



## **An Adaptive Learning Platform for teaching Practical Repair of Micro-Computers in the COVID-19 Era**

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### Abstract

This research is aimed at developing an adaptive Learning Platform for teaching Practical Repair of Micro-Computers in the COVID-19 Era. The objective of study is to develop an adaptive e-learning platform where learners are taught one on one on computer repairs and maintenance of microcomputers to encourage practical learning in the COVID-19 pandemic era. This paper was motivated because of lack of interest amongst students, immediate stopping of academic classes during the COVID-19 pandemic, high increase in search of computer maintenance engineers and poor service delivery. Top down approach was adopted in the system design of this study, in concurrence with prototyping as its methodology adopted, programming language used was JavaScript, HTML, CSS and MySQL for the database design. The result of the study is an e-learning platform that was able to easily teach student/people practical approach to computer repairs and maintenance remotely.

### Keywords:

E-Learning, Computer Repairs, Maintenance, Microcomputers, LMS, CMS, LCMS and COVID-19

### 1. Introduction

Computers are extremely important in the modern world of today more especially during an era of quos or out spring of pandemic like the COVID-19. In the fast moving life of the modern world of today, computers hold tremendous significance. Computer system and its uses could never be over emphasized as its great importance and uses in the society at large and when one witnesses a fault in his or her computer system, there is need to take a look at the problem and ensure the fault is fixed appropriately. In corporate or business world, computer system plays a very vital role in providing good interface for easy computation of records on a daily, weekly and monthly basis. In the era of COVID-19, computer machine are one of the tools used in fighting the deadly disease as organizations provides service to their respective companies and business centers around the world from home. Robots are used to deliver goods and carryout other minor services without coming in contact to each other in the office.

Despite all the benefits highlighted above, there is another problem that is being created, there is need to provide maintaining services to these complex systems. When adequate maintenance is not provided to these computer devices in a regular maintenance, then eventually the computer might begin to function below its optimal level. In addition, the computer system requires security which if not installed could cause a huge danger to the computer device and hence could also cause data loss and damage of stored records.

Nevertheless, professionals in the repairs and maintenance business of these computers are on the down side as means of learning the profession is limited, road side mechanics has rendered people's computers useless because of their gaze work method. Higher institutions try their best on the aspect of teaching this course to students in school but the problem has always been poor practical method and proper tools and technologies for the training at a remote area and the outbreak of these deadly diseases called COVID-19 brought a pause in the academic activities in Nigeria and the world at large. In Nigerian schools with emphasis on higher institutions teaching and learning are poorly done more importantly in practically oriented courses like "COMPUTER REPAIR AND MAINTENANCE", because of lack of adequate online learning facilities, more especially those that require practical application (FACE-TO-FACE activities), students and lecturers finds it difficult to come to class because being afraid of being affected by the virus and hence causing a pause in academic activities.

## **2. Literature Review**

### **The Concept and Definition of E-Learning**

The Internet has become one of the vital ways to make available resources for research and learning for both teachers and students to share and acquire information [1].

As stated by [2] e-learning is the use of technological based systems and internet resources to provide learning materials, allow teaching and learning with remote access, and manage course contents within an organization.

In providing the definition of e-learning, [2] is of the view that e-learning ranges all aspect technological devices such as system applications, learning procedures and standards while [3] outline that there is no particular term or concept to define an e-learning system. The scholar further iterate that these discrepancies saying that there may be as many definitions of the term e-learning as there are academic papers on the subject. On the same vain, [5] tried to x-ray some common terms and meaning of the term "e-Learning" by asking some questions as follows: "Is e-learning an on-line coursework for students at a distance? Does it mean using a virtual learning environment to support the provision of campus based education? Does it refer to an on-line tool to enrich, extend and enhance collaboration? OR is it a totally on-line learning or part of blended learning?".

[6] propounded a unique definition of e-learning by saying that "It is the adoption of new multimedia tools and internet to facilitate learning processes and render quality teaching and learning standards and effective collaboration amongst users in an organization. On this note, below are some of the definitions of e-learning by various authors:

[7] Stated that e-learning is the use of information system technologies that could aid in fast access virtual or online learning resources. [8] the term 'e-learning' could be used in various domain areas such as in the online-distance learning, or distributed learning and hybrid learning platforms. More so, [9] is of the view that the adoption of learning tools and technologies ICT has facilitates processes in the educational system worldwide with more emphasis to higher institutions. The use of "e-Learning" systems as stated by [9] has brought easy integration of mixed teaching and learning processes whereby eradicating the formal traditional classroom system of teaching and learning in schools.

### **3. Types of E-Learning**

There are diverse ways of classifying the types of e-learning. [10] there have been some classifications on the extent of their engagement in education. They divided e-learning into two basic types, consisting of computer-based and internet based e-learning systems. According to him computer assisted learning systems covers the use of both hardware and software tools and components that provides services with the help of information communication system devices which could be applied in providing online learning services. In computer assisted- learning, to the author are seen as use of computer tools to assist teaching and learning in place of the normal traditional approach. The computer assisted tools provides interactive platform that supports class or self-learning remotely outside classroom learning. In respect to computer managed teaching and learning method, the adoption of computers are used for data storage and information retrieval which provide easy assistance to the educational management board. The internet-based learning according to [11] is a further improvement of the computer-based learning, and it makes the content available on the internet, with the readiness of links to related knowledge sources, for examples e-mail services and references which could be used by learners remotely and the availability or absence of teachers or instructors [12] and [13] classified this by the extent of such features use in education, mixed or blended more, assistant mode, and completely online mode. The assistant mode supplements the traditional method as needed. Mixed or blended mode offers a short-term degree for a partly traditional method. [11] described completely the online mode as "synchronous" or "asynchronous" by the application of applying optional timing of interaction. In regards to the "synchronous timing" it deals with full activation of an online access to both instructors and learners and also amongst the instructors, learners and the as asynchronous. These processes provide access for users to communicate remotely on the platform. The synchronous type allows learners to discuss with the instructors and also among themselves online remotely by using tools such as the videoconference and chat rooms. This type [14], offers the advantage of instantaneous feedback. The asynchronous approach provides access for participants on the platform to interact and share resources remotely.

Furthermore, they highlighted an advantage that learners are able to learn at a time that suits them whilst a disadvantage is that the learners will not be able to receive instant feedback from instructors as well as their colleague learners.

#### **4. Review of Learning Management System (LMS)**

The term “Learning Management System” is a learning approach for the easy management of course content in various educational systems remotely. The tool is developed to facilitate teaching and learning materials and also promote collaboration of both participants on the same platform. The activities on an LMS platform include: course creation and management, students registration, examination question preparation, test and pretest for students, result computation, submission of assignments, and easy communication between students and instructors.

Fundamentally, Learning Management System is the father of all e-learning activities, as it is regarded as the main engine that controls other e-learning tools with two major approaches such as the server that provides the major activity on the platform like (course storage, users authentication, notification, storage and retrieval of data), the user interface, that provides communication channel between the platform and the users with the aid of the browsers. In building an LMS, various language platforms are adopted such as Java Enterprise Edition, hypertext preprocessor PHP, C#, C++, Python web and .Net frameworks. The database are done using either structural query language SQL, My SQL management software or PostgreSQL.

#### **5. Critical Review on LMS, CMS and LCMS**

As stated earlier, Learning Management System (LMS) according to [15] is a software platform or device that store and deliver training content and then track participants in training, with LMS learners are motivated to be interactive with the system. It also enables establishments to construct different tracks of training courses to deliver to different groups of staffs in order to fulfill their precise training objectives. Looking critically, the purpose of these paper, which deals with the development of an eLearning system that could teach participants practical means of repairing and maintaining microcomputers, would not only be seen as an LMS but rather a combined tools of LMS and CMS or rather an LCMS as it grant instructors access to create content and same time monitor students learning progress.

In the other hand, Content Management System (CMS) is a software application or set of related programs use to create and manage digital content or it can be used to view documents. A perfect common example of CMS is WordPress, and Tumblr which grant users to various roles like: upload and organize content, set access controls and Collaborate on content, and enable learning managers to upload online training content. Furthermore CMS is an extensive storage system that doesn't line up a specific user instead, it emphasizes on the storage and group of content. Therefore, it can be very helpful to consider CMS as instructional tool, while LMS is a platform allowing for more capabilities and dynamic and active events on the system [16].

Nevertheless, Learning Content Management System (LCMS) in the other hand is an incorporated or integrated multi-user administrative, authoring and distribution platform that permits administrators to host, schedule, manage registrations, assess, test, and track online training activities. LCMS platforms deals with multiple users, that is to say LCMS users tend to provide learning content itself on the platform and these contents could be done by more than a single user while the LMS users on the other side are the learner typically. LCMS are

designed for training managers/leaders mainly; they are tools for learning content design that are easily modified for individual learners. For instance, Elucidat is regarded as the most common example of an LCMS.

In summary, LMS, CMS and LCMS are good learning technologies adopted and mostly use in the academic world where content creation, storage, interaction and monitoring of various teaching and learning activities are properly made available, adequate and flexible remotely. Though their advantages could not be over emphasized as stated earlier in this research, therefore, the limitation of these tools in the academic world lies on the aspect of effective security, lack of face-to-face interaction between learner and instructor, and e-learning technological tools like internet connectivity, hardware and software's. In the learning platform, la

## **6. E-Teaching and E-Learning/ Policy Framework in Nigeria**

For a very long time, successive governments in Nigeria have consistently formulated Policies which were directed towards ensuring that there are equal and adequate educational opportunities at every level of education. As far back as 1977, Government began searching for alternative models to the traditional conventional system, which were rather restricted and limited in scope. In response to the need for a more elastic and accessible model of education, Government opted for a semblance of e-teaching and e-learning educational system. Thus, this could be that the foundation of e-teaching and e-learning educational system in Nigeria was laid through the National Policy on Education of 1977, subsequently revised in 1981.

The current "National Policy on Education (NPE)" recognizes the importance of e-learning educational system in achieving lifelong learning and confirms that lifelong educational system will be one of the major foundations of the nation's education policy.

The NPE policy further stated that every processes or stage of education of the junior secondary, there are options for any participant to choose either full-time studies or the combination of both schooling and work or rather taking option of taking full-time employment without excluding the prospect of resuming studies later.

This envisaged the development of e-teaching and e-learning educational programs in the country. The NPE defined e-teaching and e-learning educational system as the mode of teaching where students are spaced from the teacher remotely. It uses a mixture of media and technologies to provide and/or improve access to good quality education for a large number of learners wherever they may be.

As stated by "NPE", the goals of e-teaching and e-learning educational system are to:

- i. Deliver remote entrance to sound educational resources, encourage impartiality in the educational system prospects to participants already denied of such positions.
- ii. Provide important necessities of staffs by the adoption of compulsory certificate courses which could enhance their output to service delivery
- iii. Inspire them towards international appearances and collaboration, with emphasis to employers in the higher institution and international curricula
- iv. The upgrade of employers will eradicate brain drain and encourage the use of experts and professionals in the teaching process in the higher institutions without minding their tribe nor location or place of work.

## 7. Computer Maintenance/Repair

As articulated by [17] “computer maintenance” is the process of ensuring that the computer device is working properly and every functionality that could be done using the computer system is done effectively. These processes of maintaining the computer system looks at dusting areas accumulated by dust, hidden areas like the fan, motherboard etc.

In the maintenance process, tools or medium used to alleviate the computer system requires constant servicing and change regularly. For instance, if the computer cooling fan is not well filtered, then performing regular computer cleaning could result to breaking of circuit which might lead to overloading of the computer and overheating.

### Some Computer Component

**In providing maintenance to the Keyboard:** Dust, water, or other particles that could be found in the keyboard between the keys and underneath position for the keyboard must be loosen and well checked. Dust could be cleaned by spraying pressurized air into the keyboard, while the situated position for the keyboard must be properly checked for best position before screwing.

In aspect of water or oil spill, dry clothes are used to drain the water and heats are applied on the position to ensure the water is properly dry.

**Maintenance of the Monitor:** The monitor is regarded as the screen where information or output from the computer is displayed. Like a television screen, a computer screen can show still or moving pictures and it’s a part of Output Devices.

**Maintenance of the Mouse:** The mouse is an input device use to give the computer commands, in providing maintenance to the device, the top surface is made up of plastic which could be cleaned using dry cloths, while the down side are placed on a smooth surface and are cleaned and dusted regularly to ensure free movement.

**Maintenance of the Tower/desktop unit:** This is the control unit where most of other components are situated. The case are usually cleaned with a soft brush because dust are always accumulated in this area and some could be applied a cleaning agent for fast and lasting performance

**Maintenance of Software updates:** In other to make the function of the computer system performs accurately always, there is need to perform regular update of installed software’s, more especially system, application and utility software’s. When software that is due for update is neglected, it causes the computer to process task very slowly.

**Backups:** It is a very professional practice to always have a system backup plan for every computer system as its great importance could not be over emphasized. In times of system crash or failure, the backup files are used to recover lost data. But is almost important not to allow virus infect the backup files because if so found will cause a great damage of files and corrupting the entire computer system.

## 8. Adopted Methodology

In this study, the Extreme prototyping methodology was adopted because it is a system development process used especially for developing web applications and which allows developers to greater portions of the solution to demonstrate functionality and make needed refinements before development of the final solution. It is somewhat similar; it produces a

“throw away” solution designed for the sole purpose of verifying user functionality and for demonstration capability. Extreme prototyping is an excellent approach for any developing term to confirm their understanding of the required model and to be assured of the proposed solution are consistent with business expectation. These methodology is normally used or works very well with online transaction processing system (TPS) WEB BASED Development and also very useful for confirming business intelligence analytic requirement. Hence, this e-learning platform on practical approach to microcomputers adopted this methodology because it ensures that “throw away type of the proposed model is designed, tested for its functionality and confirmed” before the final and acceptable product is produced for the use.

The process of prototyping involves the following steps:

1. Ascertain elementary requirements
2. Create the initial prototype
3. Review the system
4. Revise and enhance the prototype

Therefore, the phases listed above were duly followed so that every phase of the design is captured. Below are the phase and how it was used:

**Phase 1: Identify basic requirements**

For proper development using this methodology, input and output requirements and security methods are looked into which include:

**Input Requirements:**

In other to capture user requirements and functions, a use case diagram is used and three (3) users are identified which are:

1. **Students (User) Requirement**
2. **Instructor (User) Requirement**
3. **Administrator (User) Requirement**

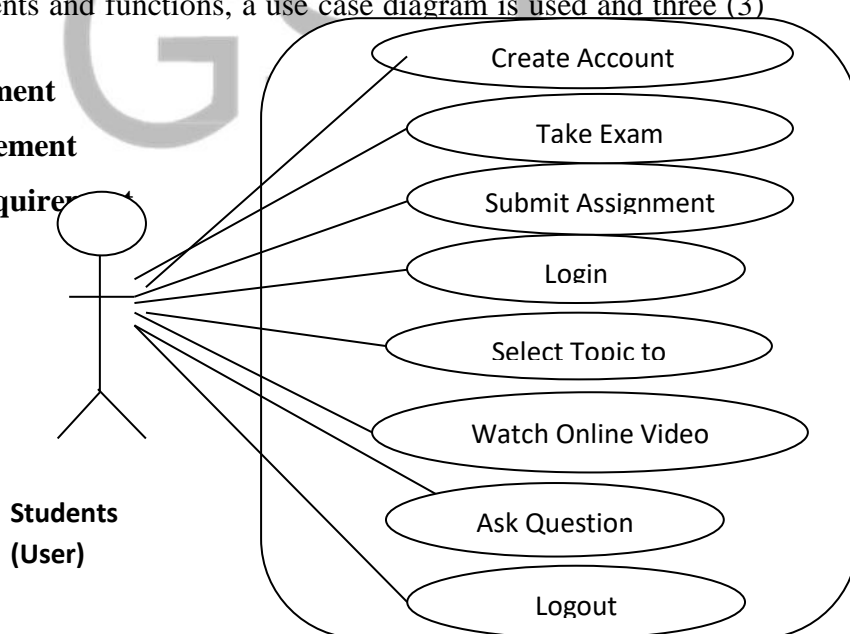


Figure 1: Student User Case Requirement (Source: Field work 2021).

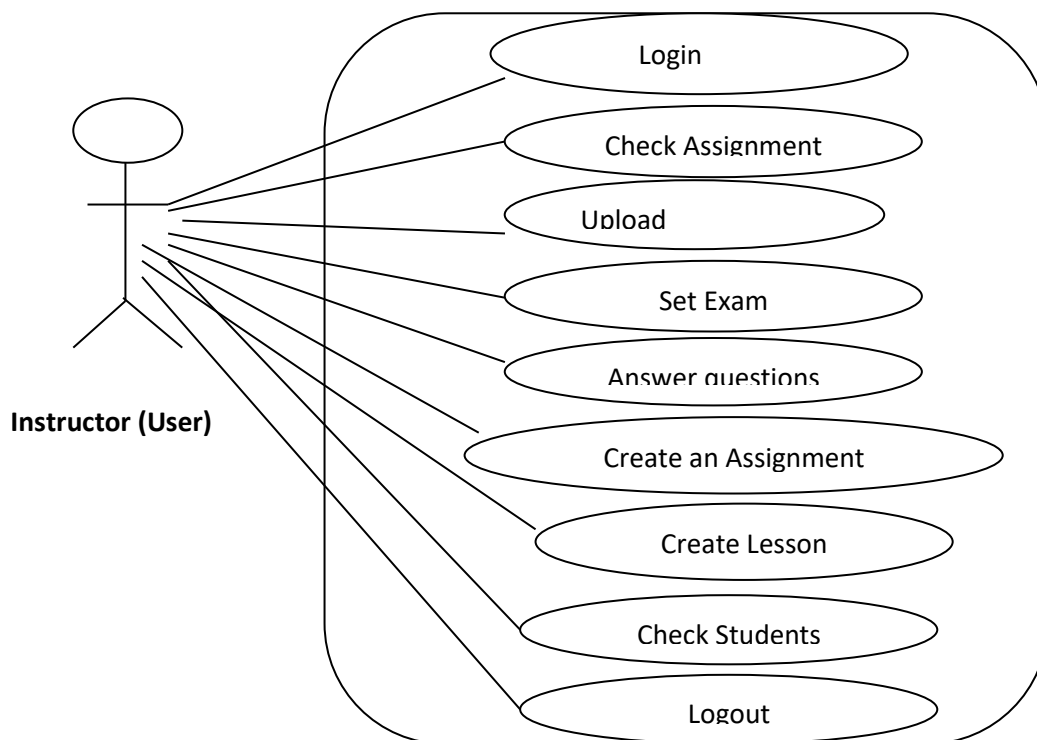


Figure 2: Instructor User Case Requirement (Source: Field work 2021)

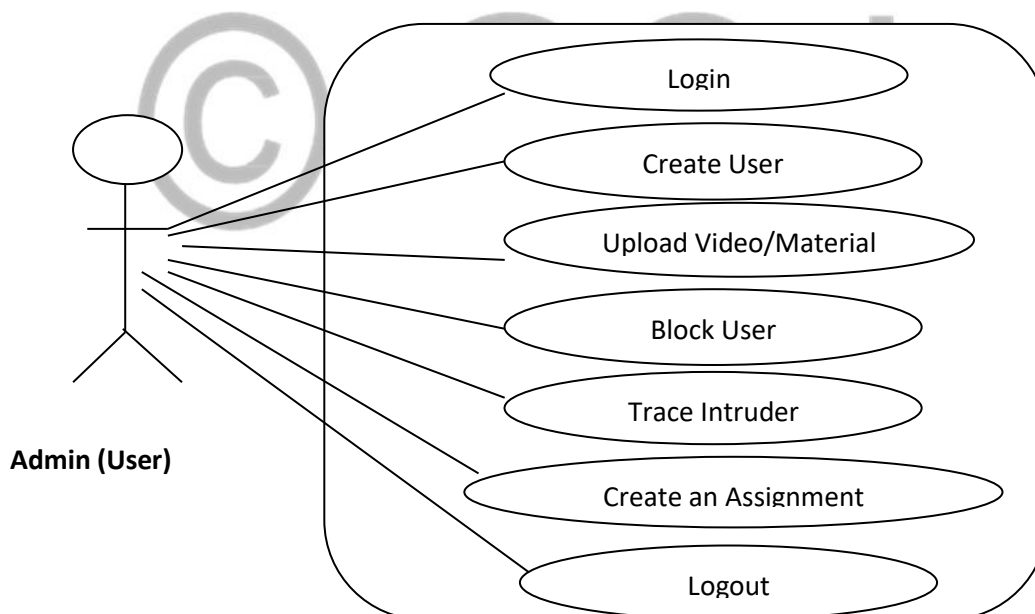


Figure 3: Administrator User Case Requirement (Source: Field work 2021).

### Security Technique Adopted

This system adopted different security measures for adequate data protection and to make sure that only authorized candidate/users are allowed on the platform.

Email redirect point was used to ensure additional protection on the platform.

### Secret Pin (Password)

Password generation, as we all know is used widely by various platforms as security technique. Ours was not different, as every user has an account and in that process a username and password are requested to be given by the user during sign-up.



### **Phase 2: Create First Prototype (Design)**

The first model is designed containing only the user interfaces, some of the interface designed includes:

1. Students Registration User interface
2. Administrators User interface
3. Upload File User Interface design
4. Create User Interface

### **Phase 3: Review (User Evaluation)**

Usability/Functionality Test, deals with a test performed on an entire system in situation of a functional requirement specification (FRS) and / or a system requirement specification (SRS). Functionality testing test not the design, rather performance, prospects of a customer on the system. The functionality test covers both the hardware and software requirements and specifications of the system. At these stage customers, including end-users, examined the proposed e-learning prototype design and provide feedback on potential additions or changes. After the evaluation test, some of their feedback includes:

1. The design looks and feel
2. Make sure that the system is more interactive with a more simple user interface
3. Ask the organization to provide mobile application for easy access to the system
4. Provide an additional security to the system

### **Phase 4: Revise and enhance the prototype**

Using the feedback, both the specifications and the prototype can be enhanced. Enquiry about the scope of the contract or product to be produced is highly important, these steps is to make sure that every change introduced in the system are duly affected else a repeat of the phase 3 and phase4 may be needed.

Therefore, enhanced e-learning health-care system was looked into so as to redesign, putting into consideration of users' request or demand into action.

#### **1. Front-End Prototype Development**

The front end development which was the link (interface) between users and the back-end of the application was redesigned with Hypertext Markup language (HTML), Cascading Style Sheet (CSS), and Java-script. Where the JavaScript provide the adequate interaction and events of action between the application and the end users. The front pages was amended with sharp colors and styling with the Cascading style sheet (CSS).

#### **2. Back-End Prototype Development**

The back end development which ensures that any request made from the front-end was serviced accordingly are designed with Hypertext Preprocessor (Php), My-Structural Query Language (MySQL).

### 9. Users Interaction between the Front-End and Back-End

Interaction between various users cannot be done without the browser and effective internet connectivity. Once a learner visits the website, the user in this case student-user must first create an account which allow the student to select a unique username and password combination where as other users details will be issued to them by the administrator. After a successful user authentication which opens the dashboard for any user to perform some activities depending user role. Figure 4 illustrates activities of various users through the browser (Front-end) and the database (back-end) activities.

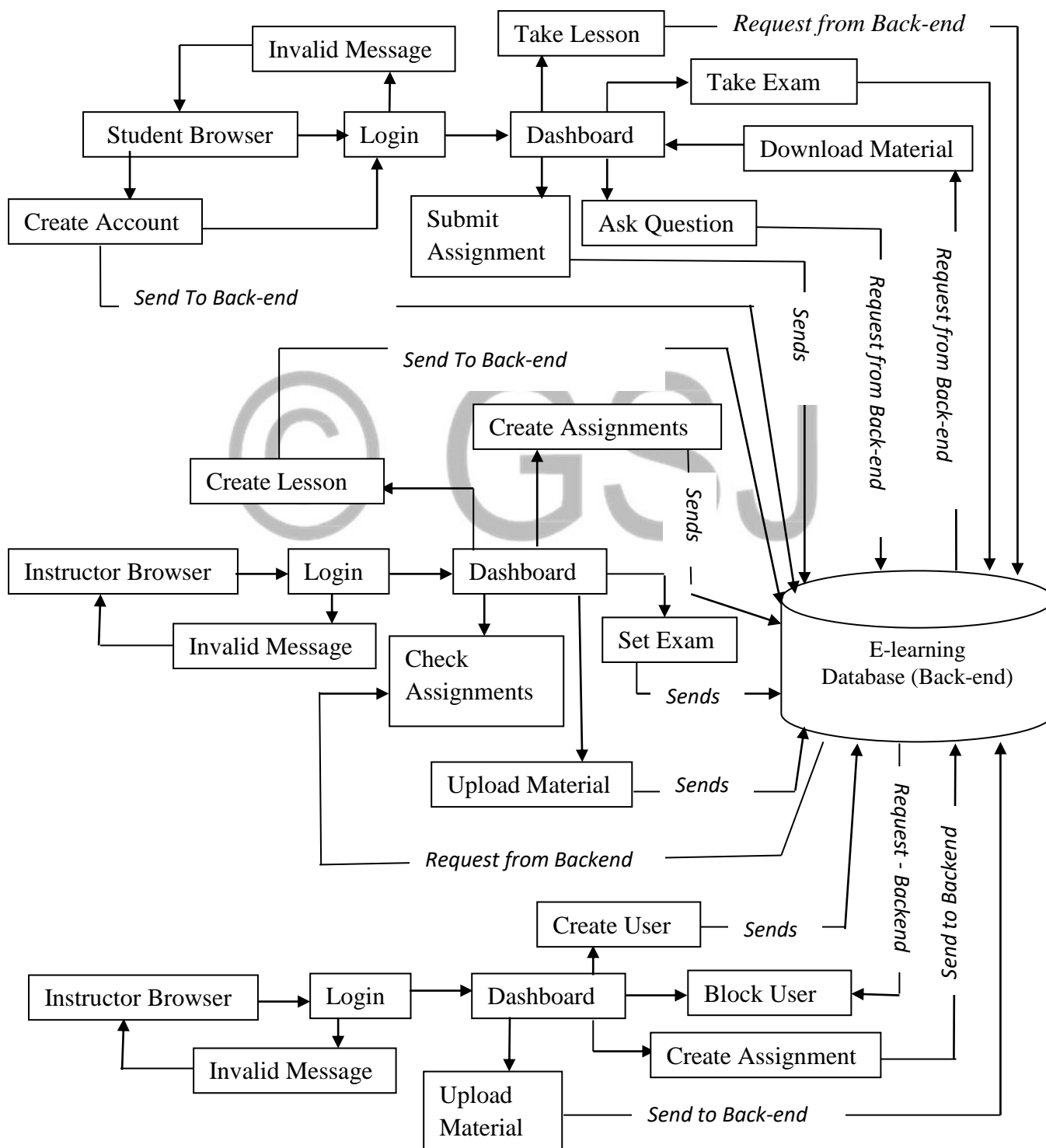


Figure 4: Components diagram of users activity on the Front-End and Back-End

### 10. Architecture of Proposed System

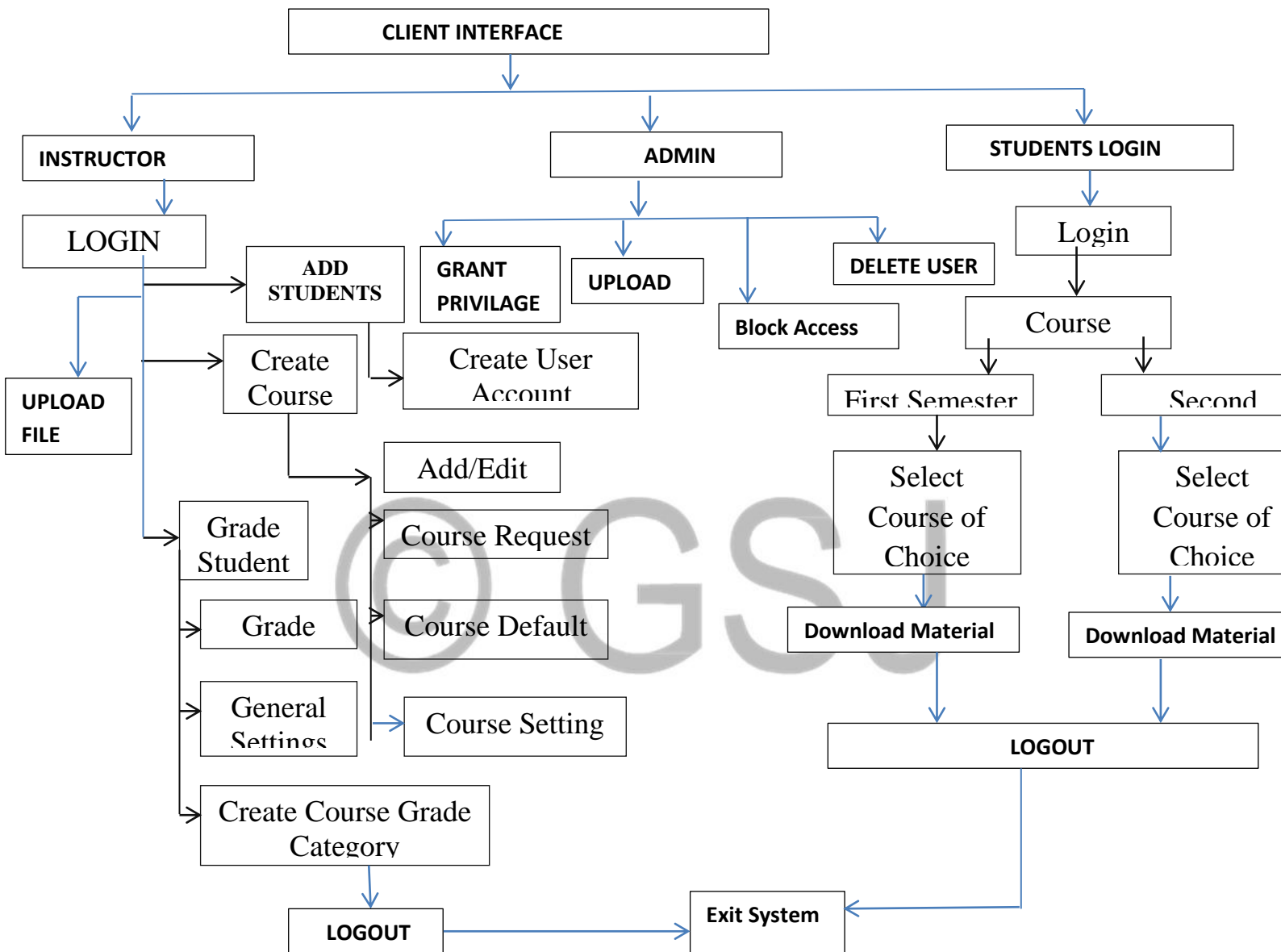


Figure 5: Architecture of Proposed System

### 11. Operation/Roles of Various Users

Users on the system required to have a correct username and password combination. Students are the only users allowed to create account on the platform while other users like Instructor and System admin done by the overall administrator who happens to be the one in charge of the operations and maintenance of the system.

**INSTRUCTOR USER:** Once a successive login is granted by the instructor through the login module, the system takes the instructor to the dashboard. It is at this dashboard that the

instructor can perform the following task such as: **Create new lesson, Set Examination questions, answer student questions, create assignments to students, check submitted questions by students, create new courses and register new student** then logout from the platform.

### **STUDENT USER:**

Before a student can access the platform, an account must be created which could provide direct entry of users on the platform with “username and password” combination. After a successive login, the student e-learning dashboard is provided. It is on this dashboard the student can perform activities like: **Taking of Lesson:** Lessons prepared and uploaded by instructors, and here various materials on repairs and maintenance of microcomputers are presented; therefore the students can download, watch video or read through any one found interesting. Other activities granted to students include:

**Asking of Question:** After a lesson, students ask question through this module, checking for answers to questions: Students check for answers to their question through this module, **Checking for assignments:** Checking and submitting of assignments are done through this module, **Exams:** Every student takes their examination through this module. All these processes and activities are required by the students for effective training on repairs and maintenance of microcomputers on the platform.

**ADMIN USER:** This is the module that allow the administrator of the platform to login and perform some activities like: **Uploading of Files, Blocking access to other users**, in this case students or instructors, **viewing all users on the platform and student information's, deleting of files/materials**, ensuring that data integrity is maintained and reduction of data redundancy.

## **12. System Description**

The proposed system development was achieved using Top-Down Approach. This approach makes use of essential problem-solving methods. The developed software is organized in a way that each subsystem is carefully chosen and implemented independently. The task is divided into several modules, which provided the final solution to the problem. Below are the modules in the system:

- a) **Lecturer Login:** This enables lecturer to login to create courses, upload files, grade students, request for course and add the students.
- b) **Student Login Module:** This module provides an interface for students to login and take or course online. Every student on the platform must create an account and a combination of matriculation number and surnames should be used for login.
- c) **Upload File Module:** The upload of file (Course Materials) by lecturers.

- d) **Add Student Module:** Creating or updating of students (Users) are done by the use of this module
- e) **Create Course Module:** Lecturers can create new courses either first semester or second semester courses.
- f) **Grade Student Module:** Preparation of student's assessment is done by lecturers on this module.
- g) **Course Request Module:** Course Request are done with this module
- h) **Select Choice of Course To Take Module:** Students can use this module to select any choice of course they wish to study.
- i) **Administrator Module:** This module enables for updating and maintenance of information on the system by the admin

### 13. Conclusion

The study has established that an adaptive Learning system for teaching Practical Repair of Micro-Computers in the COVID-19 Era involves technological tools in providing teaching and learning remotely. The designed system uses technological appliances and tools to foster adaptive learning and enable learners study remotely. The platform enables easy and efficient collaboration and interaction amongst teachers and student and also allows fast delivery of knowledge and motivates students to interact with each other and exchange and respect different point of views. The use of this learning platform in the COVID-18 era do not only allow fast teaching and learning between students and instructors, but also build strong relationship amongst student and teachers. Despite some challenges in the existing system of learning systems, the reviewed literatures in this study have explained the role of e-learning and how eLearning has made a strong influence in teaching and learning process. The adoption of eLearning in educational system has increased faculty and learner's access to information and has provided a rich environment for collaboration among students which has improved academic standards more importantly during this COVID-19 era. The literature in this paper covers both the advantages and disadvantages of e-learning and hence suggest that eLearning systems be implemented in all the educational systems in country to enable fast and remote learning practice in times of pandemic as witnesses in the COVID-19 period.

### 14. Result

The result of every designed system talks about the result. Below are the screenshot of the adaptive learning Platform on the teaching and Repair of Microcomputer.



Figure 6. System Home (On the Browser)

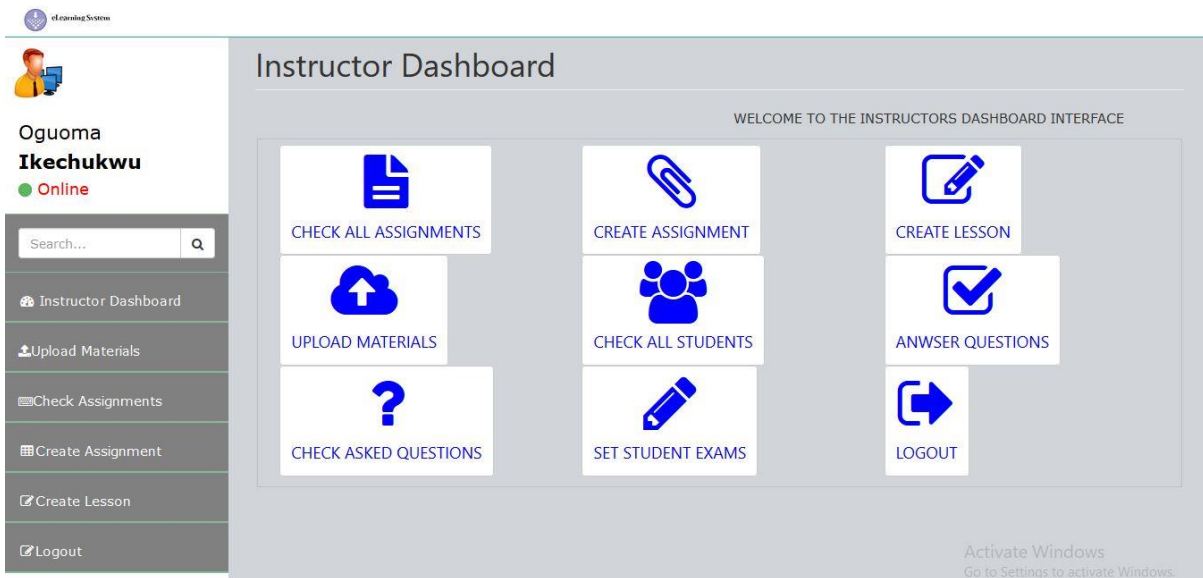


Figure 7. Instructors Dashboard

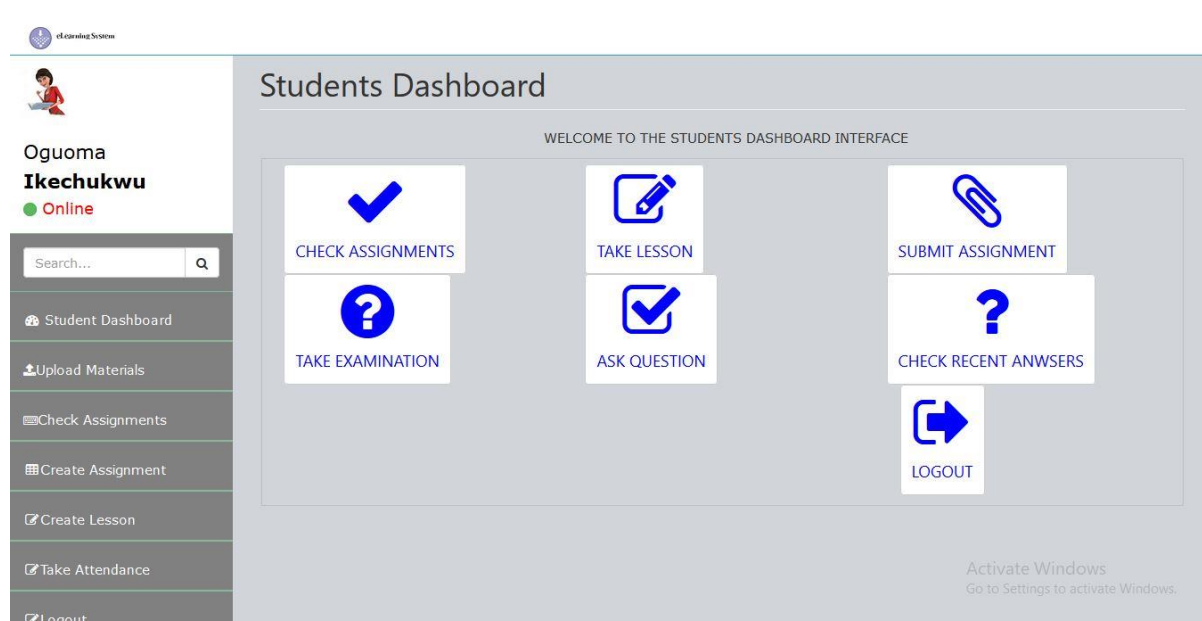


Figure 8. Students Dashboard

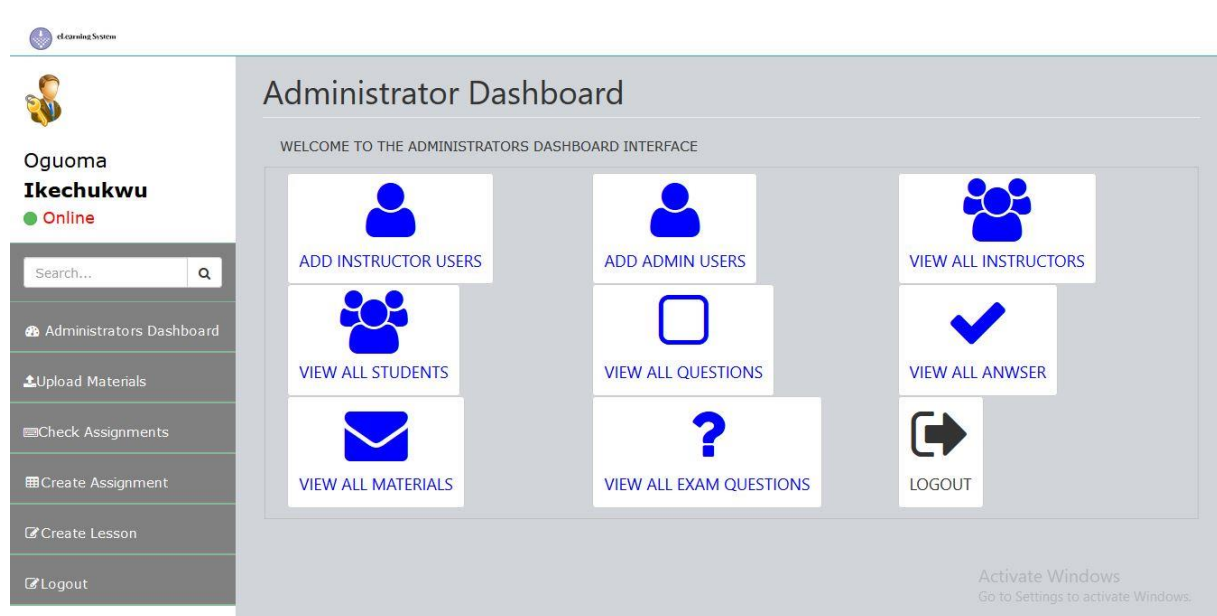


Figure 9. Administrators Dashboard

## 15. Recommendations for Further Studies

This paper recommends the following:

1. The researcher therefore recommends that this system should be redesigned with the newest technology like (Android Mobile Applications) and also with other mobile phone devices to enable mobile accessibility of practical learning in case of any outbreak.
2. Also other study should look at how to integrate effective security measures in delivering an online training and other eLearning technologies in academic world.

3. Governments should provide hardware and software tools affordable and available to schools at various level so that more effective and flexible use of e-learning technologies could be achieved.

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