Development of an Improved Virtual Learning Management System for Covid-19 Era

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***Abstract*: Improvement in technology has helped in improving the processes humans are involved in, enhancing their continuity and aiding adaptation even in times of paradigm shift, such is in the case of education and/learning. COVID-19, a global pandemic virus which took the world aback with its emergence in 2019 and stalled various processes and activities in the world including education. Again, the need to improve on existing virtual learning system to aid thorough and smooth learning process and its suitability for the local environment became an issue in the educational sector. In this paper, an Improved and reliable Virtual Learning Management System for Covid-19 era as supplementary and veritable alternative to the physical class for lecturers and students respectively was developed and presented.**

***Keywords :* Virtual Learning Environment (VLE), COVID – 19 Pandemic, Pictorial presentations, Learning-teaching aids**

I. INTRODUCTION

Learning has been part of human development process which has been evolving right from development of technology and different human paradigm shift from iron age to technology age. Learning is a continuous process that has been in existence right from the existence of man. A man learns to acquire knowledge, gain expertise, and give meaningful efforts to processes. Learning deals with the interaction between the tutors and the student and the tutor gives efforts in making the student understand terms, theories, and skills in a more simplified form.

Methodologies involved in teaching or as learning aid to the student in assimilating knowledge spelt out fast also depends not just on the tutors but the students. It also depends on the teaching materials used in which includes the media, specimens, animations diagrams, charts, and even pictorial representation. Learning and teaching methodologies have evolved due to this paradigm shift by man as a result of advancement in Information and Communication Technology (ICT) has given rise to what we now know as virtual learning. Virtual in a layman's term simply means online or something digital i.e. something that doesn't seem to exist in physical state, rather it's being run on either a computer or technological device by a software. Virtual can also be described as something done manually/ in a physical state made to be online or being simulated to run on a computer/computer network.

II. STATEMENT OF THE PROBLEM

Students all over the world and more importantly in developing countries spend more time at home idle and underproductive as a result of the negative impact of the COVID-19 pandemic ravaging the world on education. The problem could be traced to the problem of finding an alternative and effective teaching and learning processes for educational deliveries in most developing countries. In some countries, the educational sector was completely shut down for several months with no alternative solution for the stalled physical classes and students tend to spend more time at home doing nothing and not being able to attend classes. Hence the need for an improved, enhanced and more interactive learning management system for the transformation of the old physical class into an e-class.

III. THEORETICAL CONCEPT

Man, at a point write on bare ground, then on slate, blackboard, whiteboard, notebooks now to different technological devices like mobile phones, digital tablets, laptops, electronic board, online books in various formats, audio, textual, animation and visual etc. Now, man can learn over distances apart even when the tutor and the students are not in the same geographical location. This concept is known as online learning or virtual learning. New technologies, including computer networks, interactive-media, digital technologies, and the internet significantly increase the reach of virtual learning provision. It enables and allows students to connect and interact with each other, and with their teachers, at any time, and it has opened a universal market and educational platform.

Personal computers and the Internet have revolutionized entire sectors of the world today. Again, the social media platforms such as; the Facebook, Twitter, YouTube, Skype and other online communications media have greatly increased and improved access to resources to billions of users around the world enabling sharing of ideas and learning new ideas electronically at a very low cost. These advances in computer technology (Information and Communication Technology) are remarkable and have contributed to the transformation of the learning process. This emerging educational paradigm is often called "virtual learning," and it has the potential to improve students' achievement, access to education, and schools' cost-effectiveness [1] .

IV. RISE OF COVID-19

Several factors could warrant tutors and students be in geographically dispersed locations and not able to be together for a physical class such as war, natural disasters and

pandemic. recent example is is the pandemic which started in the year 2019 known as COVID-19 and has caused stalling of various activities and events, shutdown of major activities in the world even flights and movements were restricted in various countries to curb its widespread. COVID-19 is a transmissible or communicable respiratory disease that was discovered in the year 2019 and has claimed millions of lives in all nations of the world. According to WHO [2], the official website of the World Health Organization, the virus that causes COVID-19 is mainly transmitted through droplets generated when an infected person coughs, sneezes, or exhales. One can be infected by breathing in the virus if you are within proximity of someone who has COVID-19, or by touching a contaminated surface and then your eyes, nose or mouth. In order to curtail the widespread of the virus, the countries of the world resulted to shutting of schools and training institutes as a way of stopping the spread of the virus. Therefore, in order not to stall the academic process of the students, many schools and institutions came up with many ideas and systems ensure continuity of academic activities and deliveries virtually (Figures 1 and 2). Learning virtually has been in existence but was not widely used as at the time of the discovery of the virus. However, most of the existing systems were not without glitches or constraints but have witnessed considerable improvement and new ones developed due to the rapid advancement in technology and paradigm shift.

Urdan and Weggen [3], highlighted the demand of drivers of e-learning as follows: rapid obsolescence of knowledge, training, the need for just-in-time training delivery and the search for cost effective ways to meet learning needs of a globally distributed workforce that have redefined the processes that involved in the design, development and delivery of training and education in the workplace. In addition, Urdan and Weggen [3] reiterated in their work, that the need for different learning models due to skill gap and demographic changes coupled with the demand for flexible teaching and lifelong learning have characterized the innovation and reaction that is currently being witnessed in the virtual processes and environment[3].

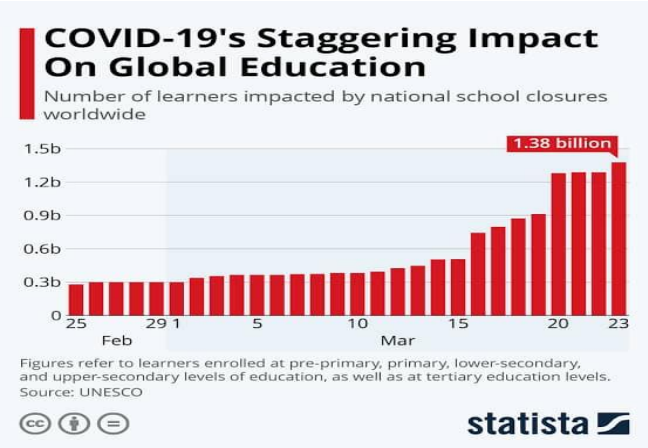


Figure 1 Global Impact of COVID-19 on Global Education
Source: UNESCO - Retrieved from unesco.org [12]

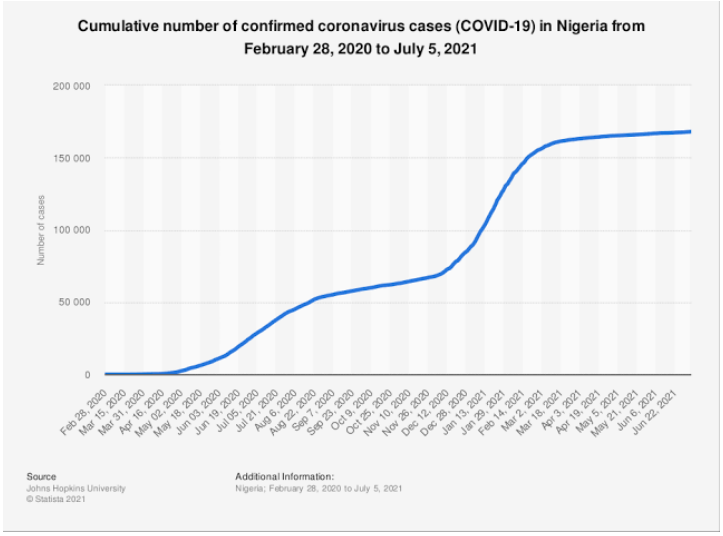


Figure 2: Graph showing COVID-19 Index in Nigeria
Source: John Hopkins University – Statista

V. VIRTUAL LEARNING (VL)

According to and Astana [4], Virtual Learning acts as the process which is directed on result and it is understood as process and result of subjects and the object's interaction. This interaction defines educational process specifics as a whole system [4]. Virtual learning can also be viewed "as online learning, open learning, web-based learning, computer mediated learning, blended learning, learning etc. and have in common the ability for users' computer to connect to a computer server in a network that offers the possibility to learn from anywhere, anytime, in any rhythm, with any means" [5]. However, Virtual Learning does not include the increasing use of E-mail or online forums to help teachers better communicate with students and parents about coursework and student progress; as helpful as these learning management systems are, they do not change how students are taught.

A, Virtual Learning System {VLS)

Virtual learning system can be described as a simulated class/physical learning system made to run on a computer network or online. Ihama and Eguasa [6] described virtual learning system as a cost-effective management platform that is geared towards knowledge-based acquisition with multiple user interaction [6]. Virtual learning systems are enormous in educational system as they provide a robust platform for users. This is as a result of its flexibility and robustness that synchronizes various learning methodologies into a unified outcome of operations.

B. Virtual Learning Environment (VLE)

According to Kumar *et al*. [7], a virtual learning environment is an online-based platform that offers students and lecturers digital solutions that enhance the learning experience. Unlike a virtual classroom, which is meant to replicate and replace the physical classroom environment for

distance learners the Virtual Learning Environment (VLE) is an integrated academic environment where students can apply for admission over the internet, enroll in the classes offered by VLE after admission, access a complete course, take tests, and interact with the lecturers and instructors as well as course mates. VLE is characterized by an environment based on computers, use of the internet, interaction between users, exchange of views and access to users to obtain various useful materials [8].

C. Learning Management System (LMS)

A learning management system (LMS) is a software application or web-based technology used to plan, implement and assess a specific learning process. Typically, a learning management system provides an instructor with a way to create and deliver content, monitor student participation and assess student performance [9]. It is an environment with digital software which is designed to manage user learning interventions as well as deliver learning content and resources to students [10]. A Learning management System is a system specifically designed to manage online courses and classes, distributing course materials, and creating a platform/interface for collaboration between teacher and students. An LMS enables teachers to utilize the collaborative aspects of the Internet like blogging, creating wikis, and podcasting, but in a safer online environment. Furthermore, an LMS can also provide methods of organization and communication that may be beneficial for learners [11]. Learning Management Systems (LMS) could be conceptualized as ‘‘learning platforms’’, ‘‘distributed learning systems’’, ‘‘course management systems’’, ‘‘content management systems’’, ‘‘portals’’, and ‘‘instructional management systems’’, and “combine a range of course or subject management and pedagogical tools to provide a means of designing, building and delivering online learning environments. Table 1 is a summary of related works.

Table 1: Table of Related Works

#	Authors/Year	Title of Work	Methodology	Weakness
1.	A. Elsaadany and K. Abbas/(2016) [13]	Development and implementation of e-learning system in smart educational environment	designed using off-the-shelf and open-source software engineering model and programming tools and database models	Works only in the SMART environment
2.	Samatha Sudarshanam /(2008) [14]	Design And Implementation Of A Distance Learning System	Java-based software, handles three different kinds of users: student, instructor and admin.	Not flexible
3.	Ellen Kalinga (2010) [15]	Development of an Interactive e-Learning Management System (e-LMS) for Tanzanian Secondary Schools	The research used Unified Modelling Language (UML) and integrated Object-Oriented System Analysis and Design (OOSA&D) and Model Driven Architecture (MDA).	Use of action research methodology. Selection and customization of open source LMS platform
4.	Rabiman Rabiman, Muhammad Nurtanto, Nur Kholifah. (2020) [16]	Design And Development E-Learning System By Learning Management System (LMS) In Vocational Education	The research method adopts the Hannafin and Peck approach model with specific phases (needs analysis, design, development and implementation).	Not flexible and targeted at a specific set of users

VI. MATERIALS AND METHODS

The development of an improved virtual learning management system for COVID-19 era was carried out by first designing the system outlook using tools such as the flowchart, identify the content of the user-interface, the front-end, back-end, database for the LMS and other necessary functionalities. The tools used for the development are the available web technologies like Hyper-Text Markup-Language (HTML), Cascading Style Sheet (CSS) and JavaScript. Thereafter, the back-end implementation took place using PHP used in adding certain functionalities to the web application and a Database Management System (MySQL) used to create and manage the database structure and functions. Collection and downloading of the application development tools needed were classified as the first phase of the implementation. The analysis and structuring of the user interface along with the system analysis of the entire application was done on paper. Identification of the objects needed for the database and models was planned and drawn on paper. Finally, MySQL workbench tools were used to model the relationships between the database entities. The Program Flow (Architecture) is illustrated in Figure 3. Figure 4 illustrates Information flow Chart for Teachers/Lecturers. Figures 5 & 6 illustrate Procedure and System Charts.

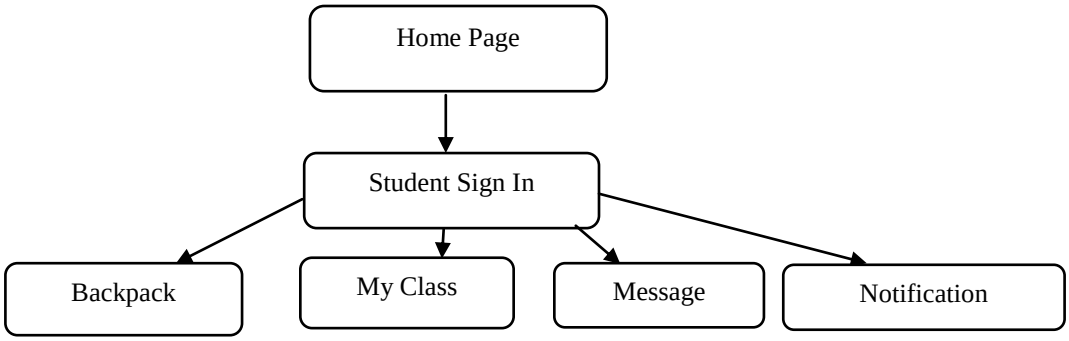


Figure 3: Information Flow Chart of Students

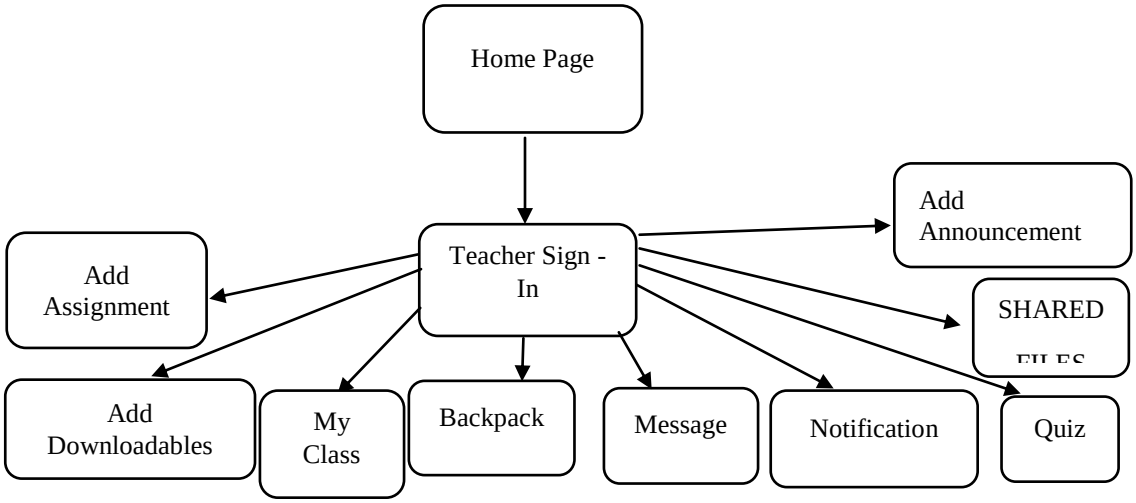


Figure 4: Information Flow Chart for Teachers/Lecturers

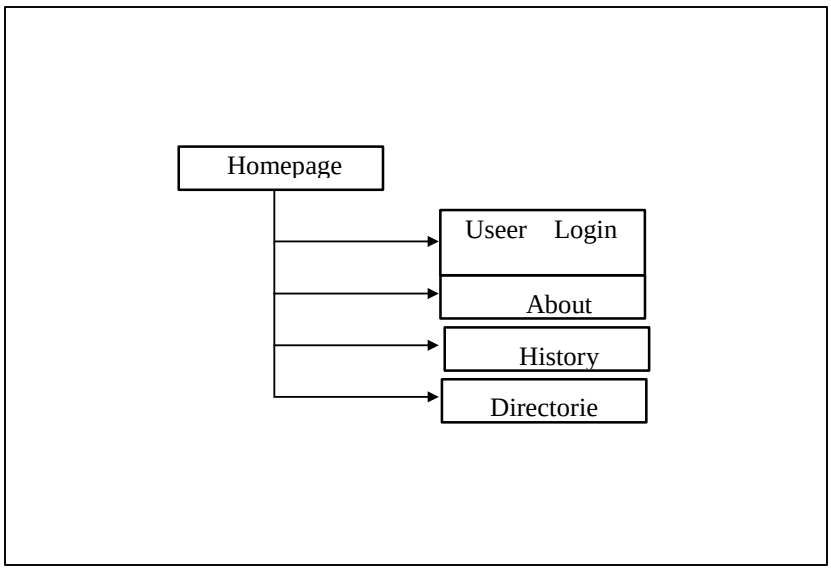


Figure 5: Procedure Chart

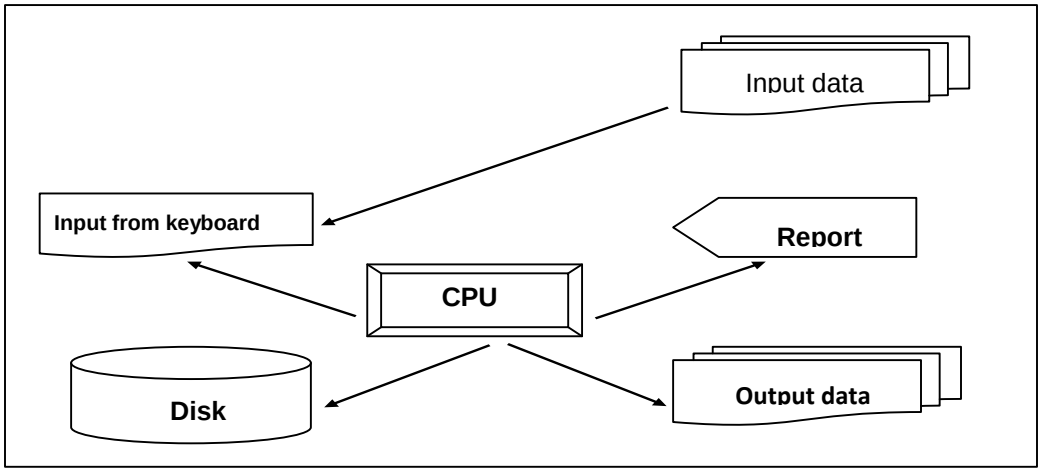


Figure 6: System Program flow

A. Tools Screen Page

This contains the dashboard of the student and the teachers. Dashboard contains all the panes at which the students and lecturers can go on their area page. For the students, it reflects their classes, course, notification pane, message pane, and downloaded PDFs. For the teachers/lecturers, it consists of their notification pane, messages, add downloadbles, shared files, classes to be taken, add backpack, add assignments, add quiz panes. The students and lecturers/teachers can mange their profile on the dashboard as it contains all they can do while on the learning management system.The Admin's dashboard also consists of various tasks that can be handled by the administator, where the Admin can add students from the backend, add the lecturers, contents to be viewed on the virtual learning management system, add courses to the database, view and share contet and activity log.

VII. RESULTS and DISCUSSION

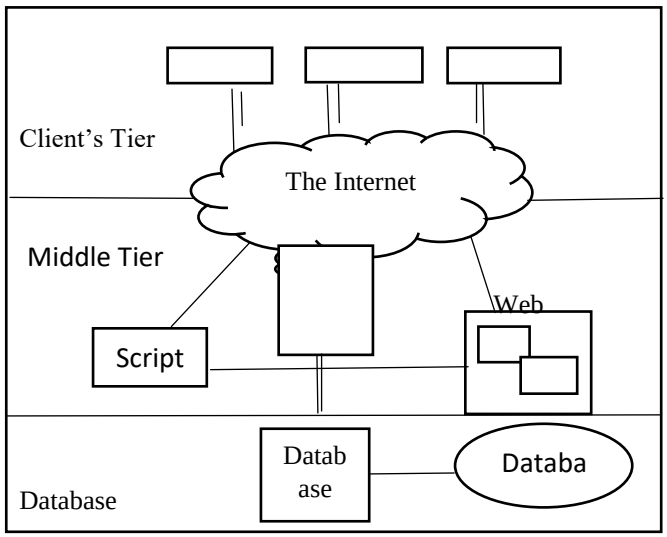
The new system efficiently allows students and lecturers to register, provides a computerized tutor, creates a platform to test students' ability, creates a platform where students can check their result to know their grade, allows students to read computer science courses and e-books, also the system allows the students to ask questions from the teacher directly (i.e. interacts with the teacher one on one on the platform and also the teacher can send personalized messages to each student on the platform), the students can also interact with one another on each platform by sending direct messages to their classmates, the lecturer can make an announcement, there is also notification panes where student and lecturer are being notified of any pending work (e.g. assignments, quiz, announcements. This Virtual Learning Management system was built around a three-tier architecture model. Each tier performs a certain function that assists the next stage of implementation. The 3-tier architecture comprises of:

(1). First Tier: This software level presents the user with the interface. It was designed with a HTML.

(2). Second Tier: This level serves as an intermediary between the interface and the database. It picks data entered by the user through the interface and either inserts it into the database or compares with the already existing data in the database

(3). Third tier: It is the database that allows the insertion, storage, and retrieval of information.

Figure 7 illustrates the complete System Architecture.



VIII. CONCLUSION

Virtual learning is not a new concept; however, it has become more prominent in the new normal life of higher education nowadays due to the evolution of ICT and the need to meet the challenges as a result of the Covid-19 pandemic for effective academic deliveries. Learning Management System, as presented in this project will assist the user to test the knowledge of people around and means of accessing the understanding increases. Unlike other existing systems, the new system allows interaction between students and lecturers, students and tutors, students with other course mates and asks questions, share opinions and ideas with the aid of the

message pane feature of the system. With the advent of ICT in developing and developed world, learning facilities are now on the increase rate [17]. Also as opposed to the existing systems where students may complain of not accessing or not being able to do assignments, tests and class works; the tutors have an access to notification/log form given by the administrator where they see each unique login and activities by students and tasks completed. The new system ensures proper monitoring of the students.

Finally, the new system allows tutors to notify every student on class scheduling and any other vital information with the aid of the notification pane. The lecturer can even get to announce when a course material, assignment or even link is uploaded for the students. Again, the lecturers have an easier time reaching out to their students out of class hours and can instantly update them over the LMS about issues regarding their coursework [10].

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