



## Applications and Derivable Benefits of Cloud-Based Mobile Learning Platform in Nigeria Higher Institutions

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**Abstract-** *Mobile computing involves the use of portable handheld devices having network connections to access online resources via the internet. With mobile computing people can collaborate from various remote locations, they can be involved in online forums, conferences, chats and distance learning. Mobile learning or M-learning presently is a more efficient, effective and convenient learning method. But as the education contents and resources as well as number of users and services increases, it becomes challenging deploying the m-learning technique. This is where cloud computing comes into play as it provides a more reliable, scalable and dynamic computing platform for the end users. In this paper, a new platform for cloud-based mobile learning is presented where mobile and wireless devices are used for its implementation. This new learning method can be applied in higher institutions or any other environment where teaching and learning takes place, with particular interest in the Engineering discipline. The various applications and numerous benefits of mobile computing especially in the area of mobile learning are outlined in this paper. This platform can be applied everywhere where there is a need for teaching and learning in higher education with particular interests in the Engineering discipline. The various applications and numerous benefits of mobile computing especially in the area of mobile learning are outlined in this paper.*

**Keywords-** *Cloud, Internet, Learning, Mobile, Wireless, Communication.*

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### I. INTRODUCTION

“Cloud computing is the delivery of computing services over the internet” [1]. This essential feature enables people to access online resources via their computers having internet connections. According to the official NIST (National Institute of Standards and Technology) definition, “Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” [2]. The cloud concept can be applied in the area of mobile learning which involves the use of mobile or handheld devices for distant learning, enrollment in online courses and mobile computing. Modern technology has transformed the education system such that teaching and learning cannot only take place at schools, but also in the office or at home. It allows users to carry large amount of resources in their pocket sized devices and to access them whenever and wherever convenient. With the speedy and rapid growth of the internet, mobile applications, mobile networks and cloud computing, m-learning is a very viable application for mobile devices. Electronic Learning provides the ability to harness the power of mobile technologies to make the learning experience more convenient and effective. In this paper, the methods used in the design of the software modules for the mobile learning platform are explained using algorithms and flowcharts. The areas of application and derivable benefits of the mobile learning platform and how it enhances the learning process are also illustrated.

### II. METHODOLOGY

The implementation of the mobile learning platform involves both hardware and software components which are utilized to actualize the design.

The **software** involves the development of the software applications that run on the hardware. A module design approach was used to develop the softwares. It involves the use of the following programming languages:

**PHP** (PHP Hypertext Preprocessor): This is the key software used for the application development.

**MySQL** (Structured Query Language): The connection of the client software to the cloud database is achieved by using the Structured Query Language.

**HTML** (Hyper Text Markup Language): The hypertext links the web pages to the World Wide Web which enables interconnection to the platform via the internet.

**WAMP** (Windows, Apache, MySQL and PHP) server software. This software enables offline development and testing of the application software. The platform design was completed using the WAMP software before hosting it on the cloud.

The **hardware** part comprises the handheld devices that are used in the mobile learning process. These include devices such as smart phones, iPads, PDAs, Tablet PCs, and so on. These mobile devices, however, are readily available and not designed in the course of this work but are devices that are utilized in demonstrating the cloud-based m-learning. The network infrastructure is also a vital aspect of the hardware components since it comprises the telecommunication

network, the internet, wireless networks, cloud service infrastructure constituted of servers, gateways, and so on, through which data services are being transmitted.

The design goals behind the use of mobile and handheld devices in the implementation of the m-learning platform are for the following benefits as stated under:

- **Portability:** This is due to the miniaturized shape and sizes of handheld devices which enables them to be carried about easily [3].
- **Wireless Connectivity:** The devices have no physical wired connections for the exchange of data but interconnect via wireless transmission technology.
- **Mobility:** Based on the above attributes, easy movement of the devices is guaranteed enabling students to make use of them anytime, anywhere.

**A. The Software Design**

The entire system comprises the following modules which are designed and developed separately as represented in the block diagram of the mobile learning platform below:

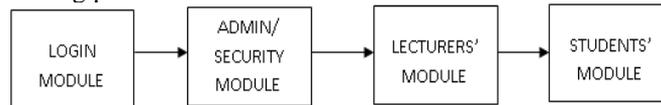


Figure 1: Block Diagram of the M-learning platform

The block diagram illustrates the various components that constitute the m-learning platform which include the login or authentication module, the admin or security module, the lecturers’ module and the student module. These are the modules that make up the platform.

**1. The Login Module**

The login module is the user authentication module whose primary function is for identity validation. This module is usually the first interface for anyone trying to gain access or make use of the m-learning platform. To login, a username and password is required. These login IDs are usually provided by the admin during the registration process which is stored in a database. The user is required to supply the correct user IDs to gain access. A comparison is done with the information in the data base and what the user supplies, if they match, then the user is granted access, else he is prompted to supply again the correct login IDs. This login process is illustrated using the algorithm and flow chart as shown below:

**i. ALGORITHM FOR THE LOGIN PROCESS:**

The algorithm of a program refers to its logic. It is the step by step description how to arrive at the solution to a problem. It defines a sequence of instructions that when executed in the specified sequence the desired results are obtained.

The algorithm below defines the steps for the login process.

- STEP 1: START
- STEP 2: Launch the M-learning platform
- STEP 3: Enter username and password
- STEP 4: Validate login details
  - IF username and password are correct,
  - THEN go to STEP 5
  - ELSE go back to STEP 3
- STEP 5: Enter the platform
- STEP 6: STOP.

**ii. FLOW CHART FOR THE LOGIN PROCESS:**

The flow chart for the login process is as shown in figure below.

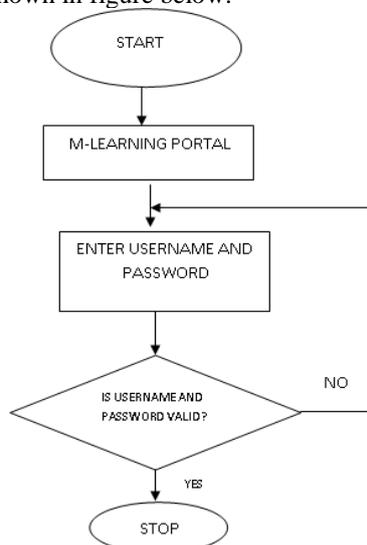


Figure-2: Flowchart for the Login process

**2. The Admin Module:**

The Admin module is designed to manage the other modules in the m-learning platform which include the lecturers' module and the students' module. It is central to the two modules. The admin module is where user registration is done for both the students and the lecturers. For the lecturers, usernames and passwords are being created and supplied as their login details. For the student registration, registration numbers are supplied to the students and are required during the login process.

**i. ALGORITHM FOR THE ADMIN MODULE**

- STEP 1: START
- STEP 2: Login as Admin
- STEP 3: Validate Admin IDs
  - IF username and Password are correct
  - THEN Go To STEP 4
  - ELSE Go back To STEP 2
- STEP 4: View Admin Page
- STEP 5: Create User Accounts
- STEP 6: Confirm all fields are completed
  - IF all fields are completed;
  - THEN: Go To STEP 7
  - ELSE: Go back To STEP 5
- STEP 7: STOP

**ii. FLOW CHART FOR THE ADMIN MODULE:**

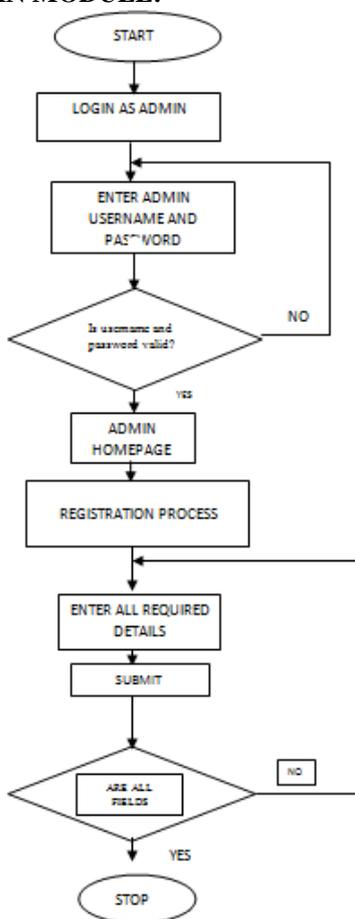


Figure-3: Flowchart for the Admin Module

**3. The Database**

The database functions at the physical layer of the model. It is the storage location of all data content and information. The database server is where the details of each registered student, all lecture materials and notes are stored and retrieved on demand. For the purpose of this design, the database is hosted on the Microsoft Apache server which is a reliable database server for cloud applications. The application of the cloud broadens the versatility, scalability and flexibility of the web application. In traditional m-learning systems, the website could be hosted on a singular and localized server. This limits the speed and capabilities of all hosts to the processing power of the single server. However, with cloud computing, the database is hosted on cloud resources provided by a Cloud Service Provider (CSP). In this architecture, basic information and applications are stored and retrieved from distributed servers. The implication of this is that larger storage space, faster processing speeds and higher computational power and zero down time is guaranteed.

#### 4. Connecting To The Cloud Server

To connect to the Microsoft Apache Server, the URL (Uniform Resource Locator) address of the mobile learning portal which is its web address is entered into the address bar of the web browser. This address is linked on the World Wide Web using HTTP (HyperText Transfer Protocol) which is based on TCP/IP. To connect to the cloud server where the m-learning portal is hosted, the DNS (Domain Name Service) protocol comes into play. Domain Name Service is an Address Resolution Protocol that translates or links a URL address to its IP address. Thus, when a client request is sent from a mobile subscriber to open the m-learning portal by typing the URL in the address bar, the cloud server (or group of servers) which are highly virtualized, responds to the request by sending the webpage to the client's desktop or carrying out any other appropriate instruction.

### III. RESULTS AND DISCUSSION

The implementation of the mobile learning platform makes it clear that the M-learning process enhances learning outcomes of students significantly. A greater advantage is the integration of cloud computing into the learning infrastructure. With cloud computing, not only would physical presence of the teachers and students matter less, but also information storage and retrieval is made very dynamic due to the distributed storage features of the cloud resources. No longer would storage be localized to a particular server or information processed by a singular computer. With cloud computing a vast array of computers and integrated servers can synergize to handle a particular computational task on-demand and also guarantee large storage capabilities.

Some illustrations of the implementation of the mobile learning platform are given below. I excerpted some screenshots from the design windows which is used to demonstrate the Application Program Interfaces with which the teachers and students can used to interact from their various distances and locations.

#### A. The Login Screen

The login screen is the first and foremost platform on the portal. It is an authentication environment where users are prompted to supply their relevant IDs for validation. The login screen is very essential because it performs security functions such that only registered persons can be allowed access to their user accounts. Figure 4 below shows the admin login screen for the portal.

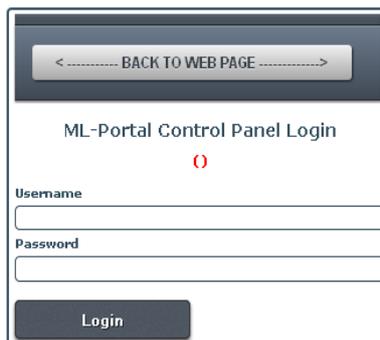


Figure-4: The login screen

#### B. The Admin Home Page:

The home page is usually the first environment to appear soon after logging in. To open the home page, enter the site's URL in the address bar. A login authentication window is prompted. The admin then inputs his username and password and is granted access to the home screen. Figure 5 below gives an illustration.

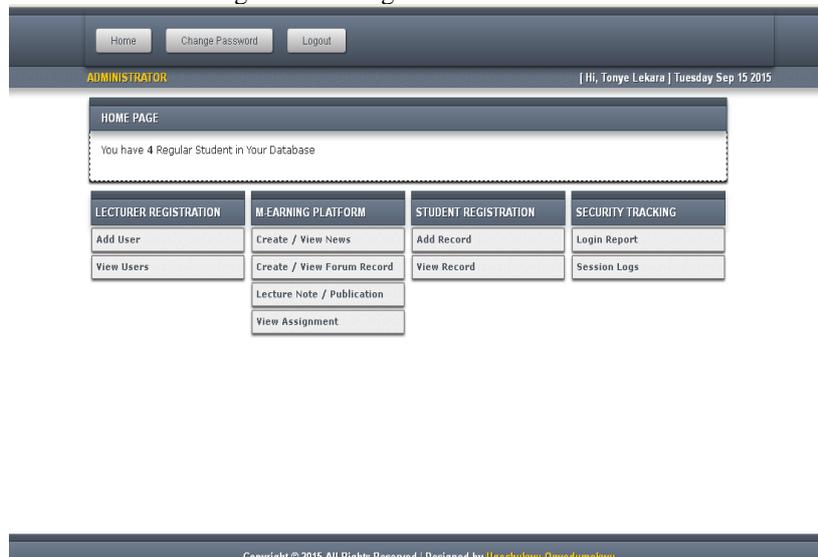


Figure 5: The Admin Home Page

The home page contains four major tabs. These include:

- Lecturer registration,
- M-Learning Portal,
- Student registration, and
- Security Tracking.

From the Lecturer Registration tab, the Administrator can register new lecturers and also view the registered lecturers in the platform.

The students' registration involves more details about the students being registered. The necessary details about each intending student are filled out in this platform to create the students profile.

For the M-Learning Portal tab, it is a link to the various interactive sessions such as creating news, creating forum sessions, upload lecture notes and publications, and also to view assignments.

The Security Tracking tab keeps a record list of all users and their login time and session activities (whether active or inactive). It keeps track of users and their interactive sessions.

### C. The Student Home Page

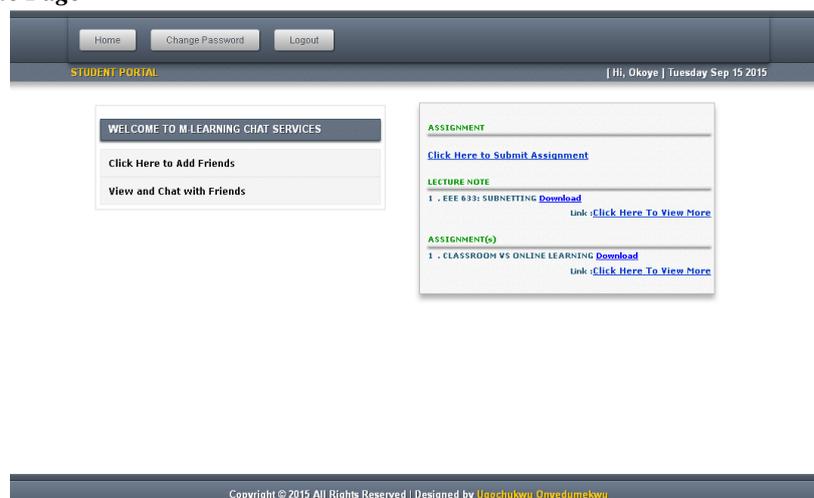


Figure 6: The Students Home Page

The above page is the student home page. To open, the student logs in with his username and password. Here he can download lecture notes, assignments. He can also submit assignments by clicking on the appropriate link as indicated in the screen shot in Figure 6 above.

## IV. APPLICATION OF CLOUD-BASED MOBILE COMPUTING

Below are some of the areas where cloud computing finds vital applications. These include:

### • E-Science:

This targets the implications of cloud computing for the e-Science community, which has long been yearning for infinite computing power. E-Science refers to the scientific disciplines (i.e. earth science, bio-informatics, particle physics, etc.) where rapidly increasing volumes of data gathered from sensors and instruments need to be processed in a timely manner. Cloud computing, with its tremendous computing power and inexpensive cost, has drawn considerable attention from the e-Science community which has traditionally relied on scientific and academic computing grids". [4]

### • Mobile Computing:

Mobile computing combines two basic technologies which are mobile communication and cloud computing. In Engineering analysis involving practical and mathematical problems, mobile computing is a veritable tool as basic softwares are used in the simulation of dynamic system to determine their behavior and performance in real life scenarios. This software is provided by the cloud providers with licenses such that it is made more affordable for use by the student. For mathematical analysis, equation editor software, graphical analysis and plotting, are provided as part of the cloud resources.

### • M-Learning:

Mobile learning deals majorly on the impact of cloud computing in educational systems, more especially in schools of higher learning. As much money is being parted by academic institutions in running operational and maintenance costs of ICT infrastructure, it is recommended that cloud solutions are adopted in such institutions such that much less is spent for higher value services. Students can learn from a distance and collaborate more effectively using the m-learning platform.

## V. BENEFITS OF CLOUD BASED MOBILE LEARNING IN ENGINEERING

- **Cost Savings:** In Engineering where lots of softwares are required for design and implementation purposes, the use of the cloud is very beneficial since it offers low cost option for using high cost computing systems and services. All that is needed is a simple mobile terminal with internet connection[5].
- **Increased Data Accessibility:** Students can access their data from anywhere in the world and at any time. This implies that the students can retrieve their stored data from the cloud system using any handheld computing device linked to the internet. Data would no longer be confined to the user's hard drive or universities internal network.
- **Anytime, Anywhere Learning:** The mobility feature of the M-learning portal enable students to learn from anywhere. It offers a better learning process since students can collaborate from their various distant locations[6]. There is no necessity converging in a single learning environment. What other convenience would compare to this?
- **Secure Data Storage:** Storing confidential and critical data centrally in the cloud is a better option. It provides more security since the cloud guarantees a safer storage. In case of the loss of one's laptop or USB device, stored data can always be retrieved from the cloud using any other device.
- **No need for Advanced Hardware:** Cloud systems would reduce the need for advanced hardware on the users' side. No longer would you need to buy the fastest computer with the most memory, greatest speed or highest processing power because the cloud would have all of such needs met.
- **Automatic Software Updates:** Students that rely on computers usually face the challenge of having updated softwares in place to get their corporate goals achieved. With cloud services in place, the students and teachers need not pay for softwares or software licenses, instead they would only pay a metered fee to the cloud service provider.
- **Physical Storage Space:** Some Organisations pay for physical space to store servers and databases because they do not have sufficient space at their site. Cloud computing offers such companies the option of storing their large data sets on remote cloud servers removing the need for physical space on the front end.
- **Rapid elasticity and Scalability:** Depending on the customers demand, services rendered can be scaled up or scaled down to meet with real-time requirements.
- **Mobile Device Dependency:** Most students have phones, tabs, pocket PCs, etc with ready internet connections, it serves as a viable media for users to utilize the cloud services from their devices.
- **Enhanced Data Storage:** Since data is stored in the cloud, it gives room for large data storage sets. Storage is no longer limited to the capacity of the hard drives or USB devices.

## VI. CONCLUSION

The design and implementation of a cloud-based mobile learning platform using handheld and wireless devices is the substance of this research paper. It demonstrates the numerous benefits obtainable by using mobile services in a cloud environment. As the numbers of mobile devices are rapidly increasing and are readily available, it makes the delivery of m-learning services more realistic. In a situation whereby there is increasing computational demands (such as software and hardware resources) for the educational institutions and required financial investments cannot be met, cloud solutions becomes the best option for them. The key benefits of cloud computing is that it provides centralized storage, processing, memory, bandwidth and also provides a convenient and cost effective solution in learning . In Engineering, it gives a clear picture of the theoretical, practical, mathematical and analytical evaluation of engineering problems.

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