CBT test design outcomes

To explore a very useful application of the network we created, we went an extra mile to create a computer based test application with HTML, CSS, JavaScript, PHP and MySQL. To access the test, the student enters the IP address of the

server with the directory name of the test as provided by the administrator into the address bar of the browser. The server, in response, returns the index file of the test application which is simply the welcome page for the test. A preview of the welcome page is shown by the figure below

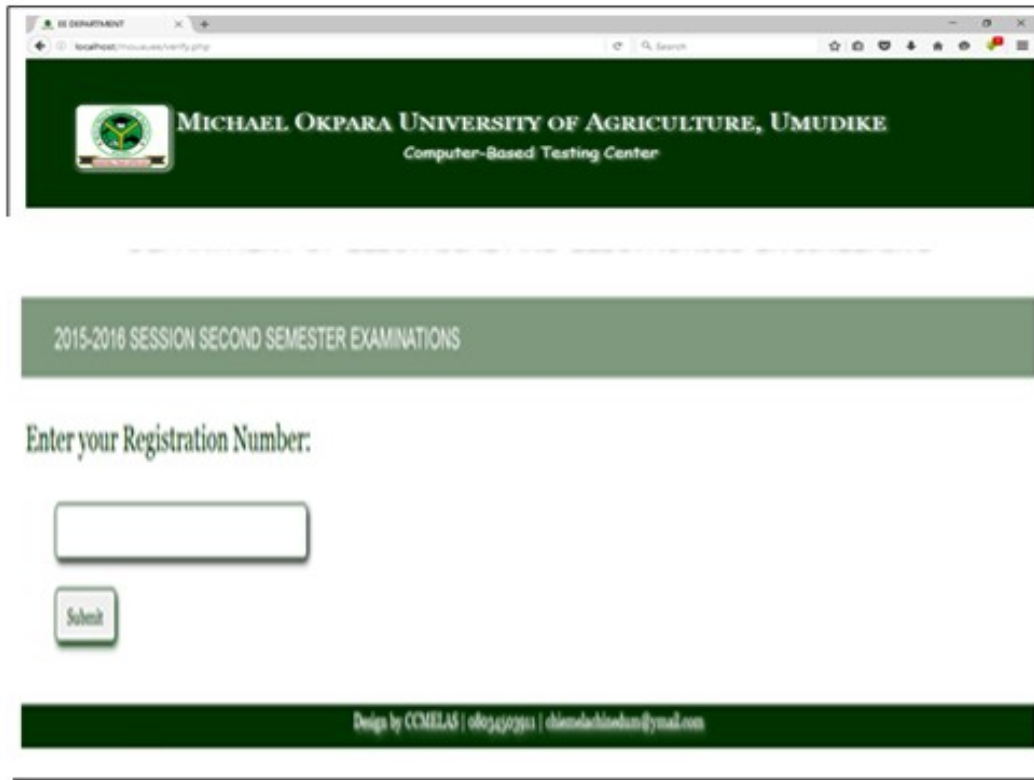


Fig.7: A preview of the test verification page

V. CONCLUSION

Telecommunications remains a key and vital aspect of Computer Science, even though this field has not fully been exploited by the department in Michael Okpara University of Agriculture, Umudike. This research has successfully demonstrated a sub-field in this area known as Networking – a medium of enabling communications between varieties of devices. The project also took a step forward to demonstrate one important application of the network – a computer based test simulation – which stands as a viable option for replacing the already existing examination method of Paper and Pen Testing.

A lot of options exist in computer networking and this project has only demonstrated an aspect of it. The good thing about networking and engineering as a whole is that there is always room for improvement. We grow in tandem with a world growing so fast when we adopt the technology speeding her growth – computers and networks.

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