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A Secure Web-Based Universal Basic Educational Administrative Management System: A National Capacity Building Strategy in Education

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Abstract
Education in Nigeria is an instrument for effecting the development of its citizens in particular, and the nation in general. The Universal Basic Education Commission (UBEC) established by UBE Act, 2004 is introduced in Nigeria to ensure unfettered access to nine years of formal basic education as well as reduce the incidence of drop-out from the formal school system through improved relevance and efficiency. In this paper, we design, implement and analyze a secure web-based universal basic educational administrative management system to deal with the problem of administration overload in managing pupils, students, teachers, personnel and curriculum data in both primary and junior secondary schools in Nigeria. We adopt the following sequence to accomplish our goal, requirement analysis, architectural design, application design and implementation. The study explores object-oriented database, PHP (Hypertext Preprocessor), Apache server pages and MySQL DBMS tools. The System prototype is built on a three-tier client server architecture to provide UBEC, primary and junior secondary institutions with broader information availability, better performance, and eliminate internal security problem, paperwork and manpower. The framework will help to improve education capacity building, reliability, robustness and quality.
Keywords: Web-based Database, Formal basic Education, Curriculum Data, Object-Oriented Design, Data-Driven System, Universal Basic Education Commission.

1. Introduction

One of the controversial problems controlling the government, parents, guardians and the teachers in Nigerian schools system is that of poor achievement of students and poor administration of schools at the primary and junior secondary school level. The national policy on Education (1981) has stressed that no education system can rise without proper administration and the provision of basic practical experience. In Nigeria today, there is a Universal Basic Education (UBE) Programme which is nine (9) years. This programme is launched and executed by the government and the people of the federal republic of Nigeria to eradicate illiteracy, ignorance and poverty as well as simulate and accelerate National development, political consciousness and national integration. The universal basic education (UBE) programme in Nigeria is a strategy for the achievement of education for all and the education related millennium development goals for national capacity building.

The universal basic education (UBE) programme is managed by the universal basic education commission (UBEC). The UBEC has the responsibility of coordinating the programme at the primary and junior secondary level. The free and compulsory education policy instituted in the state has brought about increase in number of schools, pupils/students, teachers etc. Information technology offers a variety of services for all stakeholders in a commission.

Not only does a UBEC have all the information overload of a normal primary and junior secondary institution, but it also has the extra burden of the primary and secondary school environment i.e. administration overload in managing pupils, students, teachers, personnel and curriculum data. Currently most academic institutions use an information system based on a database to handle the above problem. But in most cases, because of the system architecture, only the administrative office personnel have access to the information. We believe that this kind of information infrastructure results in redundant and imprecise data maintained at different field sites by different personnel. For example, if the commission wants to access the current grades of the pupils or students, they need to request this information from the school administrative office, and a written report will be submitted in response. This wastes computer resources, manpower and time, and generate additional paperwork. There is no reliable information system in Nigerian UBEC.

The goal of our paper is to design, implement and analyze a secure web-based universal basic educational administrative management system otherwise called Universal Basic Educational Information System for Nigerian Schools, to deal with the problem of administration overload in managing pupils, students, teachers, personnel and curriculum data in both primary and junior secondary schools. Our main objective is to provide an object-oriented web-based, data retrieval system for the Nigerian UBEC that will enable access by the various users at all times. The system will serve as computer aided system to assist the universal basic education in proper management of schools. . This will provide a platform to help UBEC take an action, answer questions

or ask the right questions in order to boost decision making. The framework will help to improve education capacity building, reliability, robustness and quality.

2. Background Of Study

Education in Nigeria is overseen by the Federal Ministry of Education, the Local authorities take responsibility for implementing policy for state and controll public education and state schools at a regional level. The education system in Nigeria is divided into Kindergarten, primary education, secondary education and tertiary education. The Universal Basic Education, *UBE*, comes as a replacement for Nigeria's Universal Primary Education scheme of the 6-3-3-4 system of primary education. The 9-3-4 system of education is designed in conformity with the MDGs and Education For All, EFA. The *UBE* involves 6 years of Primary School education and 3 years of Junior Secondary School education, culminating in 9 years of uninterrupted schooling, and transition from one class to another is automatic but determined through continuous assessment. This scheme is monitored by the Universal Basic Education Commission, UBEC, and has made it "free", "compulsory" and a right of every child. Therefore, the *UBEC* law section 15 defines UBE as early childhood care and education. The law stipulates a 9-year formal schooling, adult literacy and non-formal education, skill acquisition programs and the education of special groups such as nomads and migrants, girl child and women, Al-majiri, street children and disabled people (Aderinoye, 2007).

The federal government of Nigeria faced with the challenge of meeting the MDGs, believes that the attainment of the goals will be put in jeopardy as long as the human and material resources of the country remain under tapped. One of the strategies adopted by the country in her multi-pronged approach towards attaining these goals and meeting the needs of people is the empowerment of people through education. The United Nations Development Programme (UNDP) for its capacity to foster gender equity and sustain economic growth also endorses early and ambitious investment in basic education.

The Universal Basic Education (UBE) Programme is a nine (9) year basic educational programme, which is launched and executed by the government and people of the Federal Republic of Nigeria to eradicate illiteracy, ignorance and poverty as well as stimulate and accelerate national development, political consciousness and national integration. Former President Olusegun Obasanjo flagged off UBE on 30th September 1999 in Sokoto , Sokoto State. The UBE Programme is Nigeria's strategy for the achievement of Education for All (EFA) and the education-related Millennium Development Goals (MDGs) (Schultz, 2002).

The implementation process of the programme is on since 1999, but progress is hampered by lack of an enabling law to execute certain aspects of the programme. It is a big relief when the President signed the UBE Bill into law on 26th May 2004 following its passage by the National Assembly. The UBE Act 2004 makes provision for basic education comprising of ECCE, Primary and Junior Secondary Education. The financing of basic education is the responsibility of States and Local Governments. However, the Federal Government has decided to intervene in the provision of basic education with 2% of its Consolidated Revenue Fund. For states to fully benefit from this Fund, criteria are established which states are to comply. The Act also provides for the establishment of the Universal Basic Education Commission (UBEC) to co-ordinate the implementation of the programme at the states and local government through the State Universal Basic Education Board (SUBEB) of each state and the Local Government Education Authorities (LGEAs). The Universal Basic Education Commission (UBEC) is formally established on 7th October 2004. At the end of nine years of continuous education, every child should acquire appropriate and relevant skills and values and be employable in order to contribute his or her quota to National Development.

The objectives of UBE is to (i) ensure unfettered access to nine (9) years of formal basic education (ii) provision of free Universal Basic Education for every Nigerian child of school going age (iii) reduce drastically the incidence of drop-out from the formal school system, through improved relevance, quality and efficiency (iv) ensuring the acquisition of appropriate levels of literacy, numeracy, manipulative, communicative and life skills as well as the ethical, moral and civic values needed for laying a solid foundation for life-long learning.

However, the Universal Basic Education as introduced by the Federal Government of Nigeria described above as laudable, is leaving many issues unresolved which are likely to bedevil the programme just as the UPE Scheme. One of the issues left unresolved is the registration/management subsystem of the commission. The management subsystem is the one which is responsible for creating, sorting, retrieving and saving information of the junior secondary and primary schools integrated in the scheme. UBE, being broader than UPE, in addition to providing educational opportunities to primary school age children, it also stresses the inclusion of girls and women and a number of underserved groups: the poor, street and working children, rural and remote populations, nomads, migrant workers, indigenous peoples, minorities, refugees, and the disabled. In 2000, Nigeria's literacy rate was 52 percent (Babalola, 2000). In 1998, only 40% of all heads of households in Nigeria had any education at all, 21% had only primary education, 14% had up to secondary education, while only 5% had post-secondary education (UNDP, 1998). Data from the Federal Ministry of Education, Education Statistics (1996) showed that only 14.1 million out of 21 million school-age children are enrolled in primary school. UBE was born from these

startling statistics, to promote education among all citizens.

However UBE has caused an increase in Population of primary school pupils and secondary school students because of the territory expound. To worsen the situation, Akwa Ibom State House of Assembly through the leadership of Governor Godswill Obot Akpabio has declared free and compulsory education and this has increase the number of schools and students. The management of these schools and students has become very important to enable the commission carried out better planning in the distribution of equipment and other things. The commission however has an enrollment template which is basically used in carrying out registration; there are three types of registration templates. The first one is use by LGEA to record number of school, pupils, classroom etc. that exist therein. The second templates is use by the state to collect the records from different Local Government Area Education Authority (LGAE) and the National templates being the third is used at the federal level to know the number of school that exist in the country or different geopolitical zone.

Management Information Systems (MIS) is an organized approach to the study of the information needs of an organization's management at every level in making operational, tactical, and strategic decisions. Its objective is to design and implement procedures, processes, and routines that provide suitably detailed reports in an accurate, consistent, and timely manner.In a management information system, modern, computerized systems continuously gather relevant data, both from inside and outside an organization. This data is then processed, integrated, and stored in a centralized database (or data warehouse) where it is constantly updated and made available to all who have the authority to access it, in a form that suits their purpose (O'Brien and Marakas, 2010). MIS not only include software systems, but the entire set of business processes and resources that are used to pull together information from functional or tactical systems. Data is then presented in a user-friendly and timely manner so that mid and upper-level managers can use it to take the right actions. The primary function of MIS according to Linda (2003) is to help a manager take an action, answer a question or ask the right question. The questions or actions should directly relate to tactical or strategic goals.

3. Literature Review

Oye et al. (2011) review the challenges of e-learning in Nigerian University education based on the experience of four developed countries, UK, Australia, Korea and France. The survey shows that these countries have: (i) vision and action plans for e-learning, (ii) they have good government policies and financial support, (iii) they earmark action programs and set committees with sufficient funds to pursue it goals, (iv) they believe in research as a fundamental part of e-learning strategy, and lastly (v) they embark on awareness, training and motivational programs. The paper pointed out that, for the challenges of Nigerian university education to be reduced to minimum, the Federal Government should improve on educational funding as UNESCO recommended 26% of the annual budget. In addition the government should fulfill her promise on the issue of improving Electricity supply in the country. Furthermore, the study stress that university administrators should embark on awareness and training of staff on the use of ICTs, with motivations attached. Ochoche (2008), proposes a revolutionary approach to the evaluation of students at both primary and secondary schools. The procedure being proposed takes on more the characteristics of a survey designed to assess not just the achievements of students, the course and the programme, but also the effectiveness of the teachers who form a major part of the whole education machinery.

Aczel et al. (2008) investigate how organizations in developing countries perceive the challenge of building capacity in e-learning expertise. Data is collected on six such organizations, and a range of perceived rationales and constraints are identified. The study hypothesizes a four-part framework to define the e-learning capacity gaps that these circumstances appear to represent: the "instructional design capacity gap", the "production capacity gap", the "tutorial capacity gap" and the "community building gap". The framework is used to re-examine the data to explore the ways in which the organizations' e-learning activities might constitute strategic responses to the hypothesized capacity gaps. Yegon et al, (2014) compare challenges affecting adoption of e-learning for capacity building in public service sectors of Kenya and South Africa. Cluster sampling methodology is used and data analysed using SPSS. The study population represented participants who underwent through a capacity building course African leadership in ICT (ALICT) course offered by GESCI.

Komba (2009) documents and discuss the initiatives that Tanzania has taken to expand educational opportunities at various levels using open and distance learning (ODL) approaches. The paper begins by explaining the socio-political context for ODL in Mainland Tanzania and Zanzibar and proceeds to recount the distance education initiatives that have been established over time using both the longstanding traditional technologies and new media and technology. Agbetuyi, P. A. and Oluwatayo, J. A. (2012) discuss the correlate existing between information and communication technology and education and the extent to which it has affected the Nigerian system of education. The setback and obstacles to its full actualization is also examined. Romeo et al (2012) attempt to build the ICT education (ICTE) capacity of the next generation of Australian teachers through its focus on pre-service teachers, teacher educators and the new Australian Curriculum by providing an overview of the project including a description of its genesis in a changing educational and political

landscape, its structure and operations, its grounding in contemporary theory, the research opportunities it has engendered and its tangible outcomes.

Umoh et al (2012) we design, implement and analyze a web-based database management system: an Industrial application, otherwise called Paper Recycling Production Information System (PRPIS) to deal with the problem of industrial overload in managing production cost, revenue sales and quantity recycled. Umoh et al, (2007) we design, implement and analyze a web-based Educational Administrative Management System otherwise called Student Information System (SIS) to deal with the problem of administration overload in managing student, faculty, personnel and course data in Universities. Umoh et al. (2009) adopt a state-of-the-art technology to design an Object-Oriented Database Management System (OODBMS) for the management of information in Nigerian Universities. The study applies the object-oriented design tools to create a database model that is reliable, dependable and secure. The work focuses on creating a unified modeling language (UML) structure by specifying the use case, classes, and activities in the client-server application.

4. Research Methodology

We adopt the following sequence to accomplish our goal; Requirement analysis, Architectural Design, Application design and implementation and Analysis. Object-oriented design approach is adopted in this paper which addresses three pervasive problems: quality, productivity and flexibility. Information systems developed with the traditional approach have been notoriously error-prone, expensive and inflexible. The object-oriented approach has the potential to reduce errors, cost and increase flexibility because of its inherent features. In requirements analysis, the application is designed on a web-based architecture so that reliable access from anywhere in the UBEC and in schools is achieved. Language is platform independent and must provide easy implementation of the software Engineering concepts and principles, providing the software reuse, object-oriented structure, maintainability and reliability. A prototype of the application is provided. Later changes in the requirement and user interface are made based on this prototype. The application should provide access to the following users; UBEC, Primary schools, Junior secondary schools, Pupils, Students and Administrative office personnel. These users form the use cases employed in this work. The paper evaluated the different client/server models based on (Umoh and Nwachukwu, 2007) and adopted three-tier architecture.

5. Designs and Implementation

The implementation is based on the initial requirements of the work defined earlier. The following assumptions are made for the simplicity of the initial prototype. (i) The users are believed to have computer competency ranging from novices to expert. (ii) The user will have sufficient skill on using any web browser. (iii) As the specification of the database is not concrete, the database and its relational tables could be designed and modified according to future needs. (iv) The implementation is Database Management System (DBMS) independent, so that the system could swap the backend DBMS without requiring extensive modification.

5.1 UBECS System Archtecture

A Secure Web-Based Universal Basic Educational Administrative Management System: A National Capacity Building Strategy in Education prototype is built on a three-tier client server architecture as shown in Figure 1. The client interface is simply a web browser where the user connects to the system and retrieves the data. In this architecture, all the business logic is implemented on the middle-tier. While Apache 2.0 is configured as a web server, for the middle-tier application, PHP server page is used. The PHP has been defined as very powerful tools for the application logic, and the PHP server page as very helpful for the presentation logic. Based on these properties of Apache and PHP server pages the whole application logic is implemented in Apache where the presentation logic is divided into the related PHP server pages. The connection between the middle-tier and the database is established via MySQL Database connectivity. A relational database instance is created on MyQSL Database, and populated for the implementation purpose.

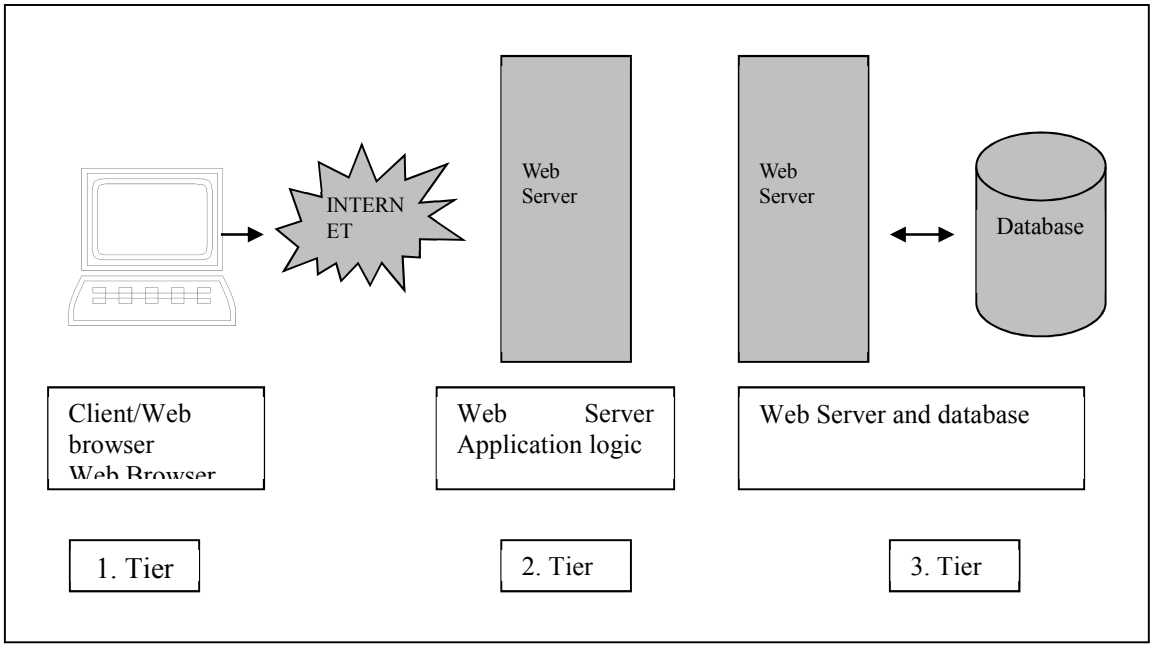

Figure 1: UBECIS System Architecture

5.2 UBECS Object Model

The UBECIS object model is developed according to the use-case defined earlier and the simplified model is shown in Figure 2. The basic objects in the system are defined and the interaction between the objects determined.

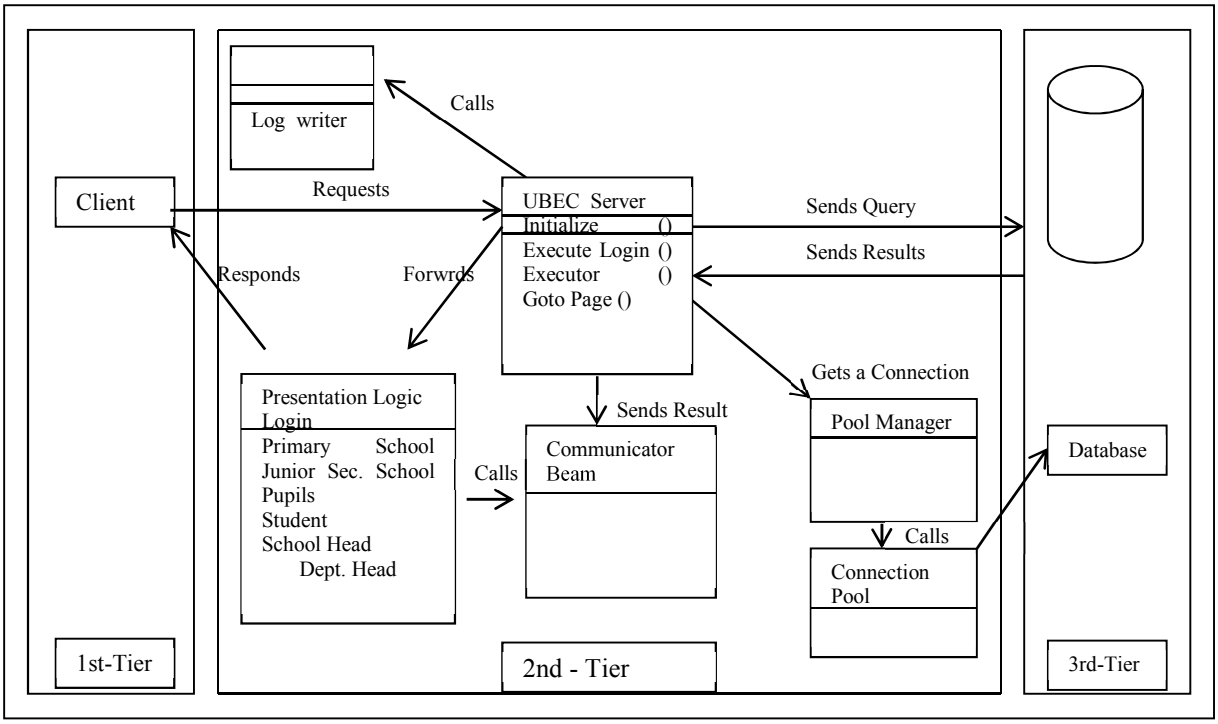

Figure 2: UBECIS Object Model

5.3 UBECS Database Model

The first step for designing a database model is to discover the candidate entities Ramakrishnan and Gehrke (2000). For this reason, based on the use-cases, the main entities of the database are selected. According to these entities, the relations between them are developed. UBECS database model has five logical subdivisions as shown in Figure 5. These include academic, administration, primary school, junior secondary school and system. Each subdivision has its unique tables and relations. The database for the UBEC prototype consists of a database instance on MySQL database server. The structure of the database instance is explained in the design phase.

According to the main entities, the related data subjects, tables and relations are created, and database structure is created using SQL DDL. After creating the tables and relations, the database is populated with data for implementation purpose. The main purpose of this application is to support the Nigerian Universal Basic Education informational, educational and administrative tasks and their requirements conveniently and consistently. To accomplish these tasks, authorized users are given access to the system according to their privileges and responsibilities. Related menu options are provided to them. The UBEC is developed with the following development tools; Windows XP, Macromedia Dream Weaver MX2004 is used with VMware Workstation version 4.0. Apache version 2.0 (web server) PHP 4.2.2 (web scripting language, and My SQL version 3.32.54 (Database server) running on Red Hat Linux Operating System.

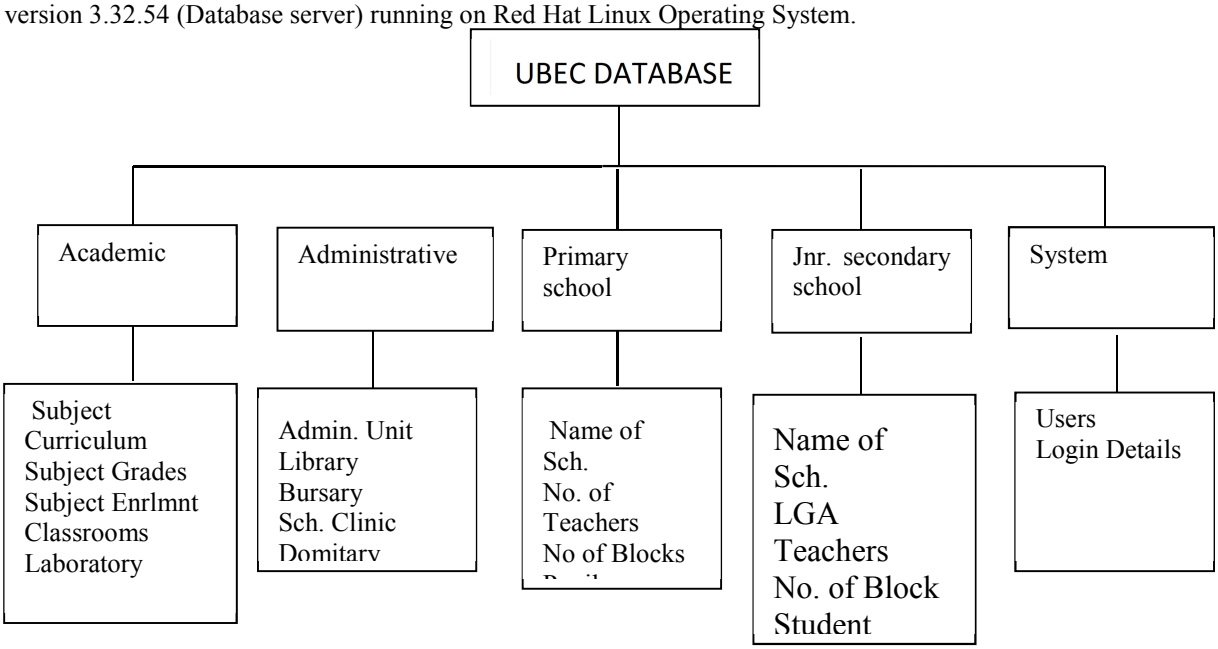

Figure 5: UBEC Database Model

5.4 Screen Shots Of UBECS

In this section, we present some of the screen shots of the system. The similar functions and pages are not repeated for each type of user. Figure 6 shows the application's Login Page. This interface provides the user with the welcome page or home page of the application. This is the only entry point for the system by all users, where the login screen prompts users for user name and identification password. Once the user authenticates the application successfully, the Home Interface is loaded within the browser as shown in Figure 6. Figure 7 shows the Main Interface which allowed permissible administrative procedures to be carried out. This interface contains controls and the entire hyperlink. The logic of the main interface changes base on who logs on. If it is administrator, the right to read/write is given else if client then read only permission is active. By clicking add new school button, a sub menu opens requesting for either primary section or secondary section. Depending on what the user selects, the registration form is displayed as shown in Figure 8 and Figure 9. The Summary templates of sample primary and junior secondary schools in Akwa Ibom State, Nigeria are presented in Figure 10 and Figure 11. The templates give comprehensive lists of all the schools entered into the system. From this summary sheet, a total number of males/females in each school can be computed easily and the total number of schools in a particular local government area can also be viewed. Unlike the manual registration template, the proposed web-based system is more efficient and accurate as little or no error in the aggregation of schools is inherent.

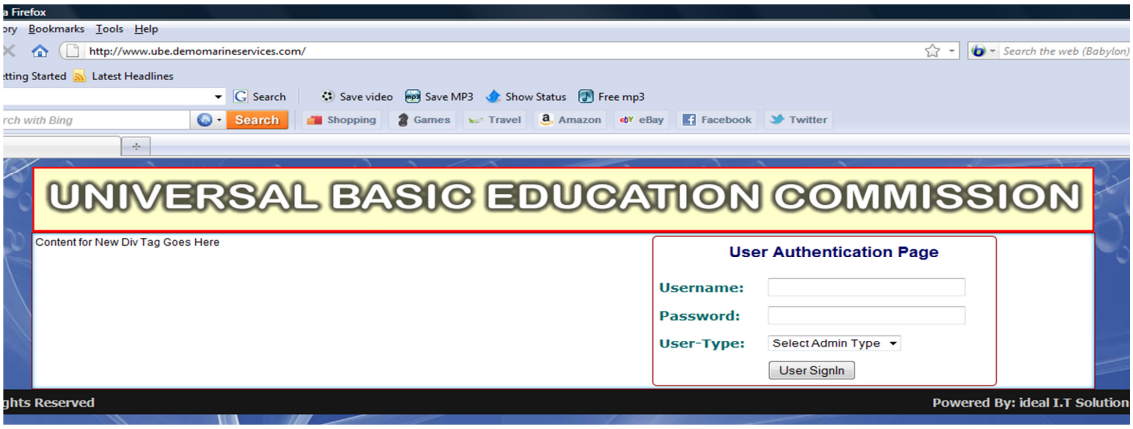

Figure 6: UBECS HOME/LOGIN Interface

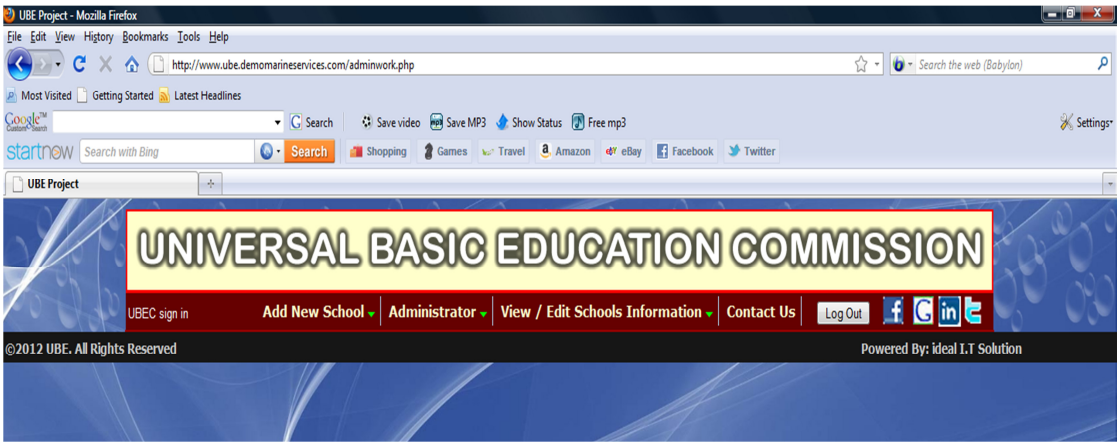

Figure 7: UBECS Main Interface

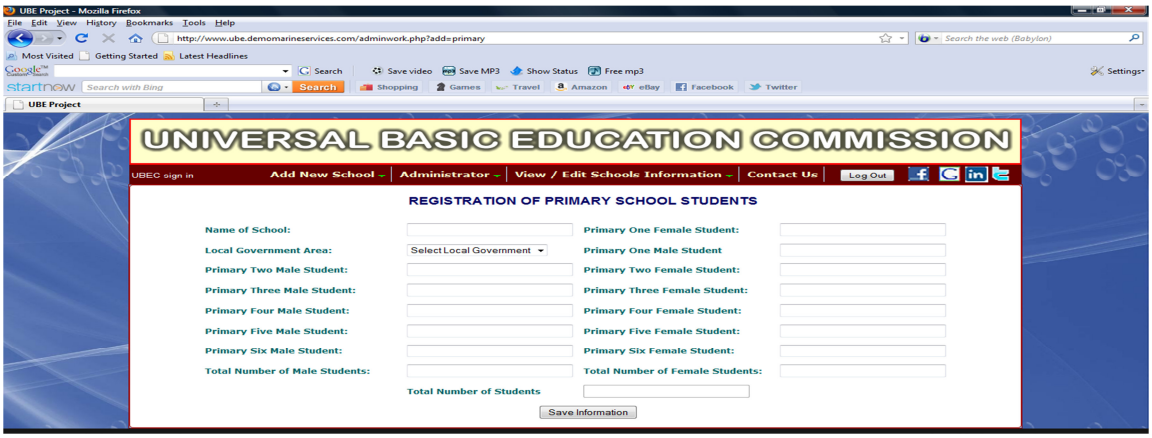

Figure 8: UBEC Primary school registration form

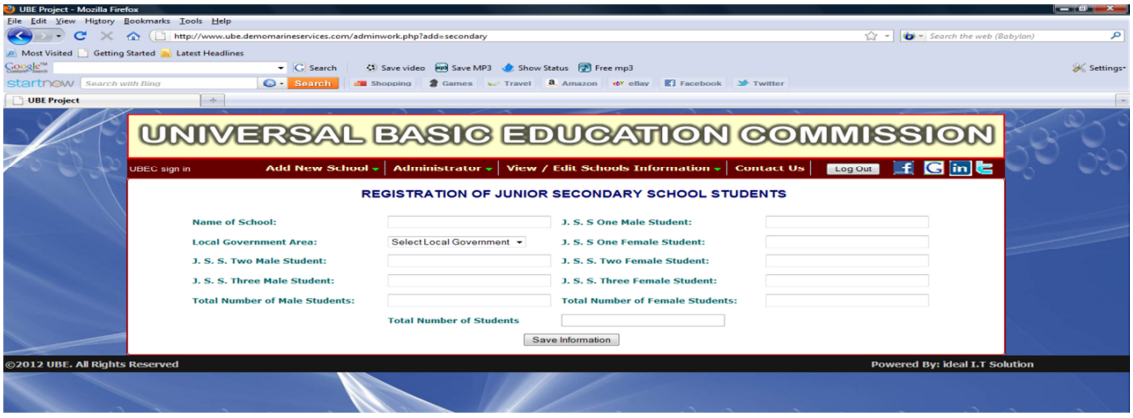

Figure 9: UBEC Junior secondary school registration form

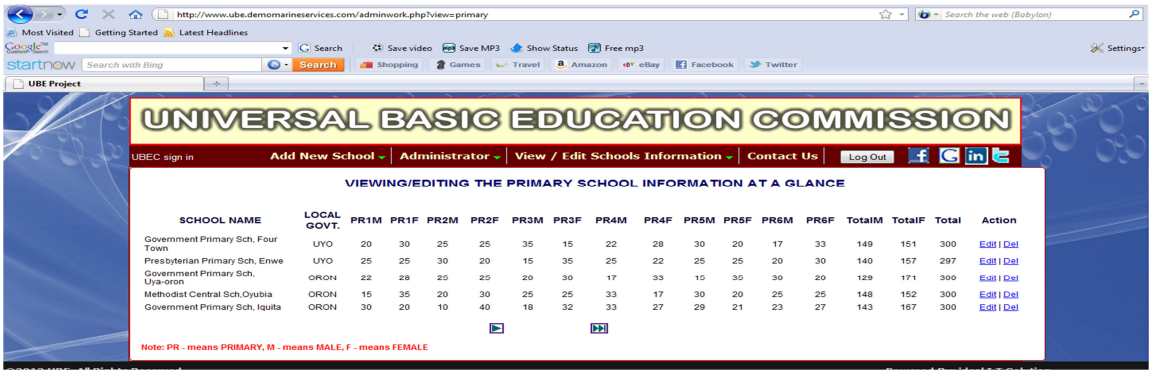

Figure 11: Summary template of Sample Primary School in Akwa Ibom State

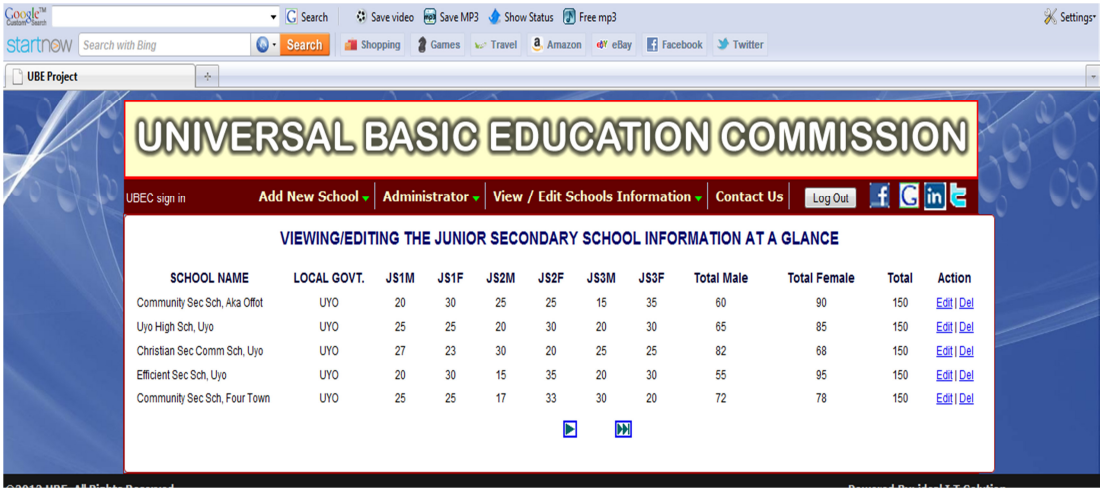

Figure 12: Summary Template of Sample Junior Secondary School in State.

6. Conclusion

In this paper, we present a Secure Web-Based Universal Basic Educational Administrative Management System: A National Capacity Building Strategy in Education for Nigerian Universal Basic education Commission. UBECS will provide primary and junior secondary institutions with broader information availability, better performance, and eliminate internal security problem, paperwork and manpower. The study also present a three-tier secure UBE information Object model for Nigerian UBEC which will help to alleviate the problems of information overload, insecurity, wastage of computer resources, manpower and time associated with the existing manual system thus, leading to high national capacity building in education in Nigeria. We design and develop UBECS using PHP scripting language and Apache as the web server. For database-tier, and instance of the database for UBEC is created using MySQL and populated with data.

In the future more user types can be added to the system for the implementation purpose to get accurate information from institutions. Another type of user for future enhancement is the system administrator who can

be given the capability to see the current online users, their activities and to perform any online support maintenance. Currently, the system uses session management features for session tracking. Additional security feature, the access to the system can be limited to the intranet by checking the IP address of the client in the implementation.

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