



A Multi-channel Cloud Based Student Information Management System

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Authors' contributions

This work was carried out in collaboration between all authors. Author DTA was the initiator, coordinator and supervisor of the entire process, managed the design and implementation of the system, reviewed the manuscript and ensure the correctness of the manuscript. Author KO designed implemented the system successfully and took active part in the entire process. Author OB wrote part of the literature review, offered suggestions during the implementation and organized the manuscript. All authors read and approved the final manuscript.

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Abstract

The system developed in this paper uses a cloud based multi-channel technology to implement and design a robust and dynamic cross platform software as a services (SaaS) application for students' information management system (SIMS). The system runs on a network of infrastructure as a service (IaaS) for the purpose of overcoming the lapses associated with the existing systems developed for managing students' information. The system was built with the capability to resolve issues on manual documentation of information on staff and students, share information simultaneously among multiple users and perform its tasks without delay or deadlock.

The system was developed using several scripting languages such as PHP, AJAX, JAVASCRIPT, HTML and CSS with emphasis on PHP and AJAX due to their robustness and network-centric ability in web application development. The database of the system was designed and implemented with WAMP SERVER and MYSQL. The developed system was tested using real live data and the results showed that the objectives of the system were successfully achieved.

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1 Introduction

The focus of this research is on the design and development of a dynamic cloud based multi-channel Students' Information Management System (SIMS) that aids in management of staff and students records and information sharing. [1] stressed that colleges relied heavily on paper records which is a traditional way of managing students' data. However, this method showed several drawbacks and paper records generally are associated with problems such as:

It is difficult to manage and track;

Physical exertion required in retrieving, altering and re-filing records which are all non-value added activities.

It is worthy to note that in this modern age, students, lecturers and other category of staff place much value on their time and are consequently craving for a system that will enable them maximize their time. It is within this premise that the conception of the development of the dynamic cloud based multi-channel Student Information Management System (SIMS) was conceived to provide a robust system that will assist management of institutions to maximize their time and provide a platform under which information can be made available to staff and students when it is requested.

SIMS uses a dynamic multi-channel system to allow prompt access to and sharing of information by students, staff and lecturers and also ensure that information shared reaches the destination without hindrance unlike in a single channel system where information can disappear or lost during the process of data sharing. SIMS system saves time, ease stress and able to manage and share information concurrently among multiple users. The dynamic cloud based multi-channel system technology is cheap, easy to implement, efficient, more secured and a faster technology for information processing.

2 Research Objectives

The primary objective of this research is to develop a multi-channel cloud based system that provides a robust system for accessing and sharing information. In addition to this, other objectives are to:

- a. Provide an online interface for students, staff and lecturers and a mechanism for managing, securing and monitoring users;
- b. Increase the efficiency and flexibility of managing college and students records;
- c. Reduce time required to access and deliver students' records;
- d. Manage and develop a secured dynamic system for information sharing and serve as an intermediary for information sharing among staff, students and lecturers simultaneously without hindrance;
- e. Facilitates result computation, course registration and financial transactions and
- f. To provide a network-centric and robust system for updating, downloading and uploading of information.

2.1 Review

2.1.1 Why information management system (IMS)?

Information in a simple way is defined as facts that have been processed. Information has many definitions from different perspectives. Information has been adequately defined in [2]. According to [2], Information is what people or systems needed to be able to perform work practices. It is an essential but elusive concept.

Generally speaking, everything that is psychological begins with information. [3] stressed that the current conceptualization of information technology (IT) enable knowledge management suffers from the fallibility in imposing the traditional information-processing model on the strategic needs of contemporary organizations. The traditional knowledge management model emphasizes convergence and compliance to achieve pre-specified organizational goals. However, this model is increasingly inadequate for an era characterized by increasing pace of discontinuous environmental change [3].

2.2 Information management system as a cloud based technology (cloud computing)

Cloud based technology is a pay per use model for enabling 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; [4].

According to [5], Cloud computing is a new concept that brings together all the disciplines, technologies (Web services, virtualization, SOA: service oriented architecture, grid computing, . . .) and business models used to deliver IT capabilities (software, platforms, hardware) as a service request, scalable and elastic. This is the new trend of computing where IT resources are dynamically scalable, virtualized and exposed as a service on the Internet.

There are four main models of deployment of cloud computing as shown in Fig. 1 and these are public cloud, private cloud, hybrid cloud and community cloud that provides different level of functionality and service. In addition, there are three levels or models of cloud computing as discussed in [5] and [4] and they are Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). These are shown in Fig. 1.

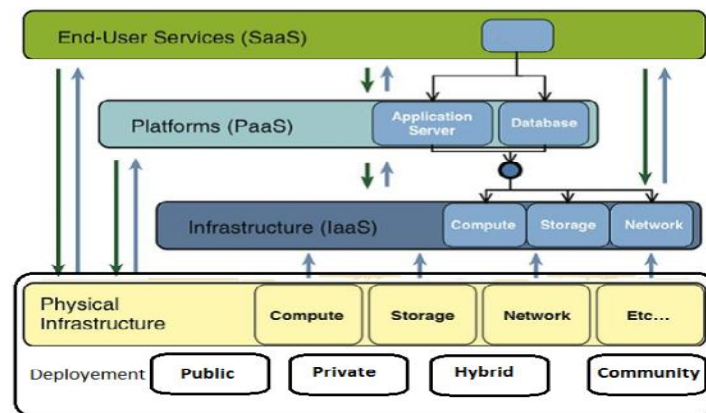


Fig. 1. Cloud based model

[4] stressed that cloud computing provides broad network access, resource pooling and application programming interface, reliability and security.

2.3 Multi-channel for enterprises

Multi-channel delivery system is seen as a solution to enterprises' need to support the new method of resource maximization known as bring your own device (BYOD) and this been the rationale for an influx of employees wanting to access enterprise apps on their own devices such as phones and tablets. A multi-channel system can determine how to push apps, media and other content to each user based on who they are, what devices they're using, job function, geo-location, security clearance, and other factors.

2.4 Advantages of a multi-channel system

Some of the pros of using a multi-channel development framework for developing mobile apps are:

- Ease of use
- Re-usability of Code
- Easy availability of plug-ins
- Support for cloud services
- Fastest to Market
- Lower total cost of ownership (TCO)

According to Carlo et al. [6], the growing standardization, acceptance, and diffusion of novel devices (e.g., PDA, Smartphones) and network infrastructures (e.g. Wi-Fi, UMTS, Bluetooth) require an overall shift of the paradigms for design and development of traditional information systems in order to enable the access of services from users exploiting several distinct technologies. In other words, traditional information systems are evolving to multichannel information systems in which a service is provided on several distinct channels. Furthermore, [7] expressed that e-Services are self-describing components that are open and enable fast development and deployment of distributed applications.

In Multi-channel information system, users can access the same service through different channels. At a high level of abstraction, “channel” examples are: a simple PC connected to the service provider through the Internet, a PDA connected through a wireless LAN, a Smartphone exploiting UMTS and a private backbone.

3 Dynamic Cloud Based Multi-channel Students’ Information Management System

[8] designed A Framework for Web Based Student Record Management System using PHP . The developed system uses a standalone framework which was created by utilizing XAMPP Server interfacing with database that used 'PHP' language as the dialect or guideline of the framework. The strength at which the standalone framework can utilize its operations is expanding the effectiveness of college record administration and conveys students’ records. The Weaknesses peculiar to this system is that due to one choice of programming language, it is not effectively dynamic, lacks the feature of a multi-channel system and is not highly secured.

[9] developed integration of a Course Enrolment and Class Timetable Scheduling in a Student Information System by using a dynamic integrated scheduling system to develop a course enrollment and automated conflict-free timetable in students’ information management system and the integrated process defines a continuous dialogue between the student groups, enrolment administration and scheduling administration. The developed system was designed to resolve the probability of students having conflict in the timetables among different courses they attend and tackle formal complexities of the course enrolment process through the use of virtual academic adviser which has a recommender system for the purpose of recommending for the students among others. The weakness associated with the system is that it was unable to proffer a perfect solution to the student enrollment for courses.

Web Based Student Information Management System was developed and implemented in [1] and it used a cloud based dynamic system for deployment of information among staff, students and administration. The system was well equipped with a manager that keeps track of both staff and students information for purpose of guiding against their loss. The system has the capability of providing an online interface for students and faculty etc. thereby increasing the efficiency of college record management. It also reduced the time required to access and deliver student records. However, the system lacked the mechanism for multiple channel system and there is a limit to the number of people that can share information on it.

[10,11] and [12] conceived and developed different systems for managing students’ record but their systems were characterized by lapses such as their inability to access information of students promptly, insecurity of information on third party platform and lack of multi-channel mechanism.

3.1 Design methodology

The system developed is made up of architectural design and data flow diagrams. The architectural design components are:

- i. **Staff, Student, Library, Admin Login:** The login information below is present in the GUI which request user to supply the followings:
 - i Library ID
 - ii Staff ID
 - iii Admin ID
 - iv MatricNo
 - v Passwords
- ii. **Information Technology (IT):** The IT users are responsible for all updates, ads, deletions, corrections and uploads needed to be posted on the developed system. The IT users can access the system by providing a valid data in the admin login.
- iii. **Access Control:** The access control is a set of measures set in place in order to prevent unauthorized users to have access to the restricted pages.
- iv. **Restricted Pages:** The restricted pages consist of several information that are confidential to each users accessing the page and a valid data is requested before accessing such pages.
- v. **Homepage:** The homepage serves as the graphical user interface of the system.
- vi. **Database and Cloud:** This is the repository of all meaningful data or information that can be updated, downloaded or retrieved by users.

The Data flow diagram (DFD) is the graphical representation of data through the system and it shows the relationship among multiple data and the outside entities as shown in Fig. 2.

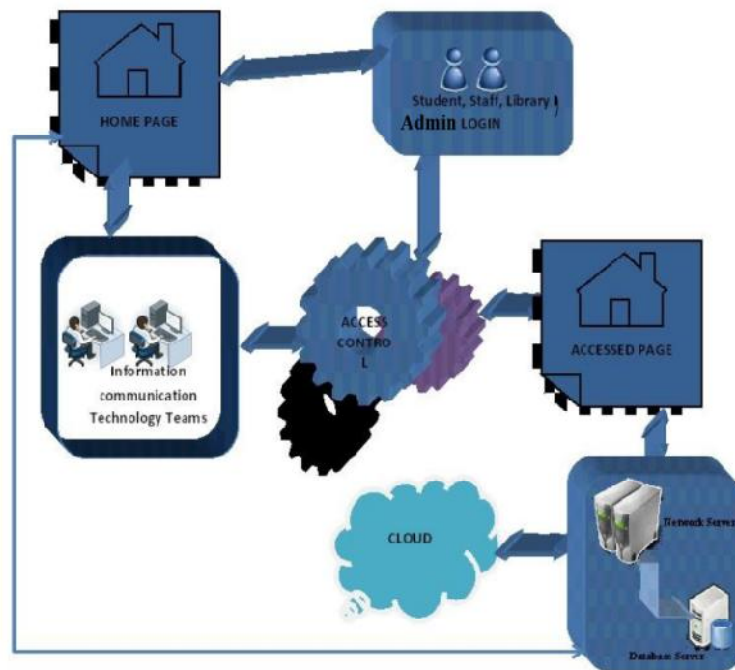


Fig. 2. Architectural design of the system

A DFD is used to analyse problem and explain in details the data relationship during development stage of a system.

The graphical user interface DFD is shown in Fig. 3.

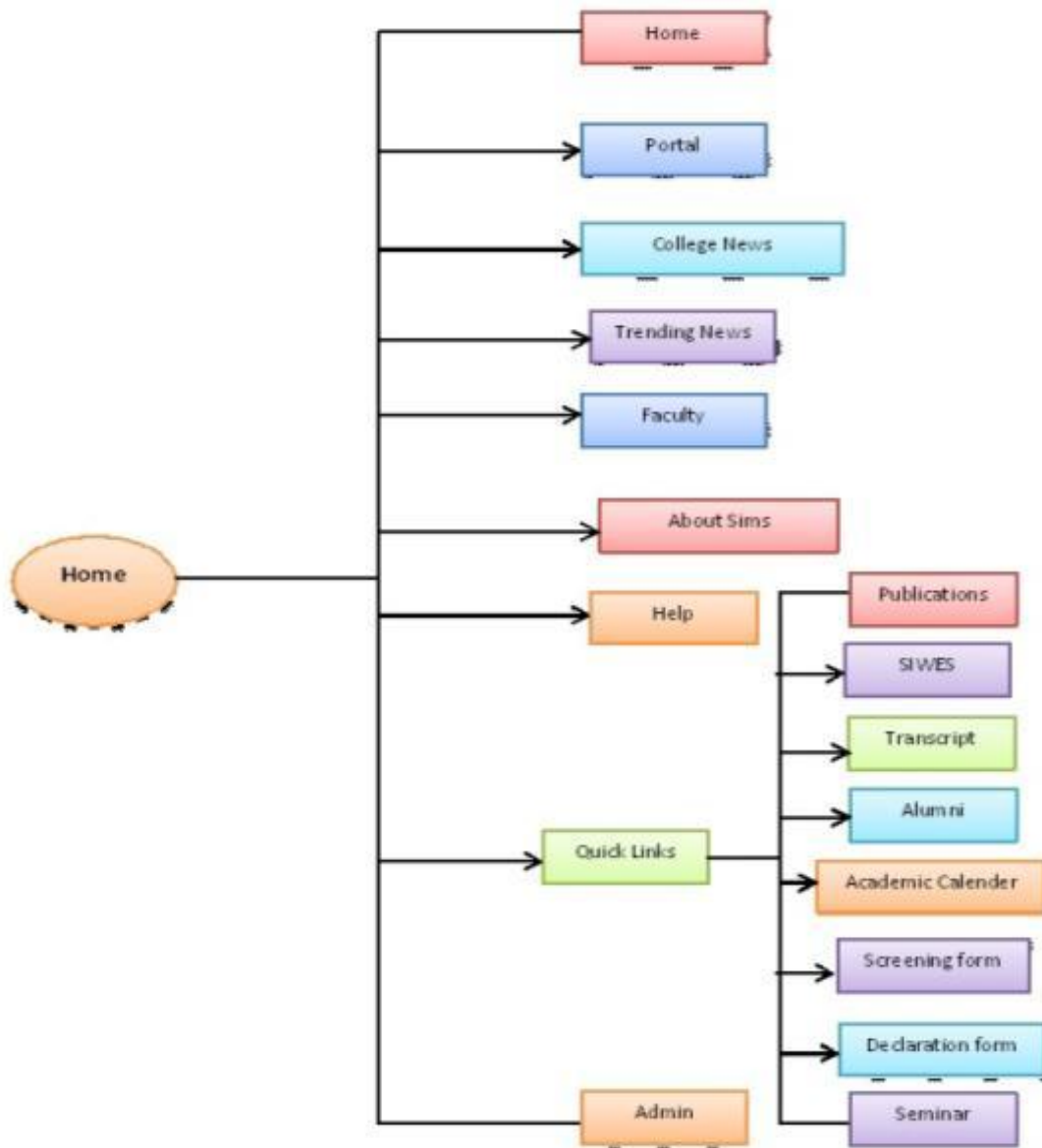


Fig. 3. DFD of the graphical user interface

The DFD of the portal module is as shown in Fig. 4.

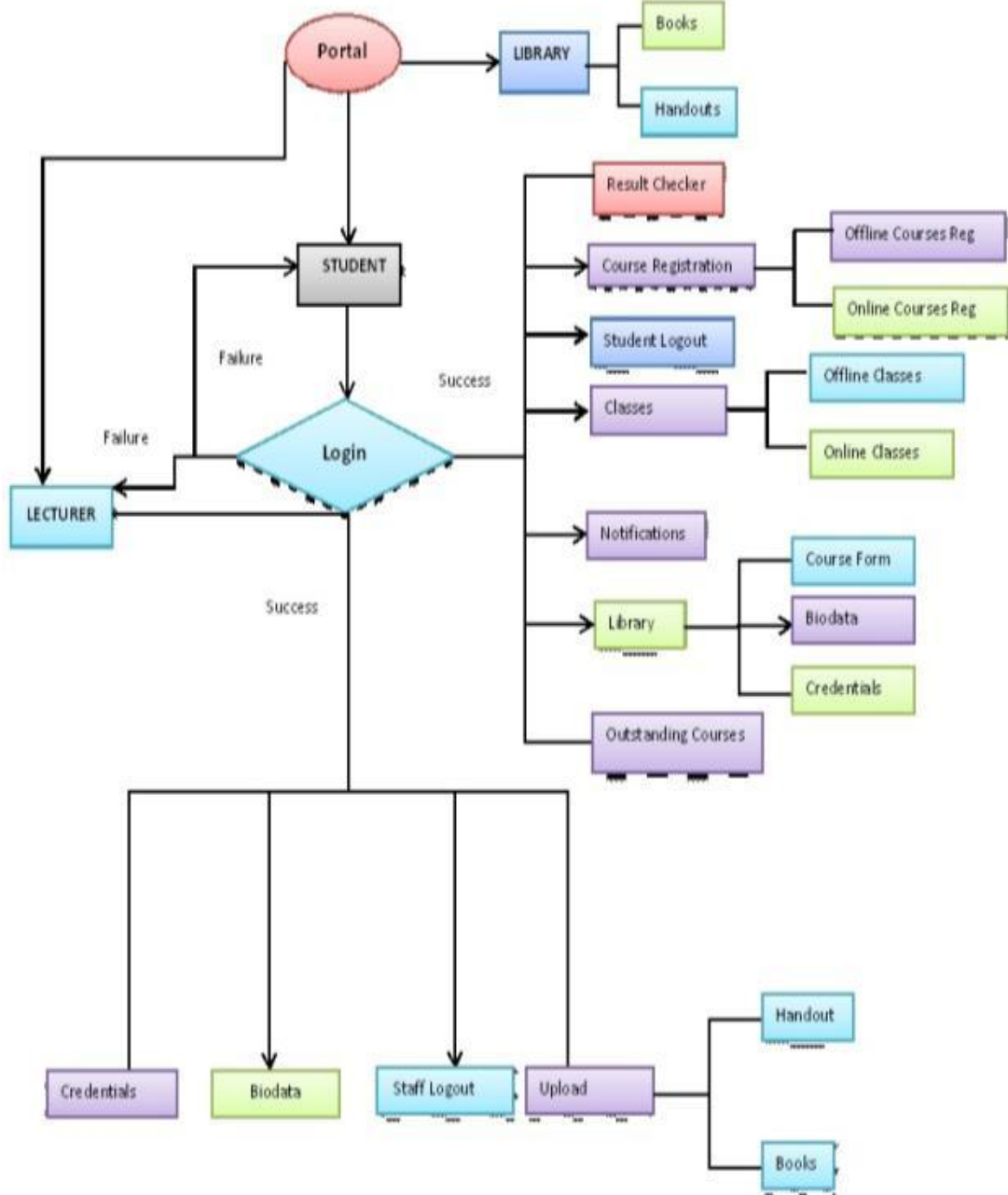


Fig. 4. The DFD of the portal system

The data flow diagram of the admin module is shown in Fig. 5.

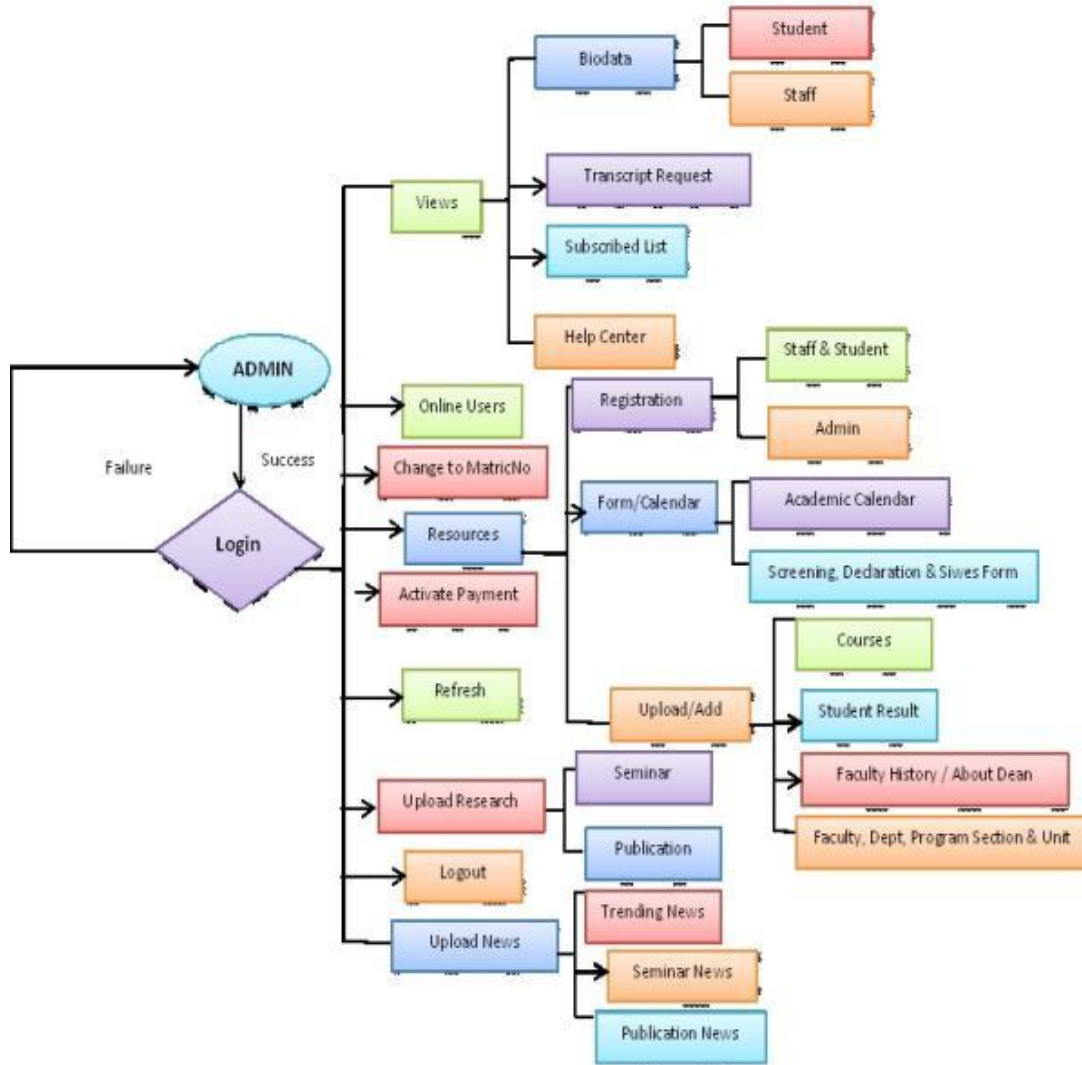


Fig. 5. The DFD of the admin system

4 System Development Modules

The system development modules incorporates the effectiveness, flexibility, functionality and standard required of a robust students' information management system (SIMS) Hence, the detailed explanation on the development modules are:

4.1 The Graphic User Interface (GUI)

This is the system interface where information and modules pertaining to the system can be viewed. Below are list of information that can be viewed in the system GUI:

- i College News: This is the layer that shows detailed information about ongoing event on campus.
- ii Trending News: This is the layer that shows list of trending information about ongoing event on.

- iii Faculties: This is the module where information about faculties can be viewed.
- iv About SIMS: This is the layer where overview of the developed system can be viewed.
- v Help Center: This is the layer where helpful information can be viewed.
- vi Quick Links: This is the layer where users can have access to varieties of resources such as publications, transcript, about SIWES, academic calendar, screening and declaration forms.

4.2 Student module

This is one of the modules in the portal that provides a medium for student to login with their matric no and password. Below are list of resources that can be accessed in the logged in page:

- i Result Checker: This is the layer where student can check their result for the semester.
- ii Course Registration: This is the layer where student can register for their semester courses.
- iii Offline Class: This is the layer where student can view all offline courses registered including the time of lectures and lecturer in charge of each course(s).
- iv Student Notification: This is the layer where student can read about trending news.
- v Complain and Resolve List: This is the layer where student can lodge complain and view their resolved issues.
- vi Student Library: This is the layer where student can view, print, download, upload and update their course form, biodatas and credentials.
- vii Outstanding courses: This is the layer where student can view their carry over courses.

4.3 Staff module

This is one of the modules in the portal that provide a medium for staff to login with their staff ID and password. Below are list of resources that can be accessed in the logged in page:

- i Courses Taken: This is the layer where lecturer can register courses taken in the institution.
- ii Upload: This is the layer where lecturer can upload students' handouts and books for particular courses that is taught by him/her so that students will be able to download the handouts and books from the library module.
- iii Staff Library: This is the layer where staff can view, print, download, upload and update their bio-data and credentials.

4.4 Library module

This is a module in the portal that serve as a repository for books and handouts made available to students, staff and lecturers for the purpose of learning and research.

4.5 Admin module

This module provides a medium for admin user to login with their admin ID and password. Below are list of resources that can be accessed in the logged in page:

- i Views: This is the module where student/staff biodatas and credentials can be updated, able to view the list of student requesting for transcript and list of subscribers for college notification and a layer for resolving issues sent by students/staff.
- ii Online Users: This is the module where admin users can view or logout users that are currently logged in or online on the system.
- iii Change to MatricNo: This is the layer where new students can convert their jamb registration to students' matriculation number or update their students' matriculation number if mandatory.
- iv Activate Payment: This is the module where student payment is activated or deactivated for current semester or session.

- v Resources: This is the module where the admin users can register students, staff and admin users, upload or update academic calendar, screening, declaration and SIWES form, Upload or Update courses, Student Results and Faculties' information.
- vi Upload Research: This is the layer where research articles (seminar and publications) are uploaded.
- vii Upload News: This is the module where latest news and notification such as trending news, seminar and publication news are uploaded

5 Technologies Used

- A. **HTML** which is an acronym of HyperText Markup Language, Cascading Style Sheet which was used to style or customize the web document defined in the html tags so that document can look more fancy and presentable. Hypertext Preprocessor Language (PHP) **JAVASCRIPT**, **AJAX** which is an acronym of Asynchronous JavaScript and XML designed to be used within HTML web document to help resolve loading of web pages. **WAMP SERVER** (Windows, Apache, MYSQL and PHP Server Software) which is a database management system that serves as a repository for meaningful information so that they can be accessed whenever they are needed was used to develop and implement the backend of the system.

6 Results and Evaluation

The system was tested using real live data and the images shown below are some of the modules of the system that were tested and implemented.

The set of data used to implement this developed system are:

- i Student with matric no: 100203015 and Password: ola001.
- ii Admin user with Admin ID: mimi and Password: mimila.
- iii Staff with Staff ID: dO3040 and Password: uthman.
- iv Library user with Library ID: LIB/KO2321/2011 and Password: ola001.

Hence, the images of the results are shown in Fig. 6.



Fig. 6. The login form

The image shown in Fig. 7 depicts the Graphic User Interface (Main Screen) of the System.



Fig. 7. The main screen of the system

The interface of the student account appears once the student has logged in with his/her Matricno and password. It provide interfaces where student can access their semester result, register courses, upload and download credentials, check and print previous and current course forms, lodge complains, view resolved issues, student notifications and outstanding courses as shown in Fig. 8.



Fig. 8. The student account showing a student semester result

The image shown in Fig. 9 illustrates the Staff Account Module.



Fig. 9. The interface of the staff account

The interface of the staff account appears once the staff has logged in with his/her staff identification and password. It provides interfaces where staff can access their biodatas, credentials, list of courses taken, be able to upload students' handouts and books, lodge complains and view resolve issues.

The image shown in Fig. 10 illustrates the Library Account Module where books and handouts can be downloaded for research or acquisition of knowledge purposes.



Fig. 10. The interface of the library system

The interface of the admin system is the admin account module that appears when an authorized user (admin staff) logged in with his/her admin identification and password. It provide interfaces where admin staff can access varieties of resources pertaining to the regulation and management of the developed system. The admin account module is shown in Fig. 11.



Fig. 11. The interface of the admin account showing mailing of trending news

The database management system (i.e. the system backend) of the system consists of 32 data tables that work in relation with the system (i.e. the system front end). The data in the image is the students' profile data as shown in Fig. 12.

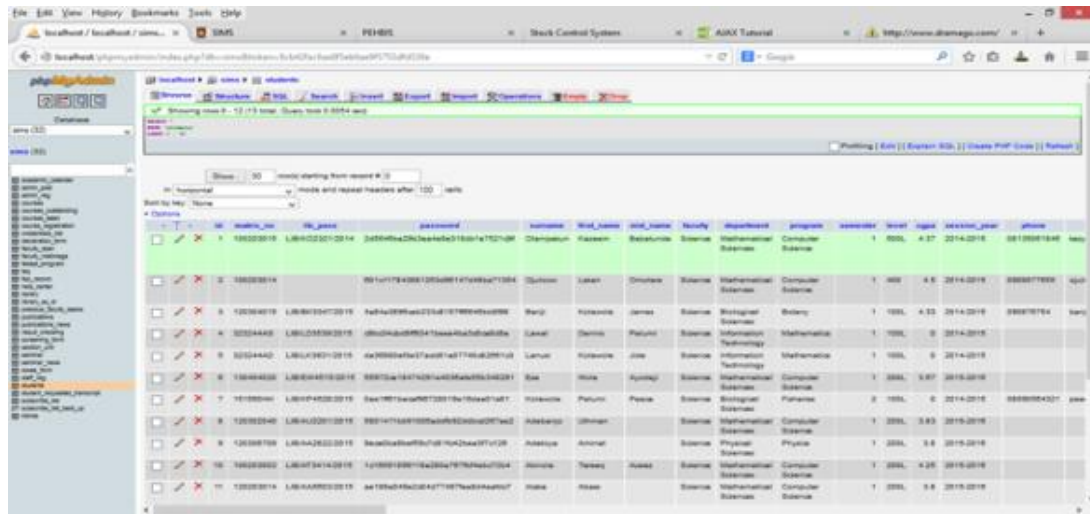


Fig. 12. The database management system

7 Conclusion

Students' Information Management System (SIMS) has been a core part of Information Technology (IT) which has exposed the IT staff in diversity of ways such as resolving issues of manual computation of students' result, hardcopy documentation of files, reduce examination malpractice and ease the sharing of information among multi user concurrently.

The developed system is across platform software as services that used a cloud based multi-channel system approach. The system was developed so that students and staff can be enlightened, exposed and obliged with modern modes in managing and sharing of information and to improve the state of social culture of Nigerian students and staff by providing a medium for information processing and publication.

In this latest evolution, SIMS portfolio provides IT with a unified way to build and manage services across private and public cloud providers and traditional IT solutions.

Competing Interests

Authors have declared that no competing interests exist.

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